Final Draft Report

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Task 1 Working Paper — Literature and Methodology Review

Prepared for

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TASK 1.
Literature and Methodology Review

The first task in BBC's work to assist AQMD in developing potential enhancements to its socioeconomic assessment process was to conduct a literature and methodology review—particularly focusing on facility-based assessment and post-rule assessment. This section provides key findings from this review, organized by topic area. A list of all reports, studies and papers reviewed and personal interviews conducted during Task 1 are found in Attachment A.

Overview of the Literature and Methodology Review

The topics of the literature and methodology review were initially defined by AQMD's Request for Proposals for this study (#P2001-01 issued in June 2000) and further refined in BBC's proposal responding to that RFP. Initial meetings in January 2001 between AQMD, regulated industry stakeholders and BBC project staff provided much more specific identification of key issues to be addressed in this review. These key issues are identified in this working paper as a series of questions to which the study team has attempted to respond based upon the literature reviewed and interviews conducted during this task.

Shortly after starting the Task 1 process, it became apparent that it would be useful to divide the elements of this review into two categories: 1) theory and 2) practice.

Theory. The theoretical review encompasses the body of work and the insights of researchers trying to improve the general understanding of how firms are affected by and respond to regulatory requirements. Theory is also defined to include relevant impact assessment guidance documents of various agencies, which generally indicate goals and standards that subsequent actual studies attempt to meet.

Practice. The state of the practice review focuses on the actual procedures and studies performed by other regulatory agencies and AQMD in some cases. To develop this portion of the review, the study team contacted a number of regional air quality management agencies in the larger, non-attainment areas across the U.S., state regulatory agencies and the U.S. Environmental Protection Agency (EPA). Perhaps not surprisingly, we found that AQMD's assessment practices are far ahead of most, if not all, of the District's direct peers among the regional air quality management agencies. In fact, interviews with staff at a number of these agencies indicated that they look to AQMD as the leader in this area. Given AQMD's long-standing experience and expertise in socioeconomic impact assessment, we found that for the most part there were only two regulatory agencies whose assessment efforts were sufficiently far advanced to potentially provide useful insights for AQMD: the California Air Resources Board (CARB) and the U.S. Environmental Protection Agency (EPA)—particularly the work of the Innovative Strategies and Economics Group.

The remainder of this document provides a compilation of the study team's insights regarding the key issues in facility-based assessment and post-rule assessment based upon the interviews and documents reviewed during this task. This working paper is intended to provide a fair amount of

detail regarding what is known or believed concerning these key issues. Conclusions about how AQMD may wish to proceed in addressing these key issues are provided in the separate document—*Interim Findings and Potential Directions for AQMD Facility-based and Post-rule Assessments*—which also draws upon the stakeholder interviews conducted by the study team during Task 2 of this assignment.

Facility-based Assessment

The following key questions regarding the conduct of facility-based assessments were developed from meetings with AQMD socioeconomic assessment staff, AQMD board members and stakeholders from regulated industry. For each question, BBC has attempted to identify current theory (from theoretical and empirical research literature, impact assessment guidance documents and interviews), as well as the "state of the practice" by other regulatory entities.

What are the potential benefits of facility-based assessment?

From a policy perspective, AQMD has conducted facility-based assessments, and is interested in pursuing this type of assessment further. The goal is to provide more specific insight into the impacts of prospective rules on the directly affected firms within the regulated industry. Such assessments, in addition to AQMD's standard modeling of the broader economic impacts across the regional economy using the REMI model, are viewed as providing useful supplemental information to the Board in considering new rules. The literature and methodology review tended to confirm the perceived value of facility-based assