California Institute for the Study of Specialty Crops

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Comparing California's Cost of Regulation to Other States:

A Case Study Approach for Agriculture

Submitted by Project Director

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EXECUTIVE SUMMARY:

Comparing California's Cost of Regulation to Other States: A Case Study Approach for Agriculture

Regulatory pressure is a source of increasing concern for California producers. Though regulations have a positive impact on society in terms of cleaner air and water, as well as increased worker safety; they impose multiple costs to farmers in the state. Growers must comply with a tangle of rules from the local, state and federal levels. Many regional differences arise in California environmental regulations, and regulatory pressure is unevenly applied throughout the state.

Previous studies regarding the regulatory environment in California have quantified the total cost of regulation on the state's agricultural producers. The goal of this study was to conduct a case study analysis of regulatory costs on important specialty crops in the state, and to compare those costs with commercial-scale operations in other states where specialty crops are prevalent. Citrus and lettuce were chosen, as they are commonly among the top ten products in value of production in California, and like-sized operations could be identified in other states. Citrus and lettuce were also appealing because they represent two important production regions in the state that have very different environmental regulatory requirements. Dairy was intended to be part of the study, but cooperating producers were not identified in time to collect data.

The citrus case study provided compelling evidence that the regulatory pressure is much more significant in the San Joaquin Valley of California than is evident in the comparison state of Texas. The California grower's regulatory costs amounted to $347.12 for each acre of citrus produced. When taking into account that the cultural costs of production (not including harvest) were $1,945, this adds 17.85% to the cost of raising oranges in California; if harvest and packing costs are included, it adds over 6% to the total cost. On the Texas citrus operation, the regulatory costs were calculated to be $31.71 per acre. In terms of the relative costs of production, this adds 3.29% to the grower's cost of production of $963 per acre. If harvest costs are included, regulatory costs decrease to .75% of total production costs. The primary regulatory differences between the states include workers' compensation costs as well as air and water quality regulations.

The evidence provided by the lettuce case study showed similar results, though as Arizona's regulatory environment is more similar to California's than is Texas, the cost differences were not as dramatic. The Salinas Valley of California is in a less restrictive region with respect to air quality than is the San Joaquin Valley, although water quality regulations are still costly. The cooperating lettuce grower reported regulatory costs totaling $114.84 per acre, or 4.82% of cultural costs. Workers' compensation is by far the highest regulatory cost for the California producer, which validates previous regulatory studies on California agriculture. In Yuma, Arizona, the cooperating grower reported a per-acre regulatory cost of $70.10, or 2.5 % of the per-acre cost of production.

Prevailing differences between the states are once again, the cost of workers' compensation, as well as pesticide regulation. However, the Arizona grower did accrue higher costs of air quality compliance, as Yuma is an area of non-attainment with respect to particulate matter, and the Salinas Valley has no air quality requirements that impact lettuce production.

In both crops, the costs of production reported by the growers and production budgets prepared by the university-based extension services in each state were substantially higher in California. The Golden State's production budgets at both the grower and university level showed expenses ranging from 21% to 57% percent higher than in the comparison states. The average of the cost differences was 44%. The primary differences are the higher labor, land and water charges in California relative to southwest Texas and southwest Arizona.

A review of workers' compensation and regulations with respect to air quality, water quality and pesticides showed significant differences among the states, particularly between California and Texas. Arizona's laws were closer to those of California, but for the most part are not as stringent as those in California. Major regulatory differences in each category are outlined below. It should be noted that air and water quality regulations were assessed at the growers' locations; they could be different in other parts of each state.

Air Quality:

- California
    - Central Coast – No air quality requirements regulations for irrigated crops
    - San Joaquin Valley – Growers must file a Conservation Management Plan, pay an acreage-based fee, and participate in dust-reducing agricultural practices
- Arizona – Air quality practices are based on a voluntary, incentive-based program, though program of Best Management Practices is similar to California's
- Texas – No air quality regulations in West Texas, open burning is permitted

Water Quality

- California – Both the Central Coast and San Joaquin Valley must monitor nonpoint source discharge via an individual Waste Discharge Requirement (WDR), or participate in a Conditional Waiver program that charges fees and requires training and voluntary discharge monitoring. Growers voluntarily monitor irrigation water for food safety issues.
- Arizona – No WDR, discharged water is not monitored, only irrigation water is tested as a voluntary food safety issue
- Texas – No water quality requirements

Pesticide Registration

- California – Administered by the Department of Pesticide Regulation under Cal EPA. Separate review and testing in addition after approval by U.S. EPA, can

take several years and cost several million dollars. Annual registration is $750 per product.

- Arizona – Manufacturer sends in label and EPA registration documentation. Process takes 105 days. Registration is $100 per product per year, administered by Arizona Department of Agriculture.
- Texas – Manufacturer sends in label and EPA registration documentation. Registration is $420 per product for two-year registration. Administered by Texas Department of Agriculture.

Pesticide Use:

- California – PCA license required to make recommendations for commercial pesticide use, to apply for license must have bachelor's degree or equivalent college and PCA experience; pass written exam; 40 hours of continuing education every two years is required to renew
- Arizona – PCA license is required to make recommendations for commercial pesticide use, to apply for license must have bachelor's degree or equivalent college and PCA experience; pass written exam. Fifteen hours of continuing education are required for renewal annually.
- Texas **–** No statutory requirement to have a PCA license, only a private or commercial applicator's license is required.

Workers' Compensation

- California – All employers are required to have workers' compensation, rates are 10% for field workers, 25% for packing shed workers and .5% for clerical workers
- Arizona –All employers are required to have workers' compensation, rates are 4.09% for orchard workers, 5.93% for field crop workers and .26% for clerical workers
- Texas **–** No statutory requirement exists for employers to carry workers' compensation insurance. Non-subscribers are required to inform their employees that no coverage is provided. Should an employer choose to offer workers' compensation, the rates are 6.89% for fruit workers, 9.74% for vegetable workers and .46% for clerical workers.

Table of Contents

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Chapter 1 - Introduction

Regulatory pressure is a source of increasing concern for California producers. Though regulations have a positive impact on society in terms of cleaner air and water, as well as increased worker safety; they impose multiple costs to farmers in the state. Growers must comply with a myriad of rules, from local, state and federal levels. Other states have taken note. For example, at the World Ag Expo in Tulare, California, states such as Texas, South Dakota, Idaho, Iowa and Oregon sponsor booths in the dairy exhibit area, hoping to draw California's capital- and labor-intensive dairies to their "farmer friendly" states. Lower regulatory costs are a key selling point.

Recent studies have attempted to quantify the impacts of regulation on California farmers. Findings from a 2005 survey of nearly 1,300 specialty crop producers show that regulatory costs add nearly $1 billion to California growers' costs (Hurley et al., 2006). Johnston and McCalla cite increased regulation as a relatively new driver among 20 major factors affecting the future of California agriculture, but one that will have increasingly negative impacts on the competitiveness of the industry. A preliminary study by the California Farm Bureau notes that recent increases in water quality permits and monitoring fees, air quality permits, chemical use permits and timber harvest permits can range into the thousands of dollars. No less than 25 separate laws at the state and federal levels govern the resource base employed by agriculture (Hurley, 2005). In a 2006 study, California producers gave higher rankings to non-cash compliance costs than cash compliance costs (such as fees, permits, etc.) in terms of having a negative impact on their operations (Hurley et. al, 2006). Producers reported a 40% increase in their management time in an effort to keep up with regulations; and now spend on average just over 10% of their time on regulatory compliance, up from 7.31% in 1999 (ibid).

In addition to environmental and consumer safety regulations, California producers pay the highest labor costs in the country, which account for approximately 21% of their costs of production (Hurley, 2004). The high minimum wage relative to other states, coupled with very expensive workers' compensation insurance, liability

insurance and health care benefits cost California producers millions more than farmers who conduct business in states with lower labor expenses.

Crop-specific studies have quantified the impacts of pesticide substitution due to the changing regulatory environment. Carter, et al., investigated the impact of substituting two different chemicals to replace banned methyl bromide in the strawberry industry. Though the efficacy of one of the substitute chemicals was determined to be the same as methyl bromide, the increase in cost was $300 per acre. Another study led by Carter estimated the impact of how January 2001 Department of Pesticide fumigation regulations would affect strawberry growers and found that growers with smaller fields were more negatively affected than those with larger fields. A Salinas Valley lettuce study determined that using biologically based pesticides instead of more common organophosphate and carbamate compounds, which were being reviewed under the Food Quality Protection Act, would increase the production costs per acre by $40 to $50 (Hamilton).

These studies indicate that further investigation is warranted, especially with regard to the effect of regulatory costs on some of California's most important agricultural industries. California, which has 13 counties boasting more than $1 billion in gross agricultural sales, is by far the leading agricultural state in the U.S. In 2005, California producers sold $38.6 billion of farm-gate products; a 5.1% increase over 2004 (Summary of County Agricultural Commissioner's Reports, 2004-2005). However, the gross revenue figures do not indicate the profitability on California farms. Increasing regulatory costs chip away at growers' profit margins. This study investigates those costs in some of California's most important agricultural sectors using case study methodology.

The findings of this study will provide the agricultural industry and policy makers with more complete information when making policy decisions regarding regulatory issues for California farmers.

The objectives for the study are as follows:

1. Identify one representative case study farm in California for dairy, citrus and lettuce, and one similarly-sized farm for each commodity in states where there exists an active industry for the chosen commodity.

2. Conduct a review of relevant regulations that affect agriculture in California and the comparison states.

3. Document the costs for one production year for each cooperating grower, documenting the impact of regulatory costs on the budget line items in which they occur.

4. Determine if any significant differences exist in production costs between California operations and those in states where regulatory requirements are less stringent.

Methodology

The California Department of Food and Agriculture (CDFA), Western Growers' Association and California Citrus Mutual agreed to assist in identifying cooperating growers for dairy, citrus and lettuce, both within California and in the cooperating states. Cooperating growers were identified in Texas for citrus and in Arizona for lettuce. Though the study originally intended to include dairy, the producers identified by CDFA were unable to provide the requested information within the timeframe of the study, and thus had to be eliminated. The study was conducted from February to September, 2006. The cooperating producers in the study were assured anonymity, as their proprietary production cost data would be the centerpiece of the study.

The first task was to find the average production costs for lettuce and navel oranges within the states. For the California lettuce and orange costs of production, the U.C. Davis Extension cost-of-production budgets were used. The Texas Cooperative Extension Service provided a 2005 budget for navel oranges, and a 2005 budget for head lettuce was available from University of Arizona Extension service. These budgets were used for two purposes. First, they were used as a means to help identify production areas

in which regulatory costs might be lurking. They also provided a baseline from which to compare the growers' budgets.

A review of recent regulatory cost studies, cited above, provided background for the types of regulatory pressures that growers may face. Regulations affecting agriculture were researched in each state regarding air quality, water quality, pesticide registration and use, and workers' compensation and minimum wage laws. These are discussed in Chapters 2 through 5. This information was used to develop a list of regulatory costs that growers may face in their respective states.

The cooperating growers were contacted via phone, e-mail and, in the California cases, in person. Each grower was provided a spreadsheet that outlined the regulatory cost areas that were expected to impact their operations. They were asked to estimate the annual amount of time maintaining compliance in each regulatory area; the value of that time; whether it was their time or an employee's; and to provide the fees they were assessed for any permits, licenses, training sessions or exams. Each grower's written account was followed up with either an in-person or phone interview to verify the information. The growers were also asked to provide their annual production budgets for their crops, as a means to compare the impact of regulatory expenses on their growing costs. A total cost of regulation was summarized for each grower, and the cost per acre was calculated. The regulatory costs were also assessed as a percentage of growing costs for each producer.

The case studies for citrus and lettuce are presented in Chapters 6 through 9 and summary and conclusions are presented in Chapter 10.

Chapter 2 – Air Quality

The Federal Clean Air Act requires the Environmental Protection Agency to authorize state implementation of air quality plans. The main component of the Clean Air Act that concerns agriculture is compliance with National Ambient Air Standards, which sets limits on five pollutants known to cause health hazards, environmental damage, and/or contribute to the formation of smog: ozone, PM2.5, PM10, sulfur dioxide, carbon monoxide, and lead. PM2.5 is fine particulate matter that measures 2.5 microns or less, while PM10 is particulate matter that measures 10 microns or less, which is about one-quarter the size of a grain of salt. The EPA mandates a national standard in each of these pollutants. Each state is required to submit a State Implementation Plan to reduce or maintain pollutant levels below those standards. The regulatory burden in each region is based primarily on whether the air quality in that region meets or exceeds the pollutant levels set by the EPA under Title V, which requires the monitoring of and meeting standards for major source pollutants. This approach establishes different regulatory requirements from one air region to the next. Among California, Texas and Arizona, all have regions of non-compliance with air quality standards, but what makes a difference in regulatory costs to growers is whether agriculture is an important industry the non-attainment areas.

In California, the majority of the value of agricultural production is located within the Central Valley which is comprised of the Sacramento Valley to the north, and the San Joaquin Valley to the south. According to recent reports by the American Lung-Association (ALA), the southern portion of the San Joaquin Valley is considered to have the worst air quality in the nation, even worse than the Los Angeles area. The San Joaquin Valley air quality issues are caused by a variety of factors. The geography of this region is particularly vulnerable to poor air quality. Trapped between the Sierra Nevada and Coastal mountain ranges, with two major highways and large oil fields running through it, as well as the most productive agricultural region in the U.S., the San Joaquin Valley becomes a sinkhole for air pollution, as there is rare opportunity for it to escape (American Lung Association 2006). Another study conducted by the ALA in 2006 revealed that among the 25 counties with the worst air quality in the U.S., 11 were

in California – and these 11 counties represent 84% of the state's population. Tulare, Fresno, and Kern Counties, which commonly rank as the top three agricultural counties not only in California, but in the U.S., were among the counties with the worst air quality. Further, the ALA estimates nearly 5 million people in California have asthma, costing $1.3 billion annually in hospitalizations and medications (Weisser). The ALA directly associates the high incidence of asthma conditions to poor air quality.

California Air Quality Regulation

Prior to 2003, agricultural operations in California were exempt from the federal Clean Air Act requirements. However, on September 22, 2003, Governor Gray Davis signed into law Senate Bill 700 which put new regulations on agricultural operations with respect to air quality. The bill contained six main provisions: 1) It defined "agricultural source" in state law; 2) It removed the restriction on air districts to not require permits for agricultural source air pollution; 3) It established specific permitting and exemption requirements for agriculture; 4) It required emission control regulations in areas that exceed federal air quality standards for PM10 (particulate matter); 5) It required permits and emission mitigation from Confined Animal Facilities (CAFs); 6) It requires CAPCOA (California Agricultural Pollution Control Officers Association) to compile a clearinghouse of information about current emissions control and mitigation activities (Feather River Air Quality Management District). These policies establish the growers' obligations to reduce fugitive dust emissions as well as particulate matter, commonly referred to as PM10, to improve air quality within air districts. Fugitive dust can be defined as dust that is not emitted from defined point sources such as industrial smokestacks. Sources include open fields, roadways, feedlots and storage piles. PM10 irritates the sensitive lung tissue and can block small airways causing reduced breathing capacity of the lungs (San Luis Obispo Air Pollution Control District).

California is comprised of 35 air districts. Requirements for air quality compliance vary greatly, depending on the pollution levels inherent in a particular region. Specifically, the San Joaquin Valley Unified Air Pollution Control District, where the citrus grower is located, is subject to some of the most stringent regulations in the state

with respect to air quality, as it is a non-attainment area for three of the five pollutants on EPA's list (Figure 2.1). It requires growers to comply with Conservation Management Practices (CMP) to limit the fugitive dust and PM10 emissions. According to Rule 4550, which concerns the Conservation Management Plan Program, an owner/operator shall select one CMP from the list for each of the applicable CMP categories for each agricultural parcel of an agricultural operation site. Applicable categories within the CMP list that are specific to citrus include:

- Cropland-Land Preparation/Cultivation
- Cropland-Harvest
- Cropland-Other
- Cropland-Unpaved Roads
- Cropland-Unpaved Vehicle/Equipment Traffic Areas

A detailed list of management practices is provided in Appendix 1. They primarily deal with practices that help to reduce dust and other particulate matter, such as watering roads, practicing minimum tillage and planting cover crops.

Growers must apply for a CMP permit, and the fee is based on the size of the operation. For non-animal feeding operations, the initial fees are as follows:

- 500 acres or less: $120
- 501 acres to 1,999 acres: $350
- 2,000 acres or greater: $550

(Rule 4550 of Conservation Management Practices)

The lettuce grower in Salinas falls under the jurisdiction of the Monterey Bay Unified Air Pollution Control District, which considers agricultural operations for growing crops or livestock as generally exempt from air quality permits and regulations. As evident in Figure 2.1, Monterey County, on the Central Coast of California, has no non-attainment areas for air quality, and thus does not fall under Title V regulations for pollution reduction. Burn permits are required from the air quality control district; however, the lettuce grower would have no need for such a permit. The burden of air

quality regulations in California are depends greatly on where one lives and conducts business.

An incentive program exists in California to help offset some of the costs of emission control, primarily the Carl Moyer program. Its initial purpose was to provide cost-share assistance to businesses, including agricultural operators that wanted to replace or upgrade older, stationary diesel engines with newer, less-polluting models. Many of these engines used in agriculture would power water pumps for irrigation. To date, more than 2,000 agricultural engines have been replaced with cleaner models that can reduce emissions from 25 – 85 percent, in addition to 5,000 other, non-agricultural use engines. In its first six years, the Carl Moyer Program has provided $154 million in funding for this effort. From 2004 to 2015, the state legislature has approved annual funding of up to $141 million to provide incentives to a broader array of emission-reduction elements (California Air Resources Board). The program is funded by a tire tax and an additional fee on California automobile owners who must get smog checks every two years. An expansion of the program, which occurred via Assembly Bill 923, the Agricultural Assistance Program, allows air districts to add a $2 surcharge to the district's motor vehicle registration fee, to fund the retrofitting or replacement of a wider variety of agricultural engines. This was approved for implementation on January 1, 2005. It should be noted that these are incentive, not regulatory programs. According to the California Air Resources Board, "It is important to note that regulations will continue to be the primary means to reduce emissions to improve air quality. The incentives provided by the Carl Moyer Program, and other incentive programs, are intended to complement, not replace, these regulatory requirements" (p 2. Executive Summary, Carl Moyer Program Guidelines).

Open Burning

In recent years concern of open-burning because of the high volume of PM10 released during the process has resulted in more stringent regulations in California. Citrus and other tree fruit growers have had to increase their costs of disposal of pruning waste and orchard removal. Although agricultural burning in California is still allowed, a permit is required. Permits often take several months to obtain, there are associated fees, and a requirement of minimizing the size of burn piles is required. An alternative to

burning is chipping. Chipping is an expensive alternative costing anywhere from $300-400 per acre and takes a considerable amount of time (California Citrus Mutual).

Arizona Air Quality

Since 1995, certain agricultural activities have been considered a "significant source" of particulate matter pollution in Arizona, based on a study conducted by the Arizona Department of Environmental Quality (ADEQ). The Federal Clean Air Act requires that emissions from all significant sources in areas not meeting the national ambient air quality standards be controlled through effective programs (Guide to Agricultural PM10 Best Management Practices 2001).

In an effort to address agriculture's contribution to PM10, the Governor's Agricultural Best Management Practices (BMP) Committee was created by law in 1998. The committee's charge was to develop an agricultural PM10 general permit that would address the need for controls on agricultural operations. The committee was to identify BMPs that focused on feasible and effective practices that minimized negative impacts on local agriculture. This agricultural PM10 general permit requires that at least one BMP be implemented to control PM10 for each of the following three categories: tillage and harvest, non-cropland and cropland.

Any farmer who farmed more than 10 contiguous acres and engaged in agricultural activities before June 10, 2000, was required to comply with the agricultural PM10 general permit by December 31, 2001. A commercial farmer who engages in agricultural activities after December 31, 2000, has 18 months to comply with the agricultural PM10 general permit.

In order for farmers to comply with the PM10 permits the farmer must:

- Implement and maintain at least one approved BMP for each of the three categories: tillage and harvest, non-cropland and cropland.

Keep records detailing the BMPs selected for each category. The commercial farmer may document the practice on the practice on the sample BMP agricultural PM10 permit record or develop a record by the agricultural PM10 general permit. The commercial farmer must make available the record to the ADEQ director within two business days' of notice to the farmer.

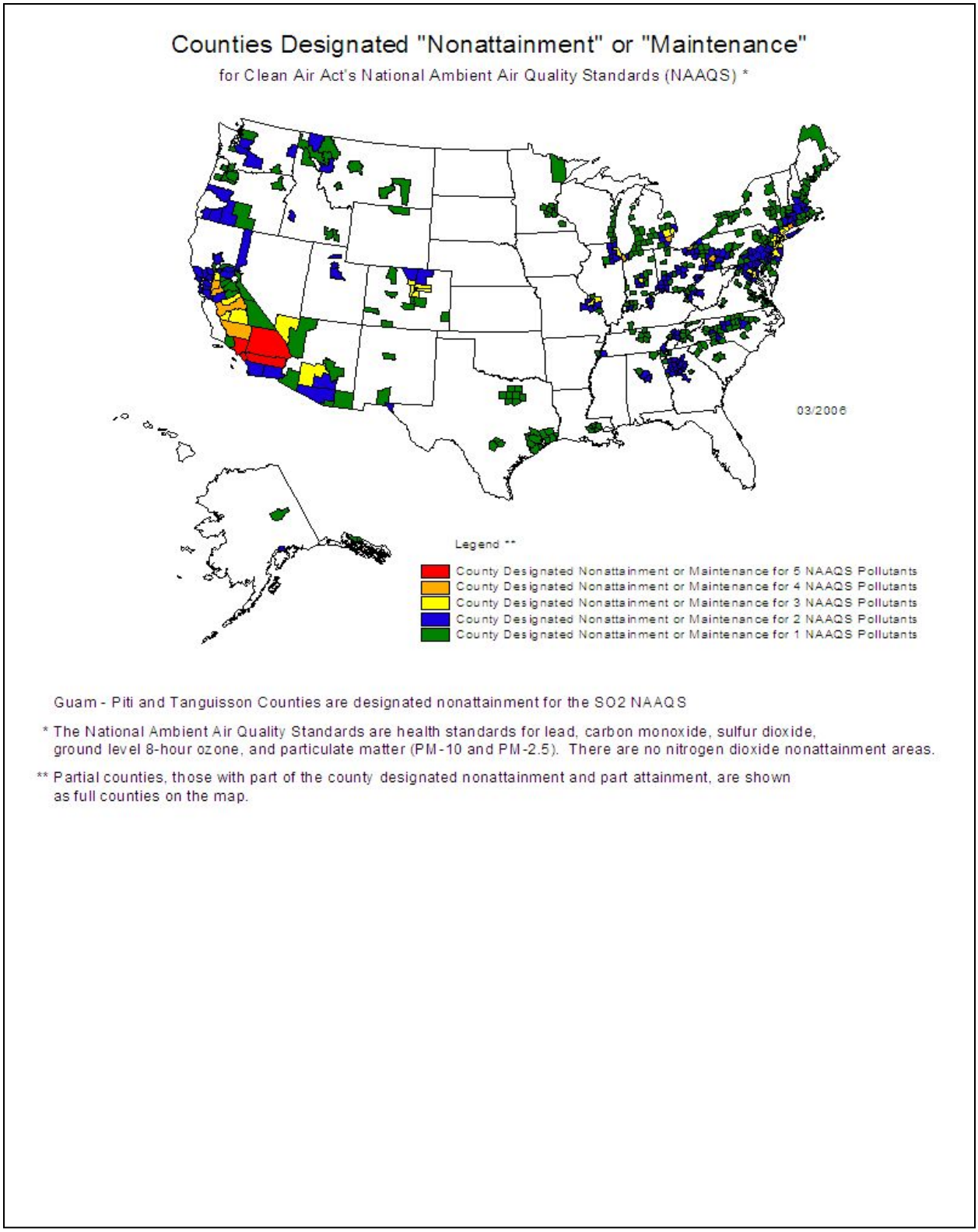

Figure 2.1: Non-Attainment or Maintenance Counties for Air Pollution Control

Source: www.epa.gov

- Additional record keeping is recommended if the BMP practice is not visible. Examples of additional record keeping include photographs, purchase records, receipts, job sheets, contractor invoices, employee timesheets, logs, narrative statements, individual farm policies, statements of understanding signed by employees or contractors, and training records.
- There is no fee associated with the agricultural PM10 general permit.

Non-compliance Procedures

If the ADEQ director determines that a commercial farmer is not in compliance with the agricultural PM10 general permit, the following three-stage process occurs.

- If the farmer has no previous general permit related compliance order, the farmer will be required to submit a plan to the local Natural Resource Conservation District (NRCD). The plan must specify the BMPs that the farmer will use to comply with the general permit.
- If the farmer has previously been subjected to an agricultural PM10 general permit-related compliance order, the farmer will be required to submit a plan to ADEQ that specifies the BMPs that the farmer will use to comply with the general permit.
- If the farmer fails to comply with the plan submission to both the NRCD and ADEQ, the director of ADEQ may revoke the agricultural PM10 general permit and require the farmer to obtain an individual fee-based permit.

The summary of BMPs approved by the Governor's Agricultural Best Management Practices Committee is provided in Appendix 2.

Texas Air Quality Regulations

In Texas, certain agricultural entities, such as dairies, cotton gins, poultry operations and grain handling facilities, must go through a New Source Review for air quality to ensure that air quality guidelines will be met. This is approved through the Texas Commission on Environmental Quality. As prescribed by the Federal Clean Act, New Source Review permits and Title V compliance are necessary. However, Title V is only required in non-attainment areas (see Figure 2.1). No counties in southwest Texas

are in non-attainment for any of the regulated pollutants, so air quality regulations do not apply. New Source Review holds for the types of farms, agricultural input or processing operations listed above, but general crop or citrus farms are exempt. Thus, air quality regulations are virtually non-existent, except for several of the larger urban areas.

Regarding burning of agricultural materials, fire marshals in Texas can grant burn permits for pruning waste and orchard removal; chipping or reducing the pile of potential burn material is not required as in California.

Chapter 3 - Water Quality

California Water Quality

The United States Clean Water Act is the primary federal statute that mandates states to control water quality. The EPA provides funding for states to administer the required planning and regulatory programs, but states must submit plans to control water pollution that meet the criteria established by federal law. The most difficult type of pollution to control is non-point source pollution, or NPS. According the U.S. EPA, nonpoint source pollution is the largest source of water quality problems in the U.S. Under the Clean Water Act**,** The United States EPA administers a National Pollution Discharge Elimination System (NPDES) that authorizes 45 states to issue permits for discharges into surface waters of the U.S. originating from a point source. However, the NPDES program only applies to certain agricultural producers, particularly operators of large animal feeding operations. Due to the fact that irrigated agriculture and agricultural storm water runoff are considered to come from non-point sources and the NPDES regulations exclude these discharges from permitting requirements, this study will not evaluate the NPDES regulations and fees.

Two California agencies are responsible for developing and carrying out the NPS pollution control policies; the State Water Resources Board (SWRB) and the nine Regional Water Quality Control Boards (RWQCB). The Porter-Cologne Act, initially adopted in 1969, is the state law that provides the authority to the SWRB and the RWQCB to control NPS pollution (Gerstein, et al.). Each regional board develops "basin plans" for their hydrologic areas, governs requirements and issues waste discharge permits, takes enforcement action against violators, and monitors water quality. The California Water Code gives Regional Water Quality Control Boards the authority to regulate discharges of waste that could impact the waters of the state of California, through permits called “Waste Discharge Requirements.” A discharge is any release of waste, such as fertilizer, pesticide or sediment, to a water of the state. Waters of the state include rivers, streams, lakes, bays and estuaries, and also groundwater. Since May 5, 2004, when the SWRCB adopted a new policy regulating NPS pollution, landowners,

agricultural producers and timber harvest operations have become subject to increased regulation to control polluting runoff (Gerstein, et al.).

This study will focus on Region 3, the Central Coast, and Region 5, the Central Valley. These Regions will be used because the majority of lettuce is grown in Region 3 and the majority of citrus is grown in Region 5, as well as the fact that the cooperating lettuce and citrus producers are located in these regions, respectively. Although similar regulations are prevalent between the two regions, each has unique differences that are best explored independently.

Region 3 - The Central Coast

Region 3, the Central Coast, is comprised of Santa Cruz, Monterey, San Luis Obispo, Santa Barbara, and parts of San Benito Counties. The Central Coast Region has approximately 600,000 acres of cropland under irrigation and more than 2,500 operations that are or may be discharging waste that could affect the quality of waters of the state. The majority of lettuce grown in Region 3 comes from Monterey County with a total acreage of 122,313 valued at $9.12 million (Agricultural Commissioners Monterey County 2005).

In 2004 the Central Coast Regional Water Quality Control Board adopted a new conditional waiver for discharges from irrigated lands, replacing a 1983 waiver that had expired. The Conditional Waiver applies to all irrigated lands used for producing commercial crops, including, but not limited to, land planted to row, vineyard, field and tree crops, commercial nurseries, nursery stock production and greenhouse operations with soil floors that are not currently operating under Waste Discharge Requirements (WDRs) (State Water Resources Control Board).

Dischargers seeking authorization to discharge under the Conditional Waiver submit a complete Notice of Intent (NOI) to comply with the Terms of the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Land. All applicants must submit the following information as part of their NOI to enroll:

- Completed application form, including location of the operation and identification of responsible parties (owners/operators)

- Copy of map of the operation (map should be the same as the one submitted to the County Agricultural Commissioner for Pesticide Use Reporting, or equivalent)
- Completed management practice checklist/self assessment form
- Certificates of attendance at Regional Board-approved farm water quality education courses, if applicable
- Statement of farm water quality plan completion, if applicable
- Election for cooperative or individual monitoring.

The Conditional Waiver provides an alternative regulatory option to adoption of WDRs for all discharges. Dischargers may seek coverage under this program through tiered waiver structure.

Tier 1 conditional waivers are five years in length. To qualify for a Tier 1 conditional waiver, dischargers must do the following:

a. complete 15 hours of Regional Board-approved farm water quality education
b. complete a Farm Plan
c. provide biennial practice implementation checklist to the Regional Board demonstrating that the Discharger has made and is implementing appropriate changes to the Farm Plan.
d. perform individual water quality monitoring or participate in cooperative water quality monitoring.

Tier 2 conditional waivers are one year in length, and renewable up to three years. To qualify for a Tier 2 conditional waiver, operations must do the following:

a. complete at least 5 hours of Regional Board-approved water quality education per year, up to a total of at least 15 hours
b. complete a Farm Plan
c. provide annual practice implementation checklists identifying currently implemented and planned management practices and progress reports on completion of requirements to the Regional Board
d. perform individual water quality monitoring or participate in cooperative water quality monitoring

In both Tier systems, a fee of $0.15 cents per acre is required by the land owner who is discharging the water. Furthermore, the water quality-monitoring program found in both Tier 1 and Tier 2 conditional waivers is required by the California Water Code Section 13269 and developed by the Regional Board. The program calls for monitoring sites located on the main stems and tributaries of rivers in the agricultural areas of the region. Monthly sampling is conducted to evaluate the quality of the water and determine whether water quality is improving over time. The total annual cost of the cooperative monitoring program is estimated to be between $900,000 and $1 million. If the cost is broken down to individual users, a fee ranging from $2-$3 dollars per acre, depending on the impact of the land use, is administered to farmers. Dischargers not in the program must still adhere to the monitoring but will be faced with much higher costs to maintain their Waste Discharge Requirements.

Region 5 - The Central Valley

Region 5 extends from the Oregon-California border to the north end of Ventura County between the Coastal Ranges and the Sierra Nevada. The Central Valley Regional Control Board encompasses both the Sacramento Valley as well as the San Joaquin Valley. The majority of citrus grown in California can be found in Tulare, Kern, and Fresno Counties, which are located within Region 5.

According to the Central Valley Regional Control Board, a permit is needed if discharges occur such that groundwater quality is affected or if the discharges are from diffused sources (e.g., erosion from soil disturbance or waste discharges to land). Operators must file a Report of Waste Discharge or a Waste Discharge Requirement (WDR).

In 2005 the Region adopted a Conditional Waiver of Waste Discharge for irrigated land. The Waiver requires Coalition Groups to develop a monitoring program to assess the sources of impacts of waste discharges from lands that are irrigated. A Coalition Group is a group established to represent individual dischargers that discharge waste to waters of the state. The Central Valley Regional Control Board defines a Coalition Group as any group of dischargers, participants, and/or organizations that form to comply with the Conditional Waiver. Coalition Groups can be organized on a geographic basis or by other factors in common such as commodity groups.

Coalition Groups must first file a Notice of Intent to the Region in order to be approved to represent individual dischargers. Approved Coalition Groups include:

- California Rice Commission
- East San Joaquin Water Quality Coalition
- Goose Lake Coalition
- Root Creek Water District
- Sacramento Valley Water Quality Coalition
- San Luis Water District
- San Joaquin Valley Water Quality Coalition
- Westlands Water District
- Westside San Joaquin River Watershed Coalition

It is required that Coalition Groups maintain and annually submit an electronic list with specific information about the landowners and/or operators of irrigated lands that discharge waste to waters of the State who are knowingly participating in the Coalition Group.

Since each Coalition Group is a separate entity with the power to administer the program to its own discretion, as long as it adheres to the guidelines of the Region's requirements, fees can vary among Coalitions. In the case that the Coalition is a water district, fees may be collected through an increase in water prices. In Coalitions such as the San Joaquin Coalitions listed above, a fee of $1-$2 per acre may be applied as well as a fee to join of approximately $100. Furthermore, fees have also been associated with an increase of rural property taxes. Whatever route a Coalition chooses to take, a fee is applied to cover the costs of monitoring.

Arizona Water Quality

The Arizona Department of Environmental Quality monitors water pollution in the state. In order to address water quality problems related to non-point pollution, the State of Arizona developed a Five-Year Non-point Source Management Plan. The plan was implemented in 2003 and will run through 2008. Using a number of methods to protect the quality of water within the state, the Management plan includes:

- Surface and ground water monitoring
- Watershed inventories
- Watershed characterizations
- Total Maximum Daily Load (TMDL) studies
- TMDL implementation plans
- Watershed-based plans
- Water quality improvement projects

Many of the methods used by Arizona to monitor water quality directly relate to those of California. Furthermore, like California, Arizona divides the state into different regions to address water quality monitoring. Unlike California's Regional Water Quality Control Boards, Arizona uses the different watersheds of the state to manage and assess water quality. Further differences among Arizona include universal regulations across the state, as opposed to the regional differences found in California's regulations. However, the underlying difference between the two states is the fact that Arizona's Management Plan is a volunteer incentive program which uses grant funding established through the Clean Water Act to alleviate educational costs and other financial burdens, whereas California's NPS pollution control program is mandatory and growers add compliance to the cost of doing business.

Texas Water Quality

The passage of Texas Senate Bill 503 in 1993 directed the Texas State Soil and Water Conservation Board (TSSWCB) to implement water quality management plans in Texas. A water quality management plan is a site-specific plan developed through and approved by soil and water conservation districts for agricultural or silvicultural lands. The plan includes appropriate land treatment practices, production practices, management measures, technologies or combinations thereof. The purpose of water quality management plans is to achieve a level of pollution prevention or abatement determined by the TSSWCB, in consultation with local soil and water conservation districts, to be consistent with state water quality standards (Texas State Soil and Water Conservation Board).

Much like Arizona's monitoring program, the water quality management plan is a voluntary incentive program that uses special grant funding from the federal Clean Water Act to carry out special educational programs and further financial assistance for implementing management measures. Furthermore, it is important to note that there is no fee associated with developing a water quality management plan in Texas.

The Texas State Soil and Water Conservation Board operates much like California's system in the sense that the state of Texas is divided into five regional districts. To obtain a WQMP the individual grower would need to contact the district office and obtain the necessary information to start the development process. The grower would then develop a plan with the National Resource Conservation Service (NRCS) and the TSSWCB assistance. A plan would include:

- A District-Cooperator Agreement
- Written Request for planning assistance
- Soil Map of the area with appropriate interpretations
- Conservation Plan Map
- Narrative Record of decisions (including all practices needed for a WQMP)
- Implementation schedule indicating the year practices are to be applied
- Worksheets used during the inventory and/or planning phase of WQMP
- Signature sheet to verify individual's privacy.

Once this is done, a WQMP is certified and the implementations would take place on the grower's land.

Chapter 4 – Pesticide Regulations

The U.S. Environmental Protection Agency regulates pesticides under the auspices provided by two major acts of Congress; the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and the Federal Food, Drug and Cosmetic Act (FFDCA). These were strengthened by the Food Quality Protection Act (FQPA), which became law in 1996. States are authorized to regulate pesticides under FIFRA and under state pesticide laws. States may place more restrictive requirements on pesticides than EPA. Both the EPA and the state must register a pesticide before distribution.

FIFRA requires all pesticides sold or distributed in the United States to be registered via a full Section 3 registration process, which ensures that the product will do what it claims, that the labeling complies with the law's requirements, and that it will not have "unreasonable adverse effects" when it is used as intended. Unreasonable adverse effects are defines in FIFRA 2(bb) as:

(*1) any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide, or (2) a human dietary risk from residues that result from a use of a pesticide in or on any food inconsistent with the standard under section 408 of the Federal Food, Drug, and Cosmetic Act.*

Federal Register, August 9, 2006 (Volume 71, Number 153).

FIFRA was amended in 1988 to create a re-registration procedure for pesticides that were first registered before 1984. As laws, testing and standards evolved, the EPA wanted to ensure that older pesticides conformed to new health and safety standards. The older products were also required to meet the pesticide tolerance limits first established by the FFDCA, and that were made more stringent by the FQPA. Under the FQPA, both previous laws were amended to include a rule that a pesticide pass a standard of "reasonable certainty of no harm." New tolerance levels were established to account for the dietary intake of infants and children, as well to assess the aggregate and cumulative risk of exposure to pesticide residues.

The EPA may require as many as 90 to 100 specific tests, and the manufacturer's cost for completing these tests can be up to $10 million. According to the USDA, the pesticide industry has estimated that the total cost of a registration for all phases, from research and development through production, may exceed $50 million and take from nine to 10 years. Most pesticide registrations can cost significantly less than this, depending on their proposed uses, the acreage over which they are applied and whether the crop is a food product (Agricultural Research Service). The EPA mandates a "restricted use" classification that restricts a product, or its uses, to those who are certificated pesticide applicators or who are under the direct supervision of a certified applicator (U.S. EPA).

California Pesticide Registration

Most states have registration requirements based upon the prior testing and approval by the U.S. EPA. Once the pesticide manufacturer has provided documentation of EPA's registration, nearly all states register the material for use within their borders, following a relatively simple application process and fee payment. However, California has a separate review process, handled by the California Department of Pesticide Regulation (CDPR), under the California EPA. Pesticide manufacturers must provide additional data to the CDPR in order to pass scientific, legal and administrative requirements in order to be granted a license to sell and use the product in California. A recent case study found that for several new pesticides under review in California, registrations were delayed for several years after the U.S. EPA had provided either conditional or full approval (Hurley et al., 2006). The new pesticides were even considered safer, perhaps more effective alternatives to older chemicals. This finding would indicate that other states might be able to access safer, more effective products several years prior to California growers. In addition to the delays, industry officials note that it costs companies an additional $6 to $8 million to register their products in California, over and above the tens of millions spent for federal registration.

California assesses higher fees than other states for pesticide registration, and also levies a mill tax on all pesticides sold. As of July 2004, a pesticide registration or

registration renewal costs $750 per year, up from $200 prior to this date. Label amendments, which formerly had been free of charge, are now assessed a $100 fee. A mill assessment is levied quarterly on wholesale pesticide sales that is now $.021 per dollar of value, plus an additional $.00075 on agricultural and dual-use pesticides.

Arizona Pesticide Registration

Registration for pesticides in Arizona is administered through the Arizona Department of Agriculture. Pesticides that are already registered with U.S. EPA and have an EPA registration number are acceptable for registration in Arizona (Arizona Department of Agriculture). The state registration fee is $100 per year for each pesticide, which must be submitted with a one-page registration application, as well as two copies of the label and a Materials Safety Data Sheet. The companies seeking registration must provide an account of the labeling for the pesticides, a full description of the tests conducted and the results of those tests (if requested by the division). For a renewal, the manufacturer only must submit a statement with respect to information that has been amended since the pesticide was last registered or re-registered. The Department states that application packets found to be complete will be processed, and the registration certificate will be returned within 105 days. There is no mill tax on pesticides sold in Arizona.

Texas Pesticide Registration

As in Arizona, the Texas Department of Agriculture has the authority to register pesticides in the state. A $420 fee is required for a two-year product registration, and the applicant must submit the current product label that is affixed to the container that includes the EPA number, establishment number and net contents; a Materials Safety Data Sheet; the EPA Stamped “Accepted” label, the letter containing EPA comments page (if applicable), approving the deviations to the label and any other EPA correspondence. No mill tax is assessed on pesticides sold in Texas.

California Pesticide Use Regulations

Not only do the pesticides undergo a more stringent and expensive review in California, but those who intend to apply or advise the application of restricted-use materials have a longer, more expensive certification and continuing education process than in other states. Again, the Department of Pesticide Regulation, under Cal EPA, administers the certification and licensing process. Owners of private firms who plan to use restricted-use pesticides (as classified by the U.S. EPA) on their own property (defined as property owned/leased, or rented by him/her or his/her employer) can apply for a Private Applicator Certificate, which requires the passage of an exam that is administered through the County Agriculture Commissioner's office. The exam covers label directions and use restrictions, calibration, pest control equipment, pest problems and identification, worker safety and environmental issues. There is no cost for the examination or certification, but a study manual is recommended which costs $35. To renew the Private Applicator Certificate, six hours of continuing education over the three years of the valid certification is required, or the applicant must re-take and pass the examination before the current certificate expires. All certified private applicators must maintain records on their applications of restricted materials for one year.

An Agricultural Pest Control Advisor's (PCA) license is required of anyone who advises the use of restricted materials, and a Qualified Applicator's license is required of anyone planning to apply restricted materials for hire. Many large growers in California use PCAs to advise their pest control needs.

To earn a PCA license, one must first either have completed a Bachelor's degree in agricultural science, biological science or pest management, or have completed 60 semester units of college-level curriculum, plus 24 months of experience as an assistant to a PCA. Both options include core course requirements of 39 semester units. An initial application fee of $50 is required, and college transcripts must be submitted. The applicant must pass a Laws and Regulations exam, and to maintain the license, the PCA must attend 40 hours of DPR-approved continuing education classes every two years. The PCA must also register in his or her home county where the work is conducted,

which costs $10 per year, plus $5 per year for each additional county in which the PCA conducts business.

Both private applicators and PCAs are required to provide a Notice of Intent to the County Agricultural Commissioner at least 24 hours before the application of restricted materials. Since 1990, when the DPR began its "full-use reporting" program, private applicators and PCAs must report their applications monthly to the County Agricultural Commissioner, who then reports the data to the Department of Pesticide Regulation. The reports must include the data and location where the application was made, as well as the type and amount of pesticides used. The type of crop must be reported, as well. The DPR keeps a comprehensive database of pesticide use in California.

Property owners or lessors who intend to use restricted chemicals on crops grown on their land must receive an annual permit from the County Agricultural Commissioner. It details the contact person, location of the property, the commodity or crop(s) grown, the proposed planted acres and the list of chemicals that may used throughout the year for each commodity or crop. In addition, custom site conditions and advisories are listed, such as proximity to an organic grower or a school. Limitations on spray buffer zones or timing of applications is included on the permit.

Arizona Pesticide Use Regulations

Arizona also has a permitting system for the use of restricted pesticides, under the administration of the Environmental Services Division of the Arizona Department of Agriculture. If a private grower is planning to purchase restricted materials, or to pay someone else to apply those materials to the crops, he or she needs a Regulated Grower's Permit, which costs $20 annually. If the same private grower intends to apply the pesticides, and he or she needs an annual CORE certification credential. This requires an examination, and the license costs $50 annually. To renew the certificate, the private applicator needs to attend three hours of continuing education each year.

Those who make recommendations to growers regarding pesticide applications must maintain a Pest Control Advisor's license. As of January 1, 2005, new applicants

for a PCA license must hold a B.S. degree in agricultural sciences, biological sciences, or pest management. Applicants without a B.S. degree must have completed 45 semester units of college-level courses that include an array of biological and physical science, entomology, pest management and plant production. In addition, these applicants must have 24 months of technical experience. All PCA applicants must pass a written examination in order to be licensed. The license costs $50 annually, and 15 hours of continuing education credit are required for annual renewal. Both private applicators and PCAs must file Form 1080s with the Arizona Department of Agriculture Environmental Services Division within a week of a restricted-use pesticide application. This is used primarily as a means to collect data on pesticide use in Arizona, but can also be used for audit and regulatory purposes.

Those who intend to apply restricted materials for hire must carry a Custom Applicator license, for air application, must maintain FAA certification for aerial applicators. A custom applicator CORE examination, plus the air or ground permit costs $100 annually. Any aircraft or piece of ground equipment used for custom pesticide application must have an equipment license tag that costs $25 each; two-year licenses are available.

Texas Pesticide Use Regulations

The Texas Department of Agriculture (TDA) administers pesticide use certifications for restricted-use and state-limited use materials. Like Arizona and California, Texas distinguishes between those who plan to use restricted materials on their own agricultural operations (whether owned or leased), and those who custom apply or recommend pesticide use for hire. Private applicators must attend a private applicator training program, offered by Texas Cooperative Extension, or a private entity approved by the Texas Department of Agriculture. The applicant must pass the TDA private applicator exam, and purchase a license for $60, which is valid for five years. The applicator must obtain 15 hours of continuing education credit over the five years to renew their license, or pass an exam, the cost of which is $50 per attempt. Some growers hold private applicator certificates, which were voluntary from 1977 through 1989.

Those holding a certificate prior to January 10, 1989, were "grandfathered" by the legislature, meaning that the certificate did not expire. In 1989 the Texas Pesticide Regulations were revised to require recertification for all applicators, including certified applicators, in order to purchase or use restricted-use or state-limited use pesticides. However, this certification does not allow the holder to supervise the application of restricted-use or state-limited use pesticides. Certificate holders must obtain 15 hours of continuing education every five years in order to renew their certificate. Additionally, applicators are to keep records of pesticide applications for two years.

Commercial applicators are considered to be those people who either operate or are employed by a business that is hired to apply restricted-use or state-limited use pesticides to another person's property. Applicants for a commercial applicator's license must pass the TDA general examination, the laws and regulations examination, and a category exam in one of eight approved subject areas. There is no fee for the general or laws and regulations exam, but a $24 fee is charged for each category and sub-category exam. The applicant must provide certification of financial responsibility for up to $100,000 in property damage and $100,000 bodily injury per occurrence. The applicant must not have been convicted of a felony involving moral turpitude. The non-refundable application fee is $180 and an Applicator Business Registration must also be submitted. Commercial applicators must renew annually and obtain five continuing education credits each year, and they are also required to have insurance and register their pesticide equipment.

Texas Department of Agriculture has no statutory requirements with respect to pest control advisor certification or licensure. Only those who are actually applying or supervising the application of restricted materials are required to have a license. No other state agencies in Texas currently regulate or require licensing of pest control advisors or crop consultants.

Chapter 5 – Workers' Compensation and Minimum Wage

California Workers' Compensation

To provide an example of how workers' compensation is structured, California's Workers' Compensation will be used to present the basics of the system. Both Texas and Arizona programs are nearly identical to that of California with the exception of rate differences. In California, the Division of Workers Compensation monitors and administers workers' compensation claims, and provides administrative and judicial services to assist in resolving disputes that arise in connection with claims for workers' compensation benefits. There are three basic parts to the workers' compensation system: the benefit structure, the benefit delivery system, and the benefit financing system.

The Benefit Structure

The benefit structure defines what injured workers are entitled to receive when they sustain an injury "arising out of and in the course of" their employment. There are six basic types of workers' compensation benefits available, depending on the nature, date and severity of the worker's injury: (1) medical care, (2) temporary disability benefits, (3) permanent disability benefits, (4) vocational rehabilitation services, (5) supplemental job displacement benefits, and (6) death benefits (Division of Workers' Compensation).

The Benefit Delivery System

Workers' compensation in California, as well as in many other states, is not administered by a government agency but by private parties -- insurance companies authorized to transact workers' compensation and those employers secure enough to be permitted to self-insure their workers' compensation liability.

The vast majorities of workers' compensation claims are handled expeditiously and are administered without dispute or litigation. These are, for the most part, the smaller claims -- those in which only medical care is provided and those in which the injured worker is disabled for only a few days. These smaller claims account for more than three-quarters of all workers' compensation claims.

The balance of the claims -- those in which there are significant periods of disability or permanent disability -- account for the vast majority of costs and litigation. In these more serious cases, litigation is common (Division of Workers' Compensation).

The Benefit Financing System

California employers generally have three options to fund their workers' compensation benefits: (1) self-insurance, (2) private insurance, or (3) state insurance.

- Self-Insurance -- Most large, stable employers and most government agencies are self-insured for workers' compensation. To become self-insured, employers must obtain a certificate from the Department of Industrial Relations. Private employers must post security as a condition of receiving a certificate of consent to self-insure.
- Private Insurance -- Employers may purchase insurance from any of the approximately 300 private insurance companies which are licensed by the Department of Insurance to transact workers' compensation insurance in California. Insurance companies are free to price this insurance at a level they deem appropriate for the insurance and services provided.
- State Insurance -- Employers may also purchase insurance from the State Compensation Insurance Fund, a state-operated entity that exists solely to transact workers' compensation insurance on a non-profit basis. It actively competes with private insurers for business, and it also effectively operates as the assigned risk pool for workers' compensation insurance (Division of Workers' Compensation).

Arizona Workers' Compensation

Arizona law requires that all Arizona employers with one or more employees maintain workers' compensation insurance. The Industrial Commission of Arizona (ICA) enforces this regulation. If an employer fails to obtain workers' compensation insurance, the ICA is authorized to assess civil penalties against the employer, which can culminate in a $10,000 fine and an injunction to close the employer's business until compliance is met. The ICA may also refer the matter to the Office of the Attorney General or to another law enforcement authority to prosecute an uninsured employer with a class 6 felony for failing to comply with the law requiring workers' compensation insurance (Industrial Commission of Arizona Legal Compliance Division).

In addition to state penalties and potential criminal prosecution, an employer with no workers' compensation insurance can be sued by the injured worker. The injured worker may also file a claim for workers' compensation benefits with the ICA through its Special Fund division that pays benefits identical to those paid by insurance carriers. Penalties may be assessed against the non-insured employer.

As in California, Arizona employers have several options available for workers' compensation coverage. They may participate in the state workers' compensation program, they may contract with a licensed, private insurance company, or they may themselves or with several other employers become certified to self-insure to provide workers' compensation insurance for their employees. Workers' compensation is a "no fault" system in which injured workers receive medical and compensation benefits no matter who causes the job-related accident (Industrial Commission of Arizona).

Texas Workers' Compensation

One glaring difference in conducting business in Texas is that in most cases, the state does not require employers to carry workers' compensation insurance. If an employer chooses not to carry any sort of workers' compensation insurance, the business is considered a "non-subscriber," and must notify the employees and the Texas Department of Insurance Workers' Compensation Division that it does not have workers' compensation insurance. If a business does not have workers' compensation insurance coverage and has more than four employees, any reportable injury must be reported by the seventh day of each month on a "Non-Covered Employers' Report of Occupational Injury or Illness" to report all fatalities, work-related diseases that the employer learns of, and all on-the-job injuries resulting in more than one day's absence from work.

Any employer who has workers' compensation is considered a "subscriber," and is required to post a notice in the work place that provides the insurance carrier's name, information regarding the Ombudsman program at the Texas Department of Insurance, Division of Workers' Compensation (Division), and a contact number for reporting unsafe work conditions. This notice must be placed in the employer's personnel office and in a prominent place where employees can see it regularly. The state does not issue its own workers' compensation insurance program, but licenses private insurance companies and provides a forum for rate comparisons on the Division's website.

Self-insurance is available to large employers. These employers must present evidence to the Division of a total unmodified workers' compensation insurance premium in Texas of at least $500,000. The business must also show sufficient financial strength and liquidity to ensure prompt attention to all workers' compensation claims. A plan for claims administration by a qualified claims servicing contractor must be submitted, and the employer must also demonstrate that effective safety programs are in place for each business location.

Accident prevention is a basic tenet of workers' compensation programs, and insurance companies are required to provide accident prevention services to its policyholders. These services might include surveys, consultations, recommendations, industrial hygiene/health services, claims history and accident analysis, and training.

In addition, the Division offers several safety and health resources to help employers with training and accident prevention needs, including regional and customized on-site training; free safety and health publications and training video loans; a safety and health update e-mail newsletter; and free safety and health consultations through the Occupational Safety and Health Consultation (OSHCON) program.

Though each state makes provisions for workers' compensation programs, the rate structure among the comparison states is quite different, as is evident in Table 5.1. Classifications for rates are set by the type of work performed by the employee, which is further explained below. The percentages are expressed in terms of each dollar of wages earned by the employee.

Table 5.1 Workers' Compensation Rates Among Three Comparison States

Texas	California	Arizona
Fruit Farm 6.89% per dollar	Field Workers 10% per dollar	Orchards 4.09% per dollar
Vegetable Farm 9.74% per dollar	Packing Shed 25% per dollar	Field Crops 5.93% per dollar
Clerical 0.46% per dollar	Clerical 0.5% per dollar	Clerical 0.26% per dollar

California maintains separate categories for workers' compensation for field workers and packing shed workers, but Texas and Arizona generalize farm operations as a whole and use the same rates for packing shed employees. For example, if an Arizona

field crop employer pays 5.93% per dollar for an employee's workers compensation, that same 5.93% rate will be used by the packing shed employer to pay workers' compensation for his employee. This drastically differs from California considering packing shed rates are more than double the rates paid for a field worker.

Minimum Wage

Both Texas and Arizona currently use the Federal minimum wage rate of $5.15 per hour; neither state has a higher minimum wage rate. California's current law requires a higher minimum wage rate than does the federal law; all employers in California who are subject to minimum wage laws must pay the state minimum wage rate of $6.75. However, a new law was signed in August 2006 by Governor Schwarzenegger to raise the minimum wage rate to $7.50 effective January 1, 2007, and then to $8 in January 2008, making California's minimum wage among the highest in the country.

This chapter and those preceding it depict the wide array of regulatory differences that occur among the comparison states with respect to air and water quality, pesticide regulations and labor requirements. The next four chapters will show in monetary terms how these regulations impact the business of agriculture in three states. The production budgets and regulatory costs for the case studies conducted in California and Texas for citrus, and California and Arizona for lettuce production follow in Chapters 6 through 9.

Chapter 6 - Case Study: California Citrus

Orange production in California is a $1.08 billion business, and it is primarily located in Tulare County, which is home to more than half of all the state's citrus sales. Tulare County is consistently one of the top two agricultural counties in the state. In 2005, agricultural sales topped $4.3 billion (Summary of Ag Commissioners Reports, 2006). Tulare County, located in the Central Valley, is in the most heavily regulated area of the state with respect to air and water quality protections.

The cooperating grower is located in a small town near Visalia, California. The 1,400 acres of citrus that is farmed by the company is comprised of navel oranges, grapefruit, lemons, Minneola tangerines, and a number of newer citrus varieties that will provide advantages in either seasonality or in consumer preferences toward sweeter, easy-to-peel fruit. The production costs presented below are based on navel oranges and are provided by the grower. The cultural and harvest costs for an established grove of navel oranges are as follows:

Table 6.1 Cultural and Harvest Costs, California Navel Oranges, Tulare County

Total Cultural Costs ($/acre)	$1945
Frost Protection	$85
Nitrogen Fertilizer	$80
Weed control	$50
Pest Management	$400
Prune	$70
Irrigate	$200
PCA consultant	$35
Lube and Repair	$40
Management Fee	$30
Land Prep/Tillage	$50
Crop Insurance	$25
Cultural Costs net Labor and Fuel	**$1065**
Fuel	$40
Labor (@ $12/hr)	$840
Fresh Market Harvest Cost ($/Carton)	**$5.32**
Yield (Ton/Acre)	12.38
Pick and Haul Fruit/Carton	$1.20
Pack Fruit	$4.00
Assessments	$.12
Total Production Costs/Acre	**$5,238.45**

In order to provide a state-level comparison, we provide the U.C. Cooperative Extension production cost budget prepared for navels and Valencias for the southern San Joaquin Valley for 2005. This provides the reader with an average cost basis for the crop. The primary difference in the budgets is that the U.C. budget provides the non-cash overhead costs, while the cooperating grower's budget does not. If one views just the cash costs per acre, the production budgets are very similar, with a cost of $5238.45 for the grower cash costs, while U.C. Davis estimates cash costs to be $5,266.

Table 6.2 UC Cooperative Extension Production Cost Budget, Oranges – San Joaquin Valley South

UC COOPERATIVE EXTENSION
Table 3. COSTS PER ACRE TO PRODUCE ORANGES
SAN JOAQUIN VALLEY - SOUTH 2005

	Operation	Cash and Labor Costs per acre				
Operation	Time (Hrs/A)	Labor Cost	Fuel, Lube & Repairs	Material Cost	Custom/ Rent	Total Cost
Cultural:						
Frost Protection (water & wind machine)	2.19	21	0	309	0	330
Fertilize: N (through drip line)	0.30	3	0	35	0	38
Weed: Pre-emergent (Princep, Karmex) 2X	0.50	9	1	36	0	45
Insect/Fertilizer: Worm (Dipel)/N Mn Zn	0.00	0	0	20	25	45
Prune: Top Trees, Stack & Shred Prunings 1X/4 Yr	0.00	0	0	0	26	26
Prune: Hedge Alt. Rows, Shred Prunings 2X/4Yr	0.00	0	0	0	20	20
Prune: Hand Prune & Stack, Shred Prunings 1X/4 Yr	0.00	0	0	0	89	89
Irrigate: (water & labor)	5.55	54	0	225	0	279
Soil Amendment:(Soluble Gypsum) w/irrigation	8.75	84	0	120	0	204
Weed: Spot Spray (Roundup) 3X	0.75	13	1	3	0	17
Insect/Fertilizer: Thrips Katydid (Success, Oil) /N	0.00	0	0	44	25	69
Insect: Thrips (Success, Oil)	0.00	0	0	37	25	62
Insect: Scale (Esteem)	0.00	0	0	98	75	173
Leaf Analysis (1 sample/10 acres)	0.05	0	0	0	3	4
Disease: Brown Rot (Lime, Kocide)	0.00	0	0	21	30	51
Growth Regulator: (Hivol) [Navel Only]	0.00	0	0	11	45	56
Growth Regulators (GibGro or GA) [Navel Only]	0.00	0	0	28	45	73
Pickup Truck Use	3.33	57	28	0	0	86
ATV Use	3.33	57	3	0	0	61
PCA/Consultant Services	0.00	0	0	0	35	35
TOTAL CULTURAL COSTS	24.64	298	34	987	443	1,761
Harvest:						
Pick & Haul Fruit	0.00	0	0	0	720	720
Pack Fruit	0.00	0	0	0	2,200	2,200
Assessments	0.00	0	0	23		23
TOTAL HARVEST COSTS	0.00	0	0	23	2,920	2,943
Interest on operating capital *						140
TOTAL OPERATING COSTS/ACRE		298	34	1,010	3,363	4,845
Cash Overhead:						
Office Expense						120
Liability Insurance						9
Property Taxes						122
Property Insurance						39
Investment Repairs						131
TOTAL CASH OVERHEAD COSTS						421
TOTAL CASH COSTS/ACRE						5,266
Non-Cash Overhead:		Per producing Acre		Annual Cost Capital Recovery		
Buildings 1800 sqft		1,000		73		73
Fuel Tanks 2-250g		58		4		4
Shop Tools		215		21		21
Land		6,500		391		391
Gypsum Machine (1)		550		131		131
Orchard Establishment		5,612		384		384
Drip Irrigation		1,250		83		83
Wind Machine (6)		2,070		175		175
Equipment		350		41		41
TOTAL NON-CASH OVERHEAD COSTS		17,605		1,303		1,303
TOTAL COSTS/ACRE						6,569

*Interest based on May 04 through April 05 Crop Year

The purpose of this study was to assess the value of the regulatory costs that do not appear as budget line items. These regulatory costs could be safety training for employees, continuing education for maintaining pesticide applicator licenses, filling out paperwork for air or water quality requirements, and paying fees associated with a number of permitting scenarios. We developed a list of possible costs that would be faced by growers as a cost of doing business in California, and asked them to estimate the amount and value of time that either they or an employee spent on each regulatory compliance area. In some cases, fees are assessed for permits or licenses, or to participate in educational programming in order to meet regulatory requirements. Most of the costs, however, are a result of increased time spent either in keeping records, filing reports or upgrading equipment to keep the operation current with the myriad of regulations.

A recent study that looked at grower perceptions of the regulatory environment in California found that citrus producers believed that workers compensation insurance and pesticide application and registration were the main regulatory areas in which their costs had increased from 1999 to 2004 (Hurley et. al, 2006). The regulatory costs reported by the grower bear out this finding, though for this particular grower, air quality would possibly rank higher. Hurley's study found that air quality compliance ranked seventh out of a list of twelve regulatory areas. For the citrus industry in the San Joaquin Valley, however, the burn restrictions to protect air quality are particularly onerous, as will be shown below.

The following costs were self-reported by the grower, and an on-farm visit and follow-up correspondence via e-mail and telephone helped to clarify the costs and activities recorded. These costs are reported in the Table 6.3 following this discussion.

Education and training is a large part of regulatory compliance. This was segmented into several areas: Labor and Employment Issues; Pesticide/Fertilizer Issues and Water Quality. Under Labor and Employment, the grower estimated the time spent annually attending meetings and educational workshops and/or conducting safety training for employees. This could be for OSHA requirements, or as a means to avoid additional worker's compensation claims through increased worker safety training and awareness. This time adds up to $3,500 per year, or an additional cost of $2.60 per acre.

California requires the application of all restricted-use pesticides materials to be recommended and/or applied by licensed advisors, applicators and businesses. California is unique among other states in that it maintains a separate Department of Pesticide Regulation under Cal EPA. Most other states handle agricultural pesticide licensing requirements under their Departments of Agriculture. In addition, licensing in California is much more stringent than in the rest of the United States, as presented in Chapter 4. If an agricultural operator chooses to maintain a Pest Control Advisor license, it requires 40 hours of continuing education every two years. Time must be spent traveling to and from the programs, and a continuing education fee must be paid. The Tulare citrus grower estimated this time to total $3,500 annually, or $2.60 per acre.

Water quality regulations, as discussed in Chapter 3, vary greatly across California. However, the lower San Joaquin Valley has the distinction of being in one of the most restrictive Regional Water Quality Control Boards. Region 5 requires an individual permit be issued if discharges will affect groundwater or surface water, or that agricultural operators join a Coalition Group. The grower estimated his time spent in attending meetings and educational programs with respect to joining the Coalition and staying current with water quality regulations to amount to $2,860, or $2.20 per acre. In addition, the fee for the grower to join the water waiver coalition is $600, or $.13 per acre, and the permits and paperwork to comply with ground water quality requirements take an employee about 20 hours annually to complete, totaling $700, or about $.15 per acre.

Air quality is perhaps one of the most burdensome issues for agricultural producers in the San Joaquin Valley. Specifically, the San Joaquin Valley Air Basin implements what is known as Conservation Management Practices (CMP) to limit the fugitive dust and PM10 emissions, as detailed in Chapter 2. The application for the grower is $800 annually, or $.20 per acre, and the paperwork takes an additional 20 hours per year, valued at $700, or about $.15 per acre.

Two activities place a large regulatory burden on the grower with respect to air quality. First, the sanding and/or paving of roads through the groves to reduce dust and particulate matter is a particularly expensive endeavor, as the managerial time, hourly labor, equipment and sanding or paving materials add up to $7.87 per acre annually.

Another important regulatory expense involves preparation of the groves, particularly when taking out old or unprofitable trees and establishing new plantings. What used to be accomplished with a burn permit and a match now requires a costly chipping service, as well as valuable time spent waiting for the chipping service, which can be a month or more. The remaining roots that can't be chipped must be bulldozed into a small a pile as possible, and the grower must wait for a burn permit to be approved from the air quality control board. The costs of the chipping service and labor involved in the final clean-up of the grove costs $200 per acre.

The cooperating citrus grower, who employees an independent pest control advisor to walk the groves and make recommendations, estimates the time spent filing paperwork with the County Agricultural Commissioner's office to amount to 100 hours per year, valued at $1.50 per acre. In addition, newer, biologically based pesticides have replaced harsher, but more comprehensive carbamate and organophosphate materials. The new pesticides are both more expensive, and in some cases, require additional applications in order to achieve the same level of infestation control as the conventional pesticides. The cooperating citrus grower reported that the increased cost of the newer, biologically based pesticides to be an additional $15.38 per acre of oranges. The additional passes through the grove with additional, albeit "softer" chemicals increases production costs by $4.13 per acre. In addition, though the grower maintains a current PCA license, he finds it necessary to employ an independent PCA in order to be sure all of the regulatory bases are covered with respect to pesticide use. The additional time required of the PCA increases the costs by $2 per acre. All told, pesticide use, licensing and documentation regulations add $23.01 to the cost of producing citrus in California.

Workers' compensation, the details of which are discussed in Chapter 5, are very costly to California agribusinesses. For the grower's 75 employees, maintaining compliance with workers' compensation regulations costs $95.60 per acre. California, though it has undergone reform over the past year, still has some of the highest costs in the country, and employers are required to carry some form of workers' compensation insurance. Texas, the comparison state for citrus, has no such regulation for employers – they can enroll in state workers' comp, they can self-insure, or they can choose to take on the full liability if a worker is injured on the job and sues.

In an effort to reduce liability due to regulatory pressure, the cooperating grower takes out additional liability insurance, which costs an additional $9.08 per acre, as well as retains a lawyer to assist with any legal regulatory compliance issues, which costs $1.50 per acre.

An additional overhead cost is gained with respect to upgrading tractors and other equipment to maintain compliance with air quality and emission regulations. This expense totals $50,000 per year, and amounts to $11.11 acre.

These regulatory costs combine to add $347.12 to each acre of citrus produced by the cooperating grower. When taking into account that the total cash costs of production, including harvest and packing, were $5,238.45, this adds 6.63% to the cost of raising oranges in California. However, if one calculates the regulatory impact on the cultural costs of production for this grower at $1,945, the percentage rises to 17.8%. The total estimated annual costs of regulatory compliance for this Tulare County citrus grower totaled $315,877.50.

Table 6.3 Activities/Costs Attributed to Regulatory Compliance - California Citrus

Compliance Category Education/Training for Regulatory Compliance:	Total Hrs/year	Value of Time Per/Hour	Total cost/year	Cost Per/Ac
Labor/Employment Issues	100	$35.00	$3,500	$2.60
Pesticide/Fertilizer Issues	100	$35.00	$3,500	$2.60
Water Quality Issues	52	$55.00	$2,860	$2.20
Air Quality Requirements				
Application Fee for CMP plan			$800	$0.20
Time Spent in filling out forms, drawing maps, etc	20	$35.00	$700	$0.15
Sanding roads				
Time	40	$35.00	$1,400	$1.07
Equipment Cost	40	$32.00	$1,280	$1.01
Labor	40	$16.00	$640	$0.49
Materials			$7,000	$5.30
Chipping groves				
Waiting time	1 Month			
Chipping cost (per acre)	304		$45,600	$150.00
Labor to clean up field	304		$15,200	$50.00

Table 6.3, continued	Total Hrs/year	Value of Time Per/Hour	Total cost/year	Cost Per/Ac
Water Quality Requirements				
Cost to join water waiver coalition			$600	$0.13
Permits/paperwork to comply with ground water quality	20	$35.00	$700	$0.15
Department of Pesticide Regulation				
Filing paperwork/record keeping	100	$20.00	$2,000	$1.50
Increased cost of biologically based pesticides			$20,000	$15.38
Increased application time	336	$16.00	$5,376	$4.13
Extra PCA Cost	4500	$2.00	$9,000	$2.00
Labor Requirements				
Worker's Compensation Costs	$1750.14 per employee		$131,260.50	$95.60
Capital Investment				
Increased technology expense to offset regulatory cost			$50,000	$11.11
Increased liability insurance cost			$12,461	$9.08
Legal costs related to regulatory compliance			$2,000	$1.50
Total Costs of Regulatory Compliance			**315,877.50**	**$347.12**

Chapter 7 – Case Study: Texas Citrus

The Texas citrus industry is concentrated in the Lower Rio Grande Valley in the southwestern part of the state. Texas ranks third in the nation in citrus production, behind Florida and California. The citrus industry is ranked 18th among commodities in Texas agriculture, with $43 million in annual sales in 2005 (Texas Department of Agriculture).

The cooperating grower is based in Texas' primary citrus growing region, and grows 5,400 acres of citrus. About 20 percent of the acreage is committed to oranges, with the balance going to grapefruit. All of the fruit is grown for the fresh market, though about 20 percent of the crop is processed because of grade defects. The groves are irrigated primarily using flood irrigation, though about 450 acres of drip irrigation have been installed on the farm. Approximately 60 full-time workers are employed.

The grower provided the following production budget for an established grove, with the explanation of each line item.

Table 7.1. Estimated Average Yearly Cost Per Acre of Level Mature Grove for 2006, Texas Citrus

Budget Item	**Explanation**	**Yearly Cost**
FLAT LABOR RATE $25 per month	Includes all labor for normal hand pruning, ant control, water application, fertilizer application, ditches, bordering and miscellaneous work as well as tank watering and all weed control.	$ 300.00
FERTILIZATION	120 lbs of Nitrogen is the typical requirement.	$90.00
WATER	Approximately four irrigations at $12 each (average) for water.	$48.00
INSECT SPRAY	Three applications as needed averaging $125 each	$ 375.00
HERBICIDE	.Two applications of residual material averaging $60 per acre each.	$ 120.00
SPOT HERBICIDE	Two applications of residual material at $15 each	$ 30.00
Cultural Costs per Acre		**$ 963.00**
HARVEST/PACK	700 cartons $1.43 carton to harvest and haul 700 cartons $3.25/carton to pack	$3,253.25
Total Production Costs/Acre		**$4,216.25**

In order to provide a broader comparison, the Texas Cooperative Extension (TCE) provided a projected production cost budget for navel oranges for the Rio Grande Valley for 2006. The budget assumes that flood irrigation is used, which coincides with the cooperating grower's method of irrigation. This budget provides the reader with an average cost basis for the crop, as each grower will have varying costs of production. The TCE budget shows a per-acre production expense of $1005.76, which is close to the grower's annual cultural costs of $963. However, the TCE budget does include fixed costs of $256.38 per acre, which are not included separately in the grower's budget. Some of the main differences between the state-prepared budget and the grower's costs appear to be in labor costs, pest control and water costs. However, the TCE budgets are provided solely as a guide and are not necessarily analogous to a particular grower's operation.

The regulatory cost areas that do not appear on a production budget are the primary interest of this study. The grower self-reported the following regulatory costs that accrue to the citrus operation. The grower was supplied with a list of possible regulatory areas to consider, such as workers compensation, pesticide, air and water issues, and estimated the annual cost of compliance with Texas requirements. Several of the costs that the grower was asked to consider were not in evidence in Texas, and those will be noted in the narrative. The per-acre costs were calculated over the entire 5,400 acres, as the regulatory expenses are overhead costs that accrue to the entire growing operation, not just the orange groves. These costs are depicted in Table 7.3.

Table 7.2. Texas Cooperative Extension Budget for Navel Oranges, Lower Rio Grande Valley, 2006.

ITEM	UNIT	PRICE	QTY	TOTAL COST
INCOME	Tons	Dollars		Dollars
Oranges, Navel	151.97		10.00	1519.70
TOTAL INCOME				1519.70
DIRECT EXPENSES				
FERTILIZER				
Amm. Sulfate	cwt	13.50	7.14	96.39
HERBICIDE				
Simizine 90DF	gal	2.80	5.00	14.00
Krovar I 80 DF	lb	11.00	3.00	33.00
INSECTICIDE				
Vydate	gal	60.00	.0625	3.75
Vendex	lb	23.00	6.000	138.00
Citrus Oil	gal	2.5	5.000	12.50
Agrimek	gal	650.00	.0540	35.10
IRRIGATION SUPPLIES				
Irrigation Water	ac-ft	16.23	1.20	19.47
ADJUVANT				
Surfactant	pt	0.88	2.00	1.76
CUSTOM ORCHD. SPRAY				
Lorsban 4E	pt	5.57	8.00	44.56
INSURANCE				
Established Oranges	acre	85.00	1.00	85.00
CUSTOM ORCHD. OPS.				
Hedging or Topping	acre	60.00	.50	30.00
Custom Fert. Citrus	acre	4.00	2.00	8.00
Custom Orchard Spray	acre	35.00	4.00	140.0
CUSTOM SPOT SPRAY				
Spot Herbicide Spray	appl.	24.00	1.00	24.00
OPERATOR LABOR				
Tractors	hour	6.50	.122	.79
HAND LABOR				
Implements	hour	7.50	.0610	.45
IRRIGATION LABOR				
Labor (flood)	hour	6.50	3.00	19.50
UNALLOCATED LABOR	hour	6.50	.0122	.07
DIESEL FUEL				
Tractors	gal	2.20	.9419	2.07
REPAIR & MAINTENANCE				
Implements	acre	.27	1.00	.27
Tractors	acre	.64	1.00	.64
INTEREST ON OP. CAPITAL	acre	40.01	1.00	40.01
TOTAL DIRECT EXPENSES				749.38
RETURNS ABOVE DIRECT EXPENSES				770.31
FIXED EXPENSES				
Implements	acre	.40	1.00	.40
Tractors	acre	1.94	1.00	1.94
Permanent Valve Irr.	acre	45.00	1.00	45.00
Year 1 Est. Costs	acre	209.04	1.00	209.04
TOTAL FIXED EXPENSES				256.38
TOTAL SPECIFIED EXPENSES				1005.76
RETURNS ABOVE TOTAL SPECIFED EXPENSES				513.93

Brand names are mentioned only as examples and imply no endorsement

Information presented is prepared solely as a general guide & not intended to recognize or predict costs & returns from any one operation. These projections were collected & developed by TCE staff & approved for publication.

Source:http://agecoext.tamu.edu/budgets/district/12/2006/orangesnavel.pdf

Texas state agricultural regulations primarily involve worker safety issues. The Texas Department of Agriculture (TDA) provides licensing for private pesticide applicators, commercial applicators and distributors. Unlike California, the Texas Department of Agriculture has no requirements regarding the certification of pest control advisors – the regulations only apply to those persons that are actually using or supervising the use of a restricted-use or state-limited-use pesticide or a regulated herbicide. A safety coordinator, employed by the grower, and the farm manager each have a role in this supervision, and thus must be certified. Eight hours of continuing education are required annually to maintain certification. The fees, time and mileage involved in maintaining certification add up to just over $800. Equipment licensing costs $170 per year, and providing the TDA with required facility diagrams and plans costs another $255. The total cost for complying with TDA regulatory issues is $1,230, or $.23 per acre.

Pesticide application regulations also add costs to the operation. Texas has a "Right to Know" law, formally known as the Texas Agricultural Hazard Communication Law, which mandates signage and notification when hazardous materials have been applied to fields. The cost of signs, the number of hours it takes to post the signs and later remove them, as well as the driving expenses for this effort add up to $4,840, or $.90 per acre.

The safety coordinator previously mentioned also manages the Worker Protection Standards (WPS), which involves training; spot checks for compliance around the groves, the investigation of any complaints to the Texas Department of Agriculture, as well as time spent searching for records to show compliance. This position requires a lot of driving time, and so the mileage costs add to the cost of compliance, which totals $9,277, or $1.72 per acre.

The Worker Protection Standards require that agricultural laborers wear appropriate protective gear, which can include jumpsuits, gloves, respirators and head coverings, while handling hazardous materials. This leads to increased application time, as workers must take time to put on and later remove the gear, as well as longer times to

move through the fields with the heavier protective gear. The grower estimates that this increases pesticide application time by $6,650, or $1.23 per acre annually.

The WPS also requires the grower to provide all protective gear to the workforce, thus an employee is tasked with purchasing and delivering the gear to the fields, as well as appropriately recycling used materials containers. The time and mileage add up to $4,085 annually, or $.76 per acre.

Managing records is one of the main challenges with respect to regulatory issues, and the grower has purchased software and hardware specifically to manage the records required for the WPS and Texas Department of Agriculture compliance. A clerical employee spends half of her time entering data and keeping records for regulatory compliance, as well as tracking re-entry intervals for fields that have been treated with pesticides. The total cost to the grower for this regulatory area is $11,948, or $2.21 per acre.

The farm manager spends about five percent of his time staying current with pesticide label requirements and maintaining compliance with re-entry intervals for the groves, as well as pre-harvest intervals that are required after spraying restricted materials. This equals $3,500 annually, or $.65 per acre.

Safety supplies are one of the largest categories of regulatory expense. The WPS requires the employer to provide all protective gear that is called for on pesticide labels, which includes gloves, overalls, respirators and head gear. The grower spends $18,083 annually, which adds $3.35 per acre.

The next two categories, Workers' Compensation and Workers' Accident Policy, are included as regulatory costs by the grower, but Texas does not actually require employers to carry workers' compensation policies: this may be considered a good business practice rather than a regulatory requirement. Businesses that do not subscribe to state-run workers' compensation must notify both their employees and the Texas Division of Insurance that they are non-subscribers. The grower carries a private workers' compensation policy, as well as a catastrophic accident policy for the employees. These comprise the largest regulatory expenses, totaling $91,667, or $16.98 per acre.

Texas does not currently require agricultural operations in the Rio Grande Valley to monitor air emissions or water quality, so no costs were recorded for those regulatory areas. If a private landowner wants to burn agricultural waste such as tree trimmings on his or her property, the local fire marshal has the authority to grant a burn permit. Texas does have a prescribed burn regulation that falls under the Department of Agriculture, but its primary purpose is to keep planned fires from getting out of control rather than to reduce air pollution.

Equipment upgrades have been the grower's primary capital investment with regulatory implications. Installing cabs and air conditioning systems on 10 tractors increases the workers' comfort, health and safety, especially during hot Texas summers. This capital outlay costs the grower $8,571 per year, or $1.59 per acre.

Food safety requirements are becoming increasingly important, and the grower has two third-party audit systems in place to comply with both HACCP (Hazard Analysis and Critical Control Points) regulations that the Food and Drug Administration administers, as well as EUROGAP, which is a food safety certification for exported food products. Documentation and auditing preparation for Primus Lab/GAP (Good Agricultural Practices) and EUROGAP, as well as fruit residue and irrigation water testing, cost the grower $11,385 or $2.11 per acre.

The total cost of regulation for this Texas citrus operation is $171, 235, or $31.71 per acre. In terms of the relative costs of production, this adds .75% to the grower's total cost of production of $4,216.25 per acre. If only cultural costs are included, regulatory costs add 3.29% to the $963 per acre cost of the production. Some in the industry may view this as a more accurate depiction, as the packing house charges are separate, and the growers did not assess regulatory charges for the packing house.

Table 7.3 Activities/Costs Related to Regulatory Compliance – Texas Citrus

Compliance Category	Annual Hours/Units	Annual Miles	Rate	Annual Cost	Cost per Acre
Texas Dept. of Ag Licensing					
Safety Coordinator				200	$0.04
Farm Manager				200	$0.04
CEU/Training 2 People	16		23.00	368	$0.07
CEU/Training Mileage		80	0.46	37	$0.01
Dept. of Ag Equip. Licensing	10		17.00	170	$0.03
Facility Diagrams/Plans	15		17.00	255	$0.05
Regulatory Category Cost				$1,230	$0.23
Field Posting/ Re-entry signs					
One application per year					
over 40-day period	200		9.50	1,900	$0.35
Vehicle for posting (mileage)		1500	0.46	690	$0.13
Signs	500		4.50	2,250	$0.42
Regulatory Category Cost				$4,840	$0.90
Safety Coordinator					
WPS Training	104		17.00	1,768	$0.33
Field Spot Checks for Compliance	260		17.00	4,420	$0.82
Mileage		5200	0.46	2,392	$0.44
TDA Field spot checks	18		17.00	306	$0.06
TDA Complaint Investigation	18		17.00	306	$0.06
Record Search for Compliance	5		17.00	85	$0.02
Regulatory Category Cost				$9,277	$1.72

Table 7.3 Continued

Compliance Category		Annual Miles	Rate	Annual Cost	Cost per Acre
Pesticide Application Issues					
Increased Time to meet Regulations					
3 crews of 5 men 3.5 hrs per day					
200 application days/year	700		9.50	6,650	$1.23
Regulatory Category Cost				$6,650	$1.23
Safety Supplies Runner/Distributor					
Time Purchasing/Delivering	416		6.00	2,496	$0.46
Purchasing/Delivering Mileage	50	2600	0.46	1,196	$0.22
Recycling Used Containers	54		6.00	324	$0.06
Recycling Mileage		150	0.46	69	$0.01
Regulatory Category Cost				$4,085	$0.76
WPS & TDA Record Management					
Software				1,200	$0.22
Hardware				250	$0.05
Clerical/Data Entry	1040		9.50	9,880	$1.83
Manage Re-entry intervals	65		9.50	618	$0.11
Regulatory Category Cost				$11,948	$2.21
Management					
Farm Manager research labels &					
prescribe treatments ensuring					
compliance to REI & PHI's					
5% of job.				$3,500	$0.65
Safety Supplies				$18,083	$3.35
Workers' Comp				$83,195	$15.41

Table 7.3 Continued		Annual Miles	Rate	Annual Cost	Cost per Acre
Compliance Category				$8,472	$1.57
Workers' Accident Policy				N/A	
Air Quality					
				N/A	
Water Quality					
Capital Investment					
Cab & Air Tractors increased turnover to maintain adequate protection. Additional cost of cab & air over 7 year life times				$8,571	$1.59
10 units					
Food Safety	135		17.00	2,295	$0.43
Primus/GAP Doc. & Audit Prep	180		17.00	3,060	$0.57
EUROGAP Doc. & Audit Prep	90		17.00	1,530	$0.28
Documentation/prep for audits				1,500	$0.28
Irrigation water testing				3,000	$0.56
Fruit residue testing					
Regulatory Category Cost				$11,385	$2.11
Total Increased Cost due to Regulation				**$171,235**	**$31.71**

Chapter 8 – Case Study: California Lettuce

Lettuce is consistently one of the top ten agricultural products in California. The most recent statistics available indicate that it is a $1.7 billion industry in terms of farm-level sales, 60 percent of which is produced in Monterey County (2004-05 Summary of County Ag Commissioners Reports). The Salinas Valley, long known as the salad bowl for the U.S., produces over 50 percent of the total U.S. lettuce crop, with the remainder being grown in other California counties and Arizona.

The cooperating grower for this case study is located in the heart of the Salinas Valley and farms 7,500 acres, approximately 3,200 of which is lettuce. This can vary by several hundred acres, depending on the weather. Other crops on the grower's ranch include broccoli, cauliflower, radicchio, peas and spinach. The production costs provided by the grower below are based on head lettuce.

Table 8.1. 2005 Production Costs per Acre for Head Lettuce, Salinas Valley

Variable Production Costs ($/acre)	
Seed	$120
Fertilizer	$290
Weed control/thinning labor	$136
Pest Management (includes PCA cost)	$570
Water	$400
Irrigation labor	$154
Tractor Labor	$172
Fuel	$100
Tractor and Machinery cost	$248
Supervision and general labor	$94
Compost	$100
Total Variable Production Costs	**$**2,384
Land Rent	$1100
Fresh Market Harvest Cost ($/Carton)	
Cut/Pack/Haul	$5.00
Average yield /acre (cartons)	850
Assessments (per carton)	$.023
Harvest Cost per Acre	$4,270
Total Production Costs/Acre	$7,754

In order to provide a state-level comparison, the U.C. Cooperative Extension production cost budget is presented for head lettuce for the North Monterey and South Santa Cruz Counties for 2001, the most recent budget available. This provides the reader with an average cost basis for the crop. However, there have been significant increases in producer costs since 2001. According to the USDA, the annual producer price indices compiled by the National Agricultural Statistics Service indicate that the prices paid by farmers for all items rose 12.9 percent from 2002 to 2005. Most notably, fuel costs increased 200 percent and fertilizer prices rose by 60 percent. These price increases have generally outpaced inflation measures in the U.S. economy. Considering that many inputs in California are already more expensive than in the rest of the U.S., and that the inputs measured by USDA are primarily for commodity crop and livestock operations, this index may be conservative.

If the U.C. budget's 2001 figure of $8,069 per crop acre is multiplied by USDA's 12.9% producer price index, the resulting cost per acre for 2005 is $9,110 (rounding to nearest dollar), and total cost per carton of $10.72.

One item not accounted for in the grower's budget that the U.C. budget includes is the cooling and selling costs per carton. However, as this is a production-level study, it was determined that these costs were not necessary for inclusion.

A recent study that looked at grower perceptions of the regulatory environment in California found that leafy vegetable producers believed that workers' compensation insurance was the main regulatory area in which their costs had increased from 1999 to 2004 (Hurley et al. 2006). Food safety, land use restrictions, pesticide application and water quality compliance were tied for the third highest areas of increasing costs. However, Hurley found that the second highest-ranked choice with respect to higher cost regulatory areas was "none," either indicating that, with the exception of workers' compensation, other regulatory costs are not negatively impacting lettuce growers' operating costs; or that the twelve growers responding to the question were not representative of the industry.

Table 8.2 U.C. Cooperative Extension Sample Budget, Head Lettuce, 2000-2001.

U.C. Cooperative Extension
Sample Production Costs for Wrapped Iceberg Lettuce* 2000 - 2001
North Monterey and South Santa Cruz Counties

Yield per Acre: 850 24-count 42-pound cartons
Price per Carton: $8.00
Labor Rate: $13.40 machine labor
$11.40 non-machine labor

Operation	No. of Times/ Crop/Acre	Cost/ Time/Acre	Material Cost/Acre	Non-Machine Labor Hours/ Acre	Non-Machine Labor Cost/ Acre	Total Cost ($/Acre)
Land Preparation:						
Cover Crop	.20	75	25			20
Disc	4X	13				52
Soil Amendments	1X	10	50			60
Subsoil	2X	35				70
Chisel	2X	21				42
Minimum Tillage	.10	40				4
Laser Level	.25	160				40
Land Plane	.25	12				3
List & Preplant Fertilizer	1X	15	60			75
Preirrigate	1X		8	1	11.40	18
Lilliston	2X	8				16
Bed Shape/Preparation	1X	15				15
Total Land Preparation Costs						*415*
Cultural:						
Precision Plant	1X	8	118			126
Irrigate	10X		80	11	11.40	205
Thin	1X			13	11.40	148
Cultivate & Fertilize	1X	10	92			102
Cultivate & Break Bottoms	1X	17				17
Herbicide	1X	8	40			48
Insect & Disease Management	Mult					350
Hand Weed	1X			5	11.40	57
Water Run Fertilizer	1X	8	29			37
Total Cultural Costs						*1,090*
Cash Overhead:						
Overhead – 10% of Prod. Costs						151
Land Rent – N. Mont./S. SC.						1,100
Total Cash Overhead Costs						*1,251*
Harvest:						
Cut, Pack, Haul @ $4.75/crtn						4,038
Cool & Sell @ $1.50/crtn						1,275
Total Harvest Costs						*5,313*
Total Cash Costs/Crop/Acre						*8,069*
Total Cash Costs/Carton						*9.49*

* *Costs will vary depending on many variables including individual grower, production location, land rent, water costs, material inputs, weather conditions and energy costs.*

Source: http://coststudies.ucdavis.edu/uploads/cost_return_articles/lethead2001.pdf

The following costs were self-reported by the grower, and an on-site visit and follow-up correspondence via e-mail and telephone helped to clarify the costs and activities recorded. These costs are reported in the Table 8.3, and an explanation of each area follows. Costs that were deemed regulatory charges that accrue to the entire 7,500 acres were divided over the entire acreage of the ranch, while several costs that primarily concerned lettuce production were assessed over the 3,200 acres of lettuce.

Continuing education, training and licensing are all regulatory costs that accrue to this Salinas Valley grower. One of the managers is a licensed labor contractor who must attend eight hours of training annually and pass an exam every other year in order to maintain his license. Cash costs include the fee for the license, which is $575, as well as the $100 every other year for the exam. The labor contractor must also be bonded, which costs $1,230 per year. The value of his time is estimated at $100 hour to participate in training sessions, which brings the total cost of labor contractor regulatory compliance to $2,655, or $.67 per acre.

Other continuing education as a regulatory requirement is undertaken by one of the ranch owners, who maintains a Pest Control Advisor license. However, maintaining a current license requires 20 hours of continuing education each year, plus the travel expense and opportunity cost of managerial time, which is valued at $100 per hour, including all benefits. The estimated cost of maintaining the PCA certification is $3,000 annually, or $.40 per acre.

Water quality issues in the Salinas Valley are governed by the Central Coast Regional Water Quality Control Board. Irrigated cropland can qualify for conditional waivers in lieu of applying for discharge permits if the growers are willing to submit a farm plan, attend 15 hours of continuing education annually on water quality issues, and can show the water quality control board that voluntary efforts are underway to monitor and improve the quality of discharged water. Again, this regulatory compliance issue falls upon upper management, and the opportunity cost of his time is estimated at $1,500 or $.20 per acre.

Besides continuing education, water quality and use regulations have a number of costs associated with compliance. As part of the Conditional Waiver, the grower spends between $5,000 and $10,000 per year on silt traps and sump maintenance to help reduce sedimentation in the irrigation discharge. An average cost of $7,500 was chosen, which totals $1 per acre for the entire operation. The fee to join the Coalition costs $.15 per acre, totaling $480 per year for the lettuce operation.

Testing of irrigation water must occur as part of a third-party food safety audit, which requires one day of upper management's time, valued at $800. In addition, the grower installed 40 flow meters to report water use to the Monterey County Water

Resources Agency. Each flow meter has an installed cost of $1,200, and has an average life span of 4.5 years; the pipes that are installed as part of the system cost $3,800 per meter. The piping has a longer lifespan, estimated at 15 years. The annual costs for the flow meter systems total $2.77 per acre, or $20,800. Filing water reports with the county resources agency accounts for another 20 hours of upper management's time per year, adding another $.20 per acre in regulatory costs.

Air quality is the one regulatory area in which growers in the Salinas Valley currently have little to worry about. With respect to agricultural operations, the Monterey Air Pollution Control Board only regulates open burning, which is not an issue for lettuce growers. Senate Bill 700, which took effect July 1, 2004, increased air quality regulations on several important agricultural areas where air quality was already a health concern. The Salinas Valley is below the major source thresholds for any particulate matter produced from agriculture, and so the growers did not report any regulatory costs for this issue. The growers voluntarily spray water on ranch roads for dust mitigation, but it is primarily a food quality issue with respect to lettuce production, is not conducted as a means for regulatory compliance.

Many California specialty crop producers employ the services of a pest control advisor, if they are not licensed themselves. The PCA or the company he or she represents pays for much of the regulatory burden of pesticide applications. However, in interviews with a manager of a pest control services company, he estimated that five percent of his costs were due to regulations, and were passed on to the grower in the form of higher fees. The grower's portion of this regulatory cost is estimated by taking five percent of the $570 cost of pest management per acre, which totals $91,200 over the lettuce acreage, or $28.50 per acre in increased fees to the grower. In addition, paperwork must be filed with the Monterey County Agricultural Commissioner's office, as well as recordkeeping, which amounts to about $3,600 of upper management's time, or $.48 per acre.

As mentioned previously, workers' compensation stood out among lettuce producers who responded to an earlier regulatory cost survey. The figures in this case study show why. Though workers' compensation laws have been reformed and costs

have been reduced, the expense to employers is much higher than in the late 1990s. To calculate the workers' compensation costs to this grower, we took the labor costs per acre that the grower supplied in the production budget, multiplied it by the number of acres of lettuce to estimate the total hourly labor costs, and then used the California field workers' compensation rate of 10% for every wage dollar earned. That figure amounted to $177,920, for a per-acre cost of $55.20, the largest regulatory compliance fee in this case study. In addition, a senior accounting clerk spends 40 percent of her time filing paperwork, corresponding with supervisors, employees, insurance companies and doctors regarding any claims that are made, resulting in an additional $25,024, which equals $3.34 in additional regulatory costs per acre.

Food safety, a prime concern with any product that is hand-packed in the field and consumed as a fresh product, is regulated by the Food and Drug Administration, which requires HACCP certification, or Hazard Analysis and Critical Control Points. Primus Labs is a third-party auditing service that administers the certifications, and audits the ranch and harvest crews. The grower receives invoices for Primus' services that add up to $3,625 per year. In addition, it takes the senior accounting clerk nearly a week of time per year to prepare for the audits, resulting in $1,190 in costs. Food safety costs per acre add up to $.64, just for field work and harvest inspections. Another level of audits takes place during the cooling period prior to shipping, but as this case study is concerned with the production phase, those costs were not included.

California growers are required to pay several fees on each carton of lettuce sold. One is assessed by the California Lettuce Research Board, another goes to CDFA, and third goes to Monterey County Agriculture Inspections for Standardizations. These amount to $.023 per carton for head lettuce, and with an estimated yield of 850 cartons per acre, these add up to $62,560, or $19.55 per acre.

The grower reported that a fair amount of staff time was required to accomplish a variety of regulatory tasks, such as filing payroll taxes and new employee forms, keeping up with state and federal filings and postings, as well as filing fuel taxes between California and Arizona when the growing operation shifts to the desert in the fall. This assorted paperwork required 300 hours of staff time annually, valued at $34 an hour, which totaled $10, 200, or $1.36 per acre.

Other regulatory costs that have been noted in this study were not reported as separate line items by this grower, such as increased capital investment to offset regulatory costs, or increased costs of managing risk from regulatory liability, such as broader insurance coverage or legal fees specifically related to regulatory compliance. Sometimes such costs are viewed as a cost of doing business, or capital investment might have a greater purpose besides offsetting regulatory costs, and so may not be viewed by the grower as a regulatory expense.

The total regulatory costs reported by this grower that accrue to lettuce production are $414,399 annually, or $114.84 per acre. As a percentage of variable production costs, the regulatory cost per acre is 4.82%.

Table 8.3. Activities/Costs Attributed to Regulatory Compliance - California Lettuce

Education/Training for Regulatory Compliance:	Hours per Week/Month/Year	Value of Time per Hour	Fee or Additional Cost	Total annual cost	Cost/Acre*
Labor/Employment Issues	8 hours per year	$100	$100 every other year for exam	$420	$0.11
(labor contractor training, testing and licensing)			$575 for license	$575	$0.08
			$1,230 for bond	$1,230	$0.16
Pesticide/Fertilizer Issues Time	20 hours/year	$100	$1000 for travel/class fees	$3,000	$0.40
Water Quality Issues	15 hours required per year	$100		$1,500	$0.20
Water Quality and Use Regulations					
Permits/paperwork to comply with water quality requirements	20 hours to compile water reports	$100		$2,000	$0.27
Tail water return system - silt traps or sump maintenance			$7,500	$7,500	$1.00
Fee to join Coalition Waiver Program				$480	$.15
Cost of flow meters: 40 @ $1,200 each installed, 4.5-year lifespan				$10,666.67	$1.42
Cost of Piping System with Meters: 40 @ $3,800 each, average 15-year lifespan				$10,133.33	$1.35
Air Quality Requirements	None reported				

*rounded to nearest cent

Table 8.3, continued

Pesticide Regulation	Hours per Week/Month/Year	Value of Time per Hour	Fee or Additional Cost	Total Annual Cost	Cost/Acre*
Filing paperwork/record keeping	3 hours/month	$100		$3,600	$.48
Increased cost of pesticides due to regulatory issues			5% of pesticide cost	$91,200	$28.50
Labor Requirements					
Workers' Compensation Costs			10% per dollar	$177,920.00	$55.60
Filing and claim requirements, office staff time.	16 hours/week	$34		$25,024.00	$3.34
Food Safety					
Primus Lab costs – ranch inspections			$3000	$3000	$.40
- harvest crew inspections			$125/crew	$625	$.08
Time spent in documentation/preparation for audits	35 hours/year	$34		$1190	$.16
Assessments – CA Lettuce Research Board, CDFA and Monterey County Ag.			.023/carton	$62,560	$19.55
Office staff time required to file assessments	15 hours/year	$23		$345	$.11
Filing Payroll Taxes, State Employee Forms, Fuel Taxes	300 hours/year	$34		$10,200	$1.36
Capital Investment					
Increased technology to reduce regulatory costs	None reported				
Risk Management					
Increased liability insurance cost	None reported				
Legal costs related to regulatory compliance	None reported				
Total Costs Related to Regulation				$414,399	$114.84

Chapter 9 – Case Study: Arizona Lettuce

Arizona ranks second in the nation in lettuce production, behind California, with an annual value of production topping $226 million in 2005 (NASS). Nearly all of the U.S. supply of lettuce comes from southwestern Arizona (see shaded area in Figure 9.1) in the winter months as the Salinas Valley nearly shuts down during the rainy California winter

The cooperating grower is a large lettuce producer in Yuma County, right in the heart of the prime vegetable growing region. The grower provided the following costs of production as a baseline comparison, which were the actual costs of production for the 2005-06 growing season for 1,563 acres of lettuce.

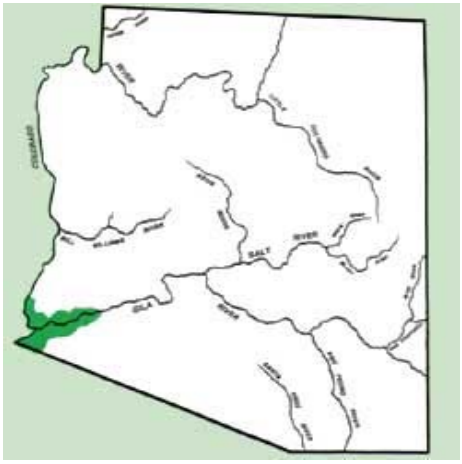

Figure 9.1. Lettuce Production Region of Arizona

Table 9.1 2005-06 Cost of Production Per Acre, Arizona Lettuce

Variable Production Costs ($/acre)	
Seed:	$116.71
Fertilizer:	$350.59
Hoe & Thin:	$180.12
Pesticide:	$255.45
Herbicide:	$128.41
Fungicide:	$99.80
Bird Control:	$12.29
Tractor:	$ 502.50
Irrigation:	$101.94
Total Variable Production Costs:	$1,747.81
Fixed Costs ($/acre)	
Water:	$55.00
Pipes:	$198.91
Rent:	$635.40
Overhead:	$177.99
Total Fixed Costs	$1,067.30
Total Production Costs	**$2,815.11**

In order to provide a state-level comparison, we provide the Arizona Cooperative Extension production cost budget prepared for head lettuce for Yuma County. This provides the reader with an average cost basis for the crop.

Table 9.2. Production Budget, Head Lettuce, Yuma, Arizona

Table 7A. Income and Cash Operating Summary; Fall Lettuce, 2001

COUNTY:	Yuma	FARM:	Yuma Vegetables	WATER SOURCE:	Yuma County Water	TILLAGE:	Double Crop
CROP:	Lettuce, Iceberg	ACRES:	1.0	IRRIGATION SYSTEM:	Flood Furrow	SOIL:	Sandy-Loam
AREA:	Yuma Valley North	YIELD:	823.0 Ct / Acre	PREVIOUS CROP:	Wheat, Winter	DATE:	8/13/01

Item	Unit	Quantity	Price/ Unit	Budgeted /Acre	Total /Acre	Your Farm Budget
INCOME -> Lettuce	Crtn	823.00	$5.26	$4,328.98	$4,328.98	
CASH LAND PREPARATION AND GROWING EXPENSES (including sales tax)						
Paid Labor (including benefits)					90.78	
Tractor/Self Propelled				30.73		
Irrigation				35.09		
Other/ Contract				24.96		
Chemicals and Custom Applications					587.48	
Fertilizer				170.14		
Insecticide				290.38		
Herbicide				74.12		
Other Chemicals				52.85		
Farm Machinery and Vehicles					69.77	
Diesel Fuel				18.33		
Gasoline				14.03		
Repairs and Maintenance				37.41		
Irrigation Water (excluding labor)					0.00	
Water Assessment (See Note Below) **						
Other Purchased Inputs &					284.50	
Seed/Transplants				95.40		
Other Services and Rentals				189.10		
TOTAL CASH LAND PREPARATION AND GROWING EXPENSES					1032.53	
CASH HARVEST AND POST HARVEST EXPENSES						
Custom Harvest/Post Harvest					2047.20	
TOTAL HARVEST AND POST HARVEST EXPENSE					2047.20	
OPERATING OVERHEAD -> PICKUP USE					13.17	
OPERATING INTEREST AT 10.0%					194.61	
TOTAL CASH OPERATING EXPENSES					$3,287.51	
RETURNS OVER CASH OPERATING EXPENSES					$1,041.47	

Notes: The above figures do not include ownership costs, see table B for detailed cost allocation.
** A water assessment charge of $31.00 per Acre is included as an ownership cost in Table B.

Source: http://cals.arizona.edu/arec/ext/budgets/western.html

The above budget, prepared for 2001, is the most recent budget available from the Arizona Extension Service for head lettuce grown in Yuma. As in the California lettuce budget, the USDA price index of 12.9 percent from 2002 to 2005 was used to scale the production costs up to current expense levels. If the cash operating expenses are multiplied by this index, the total cost of land preparation and growing expenses comes to

$1,165, and the total cash operating expenses increase to $3,712. Again, the extension budget serves only as a means to view average costs; individual grower costs are expected to vary from this average assessment. The primary areas in which the grower's costs are higher are in the tractor and irrigation expenses. Tractor expenses involve all labor, fuel and equipment charges, and irrigation is considered a variable cash cost in the grower's budget, while it is charged as an owner's expense on the extension budget, and doesn't appear as an operating cost.

The budgets are presented as a basis for discussion of regulatory costs, as well as a means to check production costs between the comparison states. The purpose of this study was to assess the value of the regulatory costs that do not appear as budget line items. These are found in Table 9.3.

Many regulatory costs consist of education and training to maintain compliance. The grower estimates that 40 hours per month during the growing season are spent on training employees in food safety and overall safety issues, and that the cost of those meetings in staff time and employee time and materials is about $5,700 or $3.65 per acre. The grower maintains a Grower's Permit, a Private Applicator Permit and Pest Control Advisor certification, which requires continuing education for renewal of the PCA license. Fifteen hours of continuing education is required for renewal of a PCA license, and the fee is $50 each year. Grower permits are $20 annually and the private applicator permit is $50. In addition, any grower-applied, restricted-use pesticides must have a Form 1080 filed with the Arizona Department of Agriculture within seven days of application. The regulatory compliance cost to the grower for training time, permit fees, and filing time add up to $11,000 per year, or $7.04 per acre.

Air quality is a concern in the arid climate of Yuma, and growers participate in agricultural practices that help to reduce fugitive dust and particulate matter air pollution, or PM10, from agricultural operations. As discussed in Chapter 2, Arizona growers must implement at least one Best Management Practice (BMP) for each of three categories: tillage and harvest, non-cropland and cropland and keep records detailing the BMPs selected for each category. The non-cropland BMP that the grower conducts that adds regulatory costs to the operation is watering the roads that go through the lettuce fields. This adds up to 5,400 hours per year for both the truck and labor, and the total cost, including truck licensing and inspections, are $140,182, or $38.49 per acre. It

should be noted that this cost is artificially high, as the water trucks also service the roads during the summer months when cover crops of wheat and sudan grass are growing. However, the total cost of the watering roads is charged to the produce operations, when in actuality, the true cost to the produce area of the farm is closer to $20 per acre.

Water quality is very important when dealing with a product that is consumed fresh, and so testing and documentation of irrigation water is conducted as a food safety issue. The grower tests the irrigation water for E. coli bacteria at least four times per year. However, this is a preventative measure, as irrigation water testing is not required by any federal or state regulatory agency at this time. There are no regulations or tests conducted for ground water quality, as the grower uses surface water irrigation for the crops. As discussed in Chapter 3, surface water quality regulations are voluntary and incentive-based in Arizona.

Workers' compensation is the primary regulatory cost with respect to labor issues. Arizona requires all companies with more than one employee to carry workers' compensation insurance. Arizona's rates are 5.93% per dollar of wages for agricultural workers, and the total bill for workers' compensation for the grower was $56,340, or $36.05 per acre.

Food safety is a critical issue for a crop that is packed in the field and consumed as a fresh product, and many regulations govern how the product is grown and handled. The grower is audited for food safety compliance, and the time spent preparing for those audits takes an upper-level staff member 10 hours per week throughout the growing season, and that same staff person spends 10 hours per month to conduct training sessions for employees who handle the food crops. In addition, the staff member spends about 30 hours per month during the growing season to keep up with any new requirements and to maintain the food safety program. This total effort adds $28,250, or $18.07 per acre.

In terms of capital investment to offset the costs of regulatory compliance, the grower paid an intern during June and July 2006 to conduct GPS mapping of all the fields. The grower had already invested in the GPS technology for efficiency reasons, so that cost is not included, but the field mapping was done to be sure of the accurate acreage measurement so that pesticides and fertilizers could be applied at the correct rate. In most cases the grower found that the original measurements were accurate, but in a few instances, field measurements were found to have differences of between one and

two acres from the original survey. This investment will ensure that the correct level of inputs is applied, which should help reduce any cases of pesticide or fertilizer over-application. The cost for the equipment and labor was $3,520, or $2.25 per acre.

Food security has become a greater concern over the past five years, and the grower has implemented an employee identification program to help ensure that no one is in the fields or packing houses who isn't supposed to be there. The employees wear photo IDs, and the farm supervisors have copies of the picture IDs of the employees. The grower spent $4,000 on the initial system, which comes to $2.56 per acre.

The total cost of regulatory compliance for this grower came to $256,492, or $70.43 per acre. This amounts to 2.5% of production costs.

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Table 9.3 Activities/Costs Attributed to Regulatory Compliance - Arizona Lettuce					
Education/Training for Regulatory Compliance:	**Hours per Week/Month/Year**	**Value of Time per Hour**	**Fee or Additional Cost**	**Total Cost**	**Cost/Acre**
Labor/Employment Issues	40 Hours Month	$ 20.00	$100 Year	$ 5,700	$1.57
Pesticide/Fertilizer Issues	30 Hours Month	$ 50.00	$500 Year	$ 11,000	$3.02
Air Quality Requirements					
Watering roads – Best Management Practice for PM10 reduction					
Equipment Cost Water Truck	5400 Hours Yr	$ 15.63	$200 Year	$ 84,602	
Labor Water Truck	5400 Hours Yr	$ 10.20	$500 Year	$ 55,580	$23.23
					$15.26
Water Quality Requirements					
Water Quality Issues	20 Hours Month	$ 50.00	$500 Year	$ 7,500	$2.06
Labor Requirements					
Workers' Compensation Costs	13.5			$ 56,340	$15.47
Food Safety					
Documentation/preparation for audits	10 Hrs Week	$ 50.00	$50 Year	$14,050	$3.86
Employee Food Safety Training	10 Hrs Month	$ 50.00	$200 Year	$ 3,700	$1.02
Maintaining Food Safety Program	30 Hrs Month	$ 50.00		$ 10,500	$2.88
Capital Investment					
GPS mapping of fields during summer	33 Hrs per Week	$ 20.00		$ 3,520	$0.97
Employee ID system for farm security				$ 4,000	$1.10

Compliance Category	Hours per Week/Month/Year	Value of Time per Hour	Fee or Additional Cost	Total Cost	Cost/Acre
Risk Management	None reported				
Increased liability insurance cost					
Legal costs related to regulatory compliance					
Total Costs of Regulatory Compliance				$ 256,492.38	$70.43

Chapter 10 – Summary and Conclusions

This study attempted to show the differences in regulatory costs between California, which is generally considered a high-cost state in which to conduct business, and the comparison states of Texas and Arizona for citrus and lettuce production, respectively. A review of relevant regulations with respect to air quality, water quality, pesticide registration and workers' compensation was conducted to not only to gain background information for the case studies, but to indicate the differences that exist in the regulatory environments among the states. This review helped to put in context the issues that would appear in the case studies.

Differences in the Regulatory Environment

In air quality, water quality and pesticide use, California's state laws provide more stringent regulations than is required by federal law. Air quality regulations in the San Joaquin Valley are particularly strict in order to meet the National Ambient Air Quality Standards. The package of SB 700 Bills, in place since 2003, brought agriculture under the umbrella of compliance with the Clean Air Act, not only for operations with confined animal units, but for those growing crops as well. Dust control and other particulate matter reduction in an area which typically receives barely 10 inches of rain per year, is a costly and time-consuming endeavor. Growers are required to file for a permit to participate in a Conservation Management Plan to mitigate dust pollution, the initial fee for which is $120 for an operation of 500 acres or less, and escalates to $550 for operations 2,000 acres or larger. They must also participate in a number of conservation practices for their operations, some of which are quite costly. Burning, once a common way of removing waste materials from permanent agricultural crops, is allowed on a very small scale, and the fees and waiting time increase the California grower's cost substantially, primarily with respect to the cost of chipping orchard waste. However, not all growers in California face the same costs. Those who live and do business on the Central Coast or in Northern California have little to no worries regarding air quality regulations, because those areas are well within the limits for air quality set by the Clean Air Act.

The agricultural production areas of Arizona are also subject to air quality regulations, but the system devised by the Arizona Department of Environmental Quality

for certain parts of Maricopa and Yuma Counties, where agriculture is subject to air quality compliance, is to implement Best Management Practices. Like California, these practices are designed to reduce particulate emissions from tilling and harvesting, fallow cropland and non cropland areas. The Arizona Department of Agriculture offers an Agricultural Consultation and Training program (ACT) to provide non-regulatory compliance assistance program for growers to ensure compliance with laws and rules that address air quality standards. The Department will send a consultant to the grower's operation free of charge to offer training, provide guidance on the best management practices to reduce dust pollution, and offer advice on maintaining compliance. The same program provides training to agricultural workers to ensure that field and machinery workers understand the air quality compliance practices. The permit record is a one-page document in which the grower checks a box to indicate the three different Best Management Practices that he or she implemented. No fee is associated with air quality compliance in Arizona.

Though Texas certainly has its share of air pollution issues, particularly in the Houston area, no areas in Western Texas are in non-attainment areas for federal air quality standards, and thus growers in West Texas have no regulatory burden with respect to air quality.

Water quality is another area in which the regulatory burden varies greatly across California. Nine Regional Water Quality Control Boards (RWQCB) set standards for non-point pollution control (NPS). Agriculture is considered a major source of non-point source pollution, and NPS pollution is considered to be California's most serious water quality problem. To maintain compliance with the federal Clean Water Act and the state Porter-Cologne Water Quality Control Act, irrigated agricultural operations must either comply with Waste Discharge Requirements individually, or join a Conditional Waiver group. Each RWQCB sets the requirements for Conditional Waivers, but most include the following: a per-acre fee to join; a management plan to control water quality, mandatory attendance at Board-approved training sessions on water quality issues, as well as cooperative or individual water quality monitoring. The waivers are valid for a maximum of five years, and many groups have formed in California in order to

cooperatively comply with the water quality regulations. Again, regardless of which of the nine RWQCB a grower operates in, water quality compliance is mandatory.

Arizona and Texas both have water quality compliance regulations, but with respect to NPS pollution from agriculture, the existing programs are voluntary and incentive-based. Fresh produce growers are likely to voluntarily test irrigation water for food safety issues, particularly since the E.coli outbreak in spinach in California. However, this testing might be considered a good business practice rather than a regulatory compliance issue with respect to federal water quality guidelines.

Pesticide registration, use and reporting requirements are much more onerous in California than in the comparison states. California is the only state to have its own review and testing process for state pesticide registration, a system which can add years and millions of dollars to the approval process. In addition, a mill tax is levied on wholesale pesticide sales to help fund the Department of Pesticide Regulation in California. The pesticide registration and review process is handled by the Departments of Agriculture in most other states, including the comparison states of Texas and Arizona. Typically, proof of the EPA registration, copies of the label and a fee are required for the registration application, and the process timeline is measured in weeks or months, not years. California's annual pesticide registration fees are much higher, as well, at $750 per product per year, as compared to $420 for two years in Texas and $100 per year in Arizona.

Regulations governing who can apply as well as advise the use of restricted pesticides also differ greatly between California and the comparison states. The U.S. EPA requires certain pesticides to be restricted for use only to those who have been certified or licensed, but it leaves those certification requirements to the states. Each of the three states allows for a private applicator certificate or license for those growers who plan to apply or supervise the application of restricted use pesticides on their own operations. These regulations governing this class of use are quite similar among the three states; all require training, passing a written examination on pesticide use and laws, as well as continuing education to maintain the license or certificate. California actually requires slightly less continuing education (six hours over three years) for the private

license than does Arizona or Texas, both of which require three hours of continuing education annually (Texas requires 15 hours over five years).

However, requirements diverge when it comes to pest control advisor (PCA) licensing. California requires a bachelor's degree in some type of agricultural or biological science to apply for a PCA license, which allows someone to make pesticide use recommendations commercially. In lieu of a bachelor's degree, 60 college semester units are required, plus two years' experience as an assistant to a PCA. An additional 39 semester units of core courses are also required, after which the applicant must pass a written examination. After a PCA license is granted, 40 hours of approved continuing education hours are required every two years to maintain it. California's requirements for a PCA license are the most stringent of the comparison states.

Since January 2005, Arizona also requires a bachelor's degree in agricultural or biological sciences, or pest management to apply for a PCA license, plus passing a written exam. If an applicant doesn't have a bachelor's degree, 45 semester units of science, pest management, and crop science courses are required, in addition to having two years of technical experience, plus passing a written examination. Fifteen hours of continuing education are required for license renewal. In Texas, commercial applicators must be licensed, following similar requirements as in the California and Arizona – however there is no statutory requirement to license pest control advisors. Essentially, what takes a college degree or the equivalent thereof, plus a host of licensing and continuing education requirements in California and Arizona can be undertaken with no requirements in Texas. A voluntary organization does exist to certify those in the crop consulting business in Texas, but it remains non-regulatory.

Pesticide use reporting is more onerous in California as well. A Notice of Intent to apply restricted pesticides must be issued to the County Agriculture Commissioners (CAC) office at least 24 hours prior to application. Private growers, commercial applicators and PCAs must follow these reporting guidelines. Afterwards, the final pesticide application menu must be submitted to the CAC office for collection by the Department of Pesticide Regulation. Arizona also requires reporting of pesticide use to the Arizona Department of Agriculture, but no prior notice of intent is required. In Texas, growers and commercial applicators are required to keep pesticide application

records on file for two years, no third-party reporting is required. Essentially, California growers and PCAs have twice the paperwork burden as Arizona because of the before-and-after nature of the reporting requirements, and several times more burden than growers in Texas, which has no reporting requirements.

Workers' compensation provides yet another area in which California leads the comparison states in terms of regulatory burden. Even though it is not alone in requiring employers to subscribe to workers' compensation insurance (Arizona requires it as well), the rates paid per dollar of employee wages are higher in every category for agricultural workers, and in the case of packing shed workers, the rates are anywhere from 2.5 to four times higher than in Arizona or Texas. Texas doesn't require employers to carry workers' compensation; they only must notify employees if they do not subscribe to a workers' compensation program. Many businesses in Texas do carry some form of worker injury insurance as guard against liability, but if they wanted to bear the risk of lawsuits from injured workers, no regulatory framework prevents it.

One hidden cost of regulation is the time and expense necessary to learn about the regulations and what is required for compliance. Hurley's 2005 study documented the number of rules and regulations that California growers must follow to maintain compliance, citing no less than 25 different laws at the state and federal levels that affect agricultural producers. However, there is no clearinghouse for a grower to learn about the variety of regulations that affect his or her operation. This is due in large part to wide variety of independent agencies that govern various regulatory areas in California. Both Texas and Arizona have very helpful and user-friendly regulatory pages on their respective Department of Agriculture websites where growers can learn about the regulations affecting their operations. No such clearinghouse is readily available from a government agency in California.

Case Studies

These differences in the regulatory environment become evident when the case study analysis is presented. The California citrus grower bears a regulatory cost burden of $347.12 per acre, as compared with the Texas grower, who estimated regulatory costs to add $31.71 per acre. The primary differences in regulatory costs in California were with respect to air quality regulations, most notably the additional cost to chip pruning

and orchard removal waste. Chipping costs added the largest cost per acre, at $150. That was following by workers' compensation, which totaled $95.60 per acre. In Texas, combined worker's compensation insurance, which again, is not required by law, costs the grower about $17 per acre. No air or water quality mitigation measures are required. However, Texas does have a Worker Safety Standard which is subject to audit by the Texas Department of Agriculture, the training, supplies and paperwork for which cost the grower close to $5 per acre, when all of the relevant categories are combined. If one only considers the cultural costs of production, the California grower's regulatory costs add 17.8% to his costs of production, and 6.63% if all of the harvest and packing costs are included. In Arizona, if only cultural costs are considered, the cost of the regulatory burden is 3.29%, and if total costs of harvest and packing are included, the regulatory cost is .75% of total costs.

The situation with lettuce tells a similar story, but since the regulatory environments are more similar between California and Arizona that are evident between California and Texas, the regulatory cost differences are not as stark. The California lettuce grower reported regulatory costs of $114.84 per acre. Workers' compensation appeared as the highest per-acre cost at nearly $59 when both actual costs and staff time were included. Pesticide regulation in form of higher costs passed along from the PCA to cover regulatory overhead were the next highest burden, at almost $29 per acre, when paperwork time is included. The relative regulatory costs to the growers' production (not including harvest/packing costs) are 4.82% per acre. In contrast, the Arizona grower reported a per-acre cost of regulation of $70.43. The most costly areas reported were in the areas of air quality regulation, as the cost of the water truck for dust mitigation on the ranch roads totaled nearly $40 per acre per year. The grower commented that in reality, the lettuce portion of that cost is closer to $20 per acre per year, but they assess the full cost of watering to the vegetable part of the operation, rather than assessing part of it to the cover crop production in the summer. Workers' compensation is the next largest regulatory bill, and that costs the grower $15.47 per acre, nearly four times less than the California grower's cost. As a percentage of growing expenses, regulatory costs add 2.5%.

The review of relevant regulations among the states, as well as the case studies, indicate that the original hypothesis of the study held true – that the regulatory burden is much higher for California growers than in the comparison states of Texas and Arizona. Though one could argue that both the limited time (seven months) and limited scope (three states, two crops) of the project present conclusions that may not be fully supported in a longer-term, broader study, the author believes that the evidence presented, even with its limitations, shows a clear picture of regulatory differences that have a significant impact on producer costs.

Policy Implications

It is hoped that these case studies and the review of regulations affecting agriculture in California, Texas and Arizona will provide a grower-based perspective on which to base future decisions with respect to the state's regulatory environment for agriculture. Policy makers, growers and agricultural industry representatives can use the results of this project as means to understand how regulatory costs can have widely varying impacts based on where a grower is located, not only between states, but also within California. These are costs that growers know they absorb, but since many of the costs arise in the form of opportunity costs of time, they are rarely documented. The regulatory burden that growers face in California is not imaginary, as these case studies indicate. It is hoped that policymakers can use this study to better understand the impact of adding further regulatory burden to California agriculture, particularly since in all areas documented by this study, California already leads the comparison states in terms of the number of regulations and the cost of compliance. This is particularly important given that the comparison states grow crops that compete with California's; and not only are the regulatory costs higher, but the average costs of production are higher as well, as evidence by the university-prepared budgets.

Policy makers and growers in other states might use this study as a crystal ball to see what their regulatory futures might hold – as the Texas citrus grower noted, he was interested in participating in this study to get a better view of what might be in store for Texas growers in about five years. Other states do watch carefully what happens in California's regulatory environment. Policy makers may also consider what types of incentive-based or cost-share measures might be implemented to assist California

growers with meeting the costs of regulatory compliance. Those interested in California land use policy might take note of the following anecdote: the California citrus grower maintained that his land purchases over the past few years have been decided primarily on development trends in the nearby town – and rather than moving away from town, he has invested in land closer to the growth patterns. His hedge against future regulatory cost increases is to be well-positioned to sell his land for development – something he never would have considered 10 years ago, when the regulatory burden was much lower.

Future Research

This project provides a platform for future study of the regulatory differences among specialty crop-producing states. If further case study analysis is pursued, dairy should be included, as regulations for animal agriculture are even more stringent than those that befall irrigated tree and row crops. A longer timeframe would be desirable, as well. If a project could last from 15 to 18 months, the cooperating growers could keep an actual diary of time spent fulfilling regulatory requirements each week or month for an entire year. The following three to six months could be used to visit the cooperating growers and clarify any issues that arise, as well to conduct interviews with industry experts. Other important specialty crop states such as Florida and Michigan should also be included, as should other significant California specialty crops, such as almonds, nursery products and strawberries. It is imperative to identify cooperating growers as soon as possible in the process; otherwise as the busy growing seasons progress it is very difficult to schedule time for interviews and on-farm visits. Though case study methodology has its limitations in terms of being able to extrapolate findings to an entire industry, it does provide a clear picture of the actual costs that growers are facing as a result of regulation.

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Appendix 1

Synopsis of California's San Joaquin Valley Air Basin's List of Conservation Management Practices

Cropland-Land Preparation/Cultivation

- Alternate Till- Tilling alternate rows for weed management allows for approximately 50% reduction in field activity.
- Bed-row size and spacing- Increasing or decreasing the size of the planting area bed, can be done for field and permanent crops. This reduces the number of passes and soil disturbance by increasing plant density/canopy thru reduction of row width, overhead vineyard production systems, containment of PM within canopy.
- Chemigation/Fertigation- Application of chemicals through an irrigation system reduces the need to travel in-field for application purposes.
- Combined operations- To combine equipment, to perform several operations during one pass. Reduction in the number of passes necessary to cultivate the land will result in fewer disturbances to the soil.
- Conservation irrigation- Conserving the quantity of water by using drip systems or sprinklers can reduce weed population, thus reducing the need for tillage.
- Conservation tillage- e.g.: no tillage, minimum tillage. These reduce the loss of soil and water in comparison to conventional tillage. Further, it reduces the number of passes and soil disturbance.
- Cover crops- By using vegetation or re-growth of plants to cover the soil surface wind erosion and entrainment of the soil can be reduced by providing a protective covering.
- Equipment changes/Technological Improvements- To modify the equipment such as combines, cotton pickers, tilling and harvesting equipment, increase equipment size, modify land planing and land leveling, matching the equipment to row spacing, grafting to new varieties or technological improvements. This will reduce the number of passes during an operation, therefore reducing soil disturbance.
- Fallowing Land- Temporary or permanent removal from production eliminates entire operation/passes resulting in less fugitive dust.
- Floor management- Smoothing and flattening the soil surface after nut harvest to remove post-harvest residue; maintain clean, smooth, firm floor throughout season by elimination of disking. By reducing passes through the elimination of disking soil disturbance will be reduced.
- Integrated Pest Management- A decision process which uses a combination of techniques including organic, conventional, biological farming practices to suppress pest problems. This practice reduces the use of herbicide/pesticide therefore reducing the number of passes for spraying and reducing the need for additional tillage.

- Mulching- Applying or leaving plant residue or other material to soil surface. This reduces entrainment of PM due to winds, reduces weed competition thereby reducing tillage passes.
- Night farming- Operate at night when moisture levels are higher and winds are lighter. This decreases the concentration of PM emissions during the day.
- Non tillage/Chemical tillage- Using flail mower and/or low volume sprayers stabilize soil through elimination and reduce soil tillage passes.
- Organic practices- Using biological control methods and non-chemical control methods reduces chemical use, therefore reduces passes.
- Precision farming (GPS) - Using GPS satellite navigation to calculate position in the field, therefore manage/treat selective area. This will reduce overlap and allow for operations during inclement weather conditions and at night.
- Time planting- Modifying the time of planting. This can assist in distributingPM10 emissions to a period when there is less PM concentration.
- Transgenic crops- The use of GMO or transgenic crops. Some GMO crops reduce the need of tillage or cultivation operations, thus reduces soil disturbance.
- Transplanting- Planting plants already in a growth state. This will reduce soil disturbance and the number of passes compared to using seed.

Cropland-Harvest

- Baling/Large Balers-Using balers to harvest crops. This will reduce PM emissions from chopping, truck passes, and residue burning.
- Combined operations- Performing several operations during one pass. The reduction in the number of passes necessary to harvest the crop will result in fewer disturbances to the soil.
- Continuous tray/D.O.V., New drying techniques for dried fruit- Any technology to reduce labor and tillage. Reduces the number of equipment passes, field entry, and soil erosion.
- Equipment changes/Technological improvements- To modify the equipment such as combines, cotton pickers, tilling and harvesting equipment, increase equipment size, modify land planing and land leveling, matching the equipment to row spacing, grafting to new varieties or technological improvements. This will reduce the number of passes during an operation, therefore reducing soil disturbance.
- Fallowing land- Temporary or permanent removal from production eliminates entire operation/passes resulting in less fugitive dust.
- Floor Management- Smoothing and flattening the soil surface after nut harvest to remove post-harvest residue; maintain clean, smooth, firm floor throughout season by elimination of disking. By reducing passes thru the elimination of disking soil disturbance will be reduced.
- Green Chop- The harvesting of a forage crop without allowing it to dry in the field. This will reduce multiple equipment passes in-field, reduce soil disturbance, and reduce dust emissions from dry materials.
- Hand harvesting- Harvesting crop by hand will reduce soil disturbance due to machinery passes.

- Night harvesting- Implementing practices at night will reduce PM by operating when air is moist, thereby reducing emissions.
- No burning- Switching to a crop/system that would not require waste burning will reduce emissions associated with burning.
- Pre-harvest soil preparation- Applying a light amount of water or stabilizing material to soil prior to harvest will reduce PM emissions at harvest.
- Shed packing- Packing commodities in a covered or closed area reduces field activity, therefore reducing PM emissions.
- Shuttle system/larger carrier- Hauling multiple or larger trailers/bins per trip reduce emissions through reduced passes.

Cropland-Other

- Alternate till- Tilling alternate rows for weed management allows for approximately 50% reduction in field activity.
- Application Efficiencies- By using low volume sprayer heads, hand spot-spraying, variable rate applicators and shielded sprayers spray emissions can be reduced as well as the number of passes on the field.
- Bailing/Large Balers- Using balers to harvest crops. This will reduce PM emissions from chopping, truck passes, and residue burning.
- Bulk materials control- Minimizing visible dust emissions from bulk materials reduces the entrainment of fugitive dust.
- Chemigation/Fertigation- Application of chemicals through an irrigation system reduces the need to travel in-field for application purposes.
- Conservation irrigation- Conserving the quantity of water by using drip systems or sprinklers can reduce weed population, thus reducing the need for tillage.
- Cover Crops- By using vegetation or re-growth of plants to cover the soil surface wind erosion and entrainment of the soil can be reduced by providing a protective covering.
- Fallowing land- Temporary or permanent removal from production eliminates entire operation/passes resulting in less fugitive dust.
- Grinding/Chipping/Shredding- Grinding prunings and orchard removals, instead of burning reduces PM from burning crop residues.
- Integrated pest management- A decision process which uses a combination of techniques including organic, conventional, biological farming practices to suppress pest problems. This reduces the use of herbicide/pesticide therefore reducing the number of passes for spraying as well as the need for additional tillage.
- Irrigation power units- Use cleaner burning engines such as electric motors. This will eliminate the PM and NOx emissions associated with spark and compression engines.
- Mulching- Applying or leaving plant residue or other material to soil surface. This reduces entrainment of PM due to winds, reduces weed competition thereby reducing tillage passes.
- Night farming- Implementing practices at night will reduce PM by operating when air is moist, thereby reducing emissions.

- No burning- Switching to a crop/system that would not require waste burning will reduce emissions associated with burning.
- No tillage/chemical tillage- Using flail mower and/or low volume sprayers stabilize soil through elimination and reduce soil tillage passes.
- Organic practices- Using biological control methods and non-chemical control methods reduces chemical use, therefore reduces passes.
- Permanent Crops- Having established permanent crops reduces incidence of wind blown dust.
- Reduced pruning- Reducing the frequency of pruning, one time per year, or every other year, reduces soil disturbance due to machinery passes and emission from the machinery engines.
- Soil amendments- Organic or chemical materials applied to the soil for improvement increase moisture retention and stabilize soil.
- Soil incorporation- Disking residues and/or soil incorporation of residue reduces emission from burning.
- Sulfur-reduction or elimination of dusting- Organic chemical used to control disease in crop can reduce dry particles.
- Surface roughening- Leaving soil surface as it stands or clods of soil when fallow reduces entrainment of PM due to winds.
- Transgenic crops- Use "herbicide-ready" crops reduce soil disturbance and weeding passes and lessens drift.
- Wind barrier- Artificial or vegetative wall/fence that disrupts the erosive flow of wind over unprotected land reduces entrainment of PM due to winds.

Cropland-Unpaved Roads

- Chips/Mulches, Organic Materials, Polymers, Road Oil, Sand- Application of any non-toxic chemical or organic dust suppressant which meets any specification required by any federal, state, or local water agency and is not prohibited for use by any applicable regulations. The application of one of these dust suppressants reduces entrainment of fugitive dust.
- Gravel- Placing a layer of gravel with enough depth to minimize dust generated from vehicle movement and to dislodge any excess debris which can become entrained.
- Mechanical pruning- Using a machine instead of hand pruning reduces the vehicle trips, thereby reducing PM emissions.
- Paving- Paving currently unpaved roads prevents dust from vehicle traffic.
- Restricted access- To restrict public access to private roads reduces the vehicle traffic and thus reduces associated fugitive dust.
- Speed limits- Enforcements of speeds that reduce visible dust emissions.
- Track-out control- Minimize any and all material that adheres to and agglomerates on all vehicles and equipment from unpaved roads and falls onto a paved public road or the paved shoulder of a paved public road. This will reduce the entrainment of fugitive dust.
- Water- Application of water to unpaved roads and traffic areas reduces the entrainment of fugitive dust.

- Wind barrier- Artificial or vegetative wall/fence that disrupts the erosive flow of wind over unprotected land. Reduces entrainment of fugitive dust due to winds.

Cropland-Unpaved Vehicle/Equipment Traffic Areas

- Chips/Mulches, Organic Materials, Polymers, Road Oil, Sand- Application of any non-toxic chemical or organic dust suppressant which meets any specification required by any federal, state, or local water agency and is not prohibited for use by any applicable regulations. The application of one of these dust suppressants reduces entrainment of fugitive dust.
- Gravel- Placing a layer of gravel with enough depth to minimize dust generated from vehicle movement and to dislodge any excess debris which can become entrained.
- Paving- Paving currently unpaved roads prevents dust from vehicle traffic.
- Restricted access- To restrict public access to private roads reduces the vehicle traffic and thus reduces associated fugitive dust.
- Speed limits- Enforcements of speeds that reduce visible dust emissions.
- Track-out control- Minimize any and all material that adheres to and agglomerates on all vehicles and equipment from unpaved roads and falls onto a paved public road or the paved shoulder of a paved public road. This will reduce the entrainment of fugitive dust.
- Water- Application of water to unpaved roads and traffic areas reduces the entrainment of fugitive dust.
- Wind barrier- Artificial or vegetative wall/fence that disrupts the erosive flow of wind over unprotected land. Reduces entrainment of fugitive dust due to winds.

Glossary of Terms

- Alternate- To do activity in an every-other-month rotation, or every –other row fashion.
- Bed, Bed Row- A surface prepared for the planting of seeds or crop.
- Chemigation- Applying chemicals through an irrigation system.
- Disturb, Disturbance- To work the soil in a fashion where it would no longer be in a firm stable state.
- Disc, Disk, Disking- An implement designed and used when pulled behind a tractor; mixes soil and eliminates weeds.
- Equipment- Implement of farm husbandry including but not limited to: tractor, disk, plow, spray machine, cultivator, and trailer.
- Fertigation- Applying plant nutrients through an irrigation system.
- Floor- The area of ground that is between the width of trees or vines. Also called the centers.
- Non-Tillage- A system whereby the soil is not moved through mechanical means.
- Tillage- Using an implement to disturb the soil surface or sub-surface.

Appendix 2
Arizona Best Management Practices for Air Quality Compliance
Arizona Department of Environmental Quality

Tillage and Harvest

Any mechanical practice that disturbs cropland or crops on commercial farm must comply with at least on of the following BMPs to comply with the general permit in regard to tillage and harvest:

Best Management practices for use during tillage and harvest

Chemical irrigation
Combining tractor operations
Equipment modification
Limited activity during a high-wind event
Multi-year crop
Planting based on soil moisture
Reduced harvest activity
Reduced tillage system
Tillage based on soil moisture
Timing of a tillage operation

Chemical Irrigation

"Chemical irrigation" means applying a fertilizer, pesticide, or other agricultural chemical to cropland through an irrigation system. Chemical irrigation reduces the number of passes across a field with tractors, sprayers, fertilizer applicators and machinery. Reducing the number of field operations reduces the emissions associated with those activities. Product recommendations should be followed to ensure proper implementation. The field operations eliminated should also be documented to demonstrate the implementation of the practice.

Combining Tractor Operations

"Combining tractor operations" means performing two or more tillage, cultivation, planting, or harvesting operations with a single tractor or harvester pass. This method reduces the number of passes or trips that a tractor, implement, harvester or other farming support vehicle makes across a field or unpaved surface, thereby reducing the amount of soil disturbed. Combining tractor operations is most effective if implemented during the time of year when PM10 is most likely to be produced.

Equipment Modification

"Equipment modification" means modifying agricultural equipment to prevent or reduce particulate matter generation from cropland. Shields or deflectors that redirect fan or vehicle exhaust sideways or upward. Dust shrouds around tillage implements and harvesters. Or spray bars that emit a mist to knock down PM10 are all suggested modifications that would result in compliance for a general permit.

Limited Activity During a High-Wind Event

"Limited activity during a high-wind event" means performing no tillage or soil preparation activity when the measured wind speed at 6 feet in height is more than 25 mph at the commercial farm site. A device to measure wind speed should be available at the commercial farm site. An individual farm policy should be developed to ensure that no tillage or soil preparation activities occur when the wind speed reaches 25 mph. Employees and family members should receive training in implementing the farm policy. Limiting activity during high-wind will reduce the transport of PM10.

Multi-Year Crop

"Multi-year crop" means a crop, pasture, or orchard that is grown, or will be grown, on a continuous basis for more than one year. The longer a crop or cover is protecting the soil surface, the less time the surface is susceptible to wind erosion.

Examples of multi-year crops include:

- Alfalfa
- Citrus
- Roses
- Livestock pasture
- Nuts (pecans)
- Sod

Planting Based on Soil Moisture

"Planting based on soil moisture" means applying water to soil before performing planting operations. Planting based on soil moisture is one of the most efficient practices to reduce PM10 between planting and crop emergence. Determining the soil moisture can be achieved by using the "feel method."

Reduced Harvest Activity

"Reduced harvest activity" means reducing the number of harvest passes using a mechanized method to cut and remove crops from a field. An example of reduced harvest activity is the elimination of a harvest or rood pass from a cotton harvest. The rood process produces a significant amount of PM10 because of the nature of the process.

Reduced Tillage System

"Reduced tillage System" means reducing the number of tillage operations used to produce a crop. Reducing the number of tillage activities can maintain the soil structure and help reduce PM10.

Tillage Based on Soil Moisture

"Tillage based on soil moisture" means applying water to soil before or during tillage, or delaying tillage to coincide with precipitation. This practice will bind soil particles with moisture reducing the amount of PM10 released into the air.

Timing of a Tillage Operation

"Timing of a tillage operation" means performing tillage operations at a time that will minimize the soils susceptibility to generate PM10. Methods of this activity would include: reducing the time between leveling and bedding, and leaving the field surface with large soil clods for as long as possible prior to preparation of seed beds.

Non-Cropland

Non-cropland is any commercial farm land that: is no longer used for agricultural production, is no longer suitable for production of crops, is subject to a restrictive easement or contract that prohibits use for the production of crops, or includes a private farm road, ditch, ditch bank, equipment yard, storage yard or well head.

Best Management Practices for use on non-cropland

Access Restriction
Aggregate Cover
Artificial Wind Barrier
Critical Area Planting
Manure Application
Reduce Vehicle Speed
Synthetic Particulate Suppressant
Track-out Control System
Tree, Shrub, or windbreak planting
Watering

Access Restriction

"Access restriction" means restricting or eliminating public access to non-cropland with signs or physical obstruction. Theoretically this will reduce the number of trips driven on agricultural aprons and access roads reducing that area's PM10.

Aggregate Cover

"Aggregate cover" means gravel, concrete, recycled road base, caliche or other similar material applied to non-cropland. Applying an aggregate cover to unpaved farm roads, parking areas and canal banks helps reduce the amount of soil particles exposed to the surface, thus reducing the PM10.

Artificial Wind Barrier

"Artificial wind barrier" means a physical barrier to the wind. Examples would include: continuous board fences, burlap fences, crate walls, bales of hay and similar material. Artificial wind barriers disrupt the erosive flow of wind over unprotected areas thus reducing PM10.

Critical Area Planning

"Critical area planning" means using trees, shrubs, vines, grasses, or other vegetative cover on non-cropland. This helps control soil movement and protects the soil surface when adequate cover does not exist. This reduces the dust and wind erosion by shielding the soil with vegetation.

Manure Application

"Manure application" means applying animal waste or biosolids to a soil surface. Applying manure to maintain or improve chemical and biological condition of the soil can reduce wind erosion and PM10.

Reduce Vehicle Speed

"Reduce vehicle speed" means operating farm vehicles or farm equipment on unpaved private farm roads at speeds not to exceed 20 mph. Reduced speeds will result in fewer PM10 generated by vehicles on unpaved roads.

Synthetic Particulate Suppressant

"Synthetic particulate suppressant" means a manufactured product such as lignosulfate, calcium chloride, magnesium chloride, an emulsion of a petroleum product, an enzyme product, and polyacrylamide that is used to control particulate matter. Synthetic particulate suppressants provide a surface barrier or bind soil particles together to retard PM10 on unprotected areas.

Track-Out Control System

"Track-out control system" means a device to remove mud or soil from a vehicle before the vehicle enters a paved public road. Using this system helps remove mud and soil from the tires of farm equipment and vehicles before they enter a paved public road, where the mud can be crushed into small particles and then becoming air born.

Tree, Shrub, or Windbreak Planting

"Tree, shrub, or windbreak planting" means providing a woody vegetative barrier to the wind. A barrier placed perpendicular to the wind direction can reduce wind speeds which will help reduce PM10.

Watering

"Watering" means applying water to non-cropland. Applying water from truck, tractor or other portable spray system to bare soil surfaces, such as unpaved roadways and equipment yards where high traffic areas exist, can help reduce PM10.

Cropland

Cropland can be defined as land on a commercial farm that: is within the timeframe of final harvest to plant emergence, has been tilled in a prior year and is suitable for crop production, but is currently fallow, or is a turn row.

Best Management Practices for use on cropland

Artificial Wind Barrier
Cover Crop
Cross-Wind Ridges
Cross-Wind Strip-Cropping
Cross-Wind Vegetable Strips

Manure Application
Mulching
Multi-Year Crop
Permanent Cover
Planting Based on Soil Moisture
Residue Management
Sequential Cropping
Surface Roughening
Tree, Shrub, or Windbreak Planting

Artificial Wind Barrier

"Artificial wind barrier" means a physical barrier to the wind. Artificial wind barriers disrupt the erosive flow of wind over unprotected cropland thus reducing PM10.

Cover Crop

"Cover crop" means plants or a green manure crop grown for seasonal soil protection or soil improvement. Cover crops help control soil movement by adding protection to unprotected cropland.

Cross-Wind Ridges

"Cross-wind ridges" mean soil ridges formed by a tillage operation. Ridges formed by tillage operations create protective windbreaks that disrupt the erosive forces of high winds.

Cross-Wind Strip-Cropping

"Cross-wind strip-crossing" means planting strips of alternating crops within the same field. Growing crops or managing residue as a protective cover in strips across the prevailing wind direction can break the effects of high wind events.

Cross-Wind Vegetative Strips

"Cross-wind vegetative strips" means herbaceous cover established in 1 or more strips within the same field. Herbaceous cover creates a protective wind-break that disrupts the erosive forces of high winds, especially during critical wind erosion periods.

Manure Application

"Manure application" means applying animal waste or biosolids to a soil surface. Applying manure to maintain or improve chemical and biological condition of the soil can help reduce wind erosion and PM10.

Mulching

"Mulching" means applying plant residue or other material that is not produced on site to a soil surface. Adding a protective layer to the soil surface reduces soil movement in high wind events. This practice also conserves soil moisture, which can reduce surface movement of soil.

Multi-Year Crop

"Multi-year crop" means a crop, pasture, or orchard that is grown, or will be grown, on a continuous basis for more than one year. Surface covers, such as crops, pasture, and orchards, that are grown and maintained for a long duration, protect the soil surface from erosive winds.

Examples of multi-year crops are:

- Alfalfa
- Citrus
- Roses
- Livestock pastures
- Nuts (Pecans)
- Sod

Permanent Cover

"Permanent cover" means applying water to soil before performing planting operations. Maintaining a long term (perennial) vegetative cover on cropland that is temporarily not producing a major crop protects the soil surface from erosive winds.

Planting Based on Soil Moisture

'Planting based on soil moisture" means applying water to soil before performing planting operations. Planting based on soil moisture reduces PM10 during the planting operation and is effective from the time of planting until crop establishment.

Residue Management

"Residue management" means managing the amount and distribution of crop and other plant residues on a soil surface. Leaving crop and other plant residues on the soil surface can protect the soil between the time of harvest of one crop and emergence of a new crop, thus reducing the PM10.

Sequential Cropping

"Sequential Cropping" means growing crops in a sequence that minimizes the amount of time bare soil is exposed in a field. By reducing the amount of time bare soil is exposed, sequential cropping helps reduce PM10.

Surface Roughening

"Surface roughening" means manipulating a soil surface to produce or maintain clods. The formation of clods helps disrupt the erosive wind over unprotected soil surface.

Tree, Shrub, or Windbreak Planting

"Tree, shrub, or windbreak planting" means providing woody vegetative barrier to the wind. Barriers placed perpendicular to the wind direction can reduce wind speeds by changing the pattern of airflow over the land surface, which helps to reduce wind erosion and PM10.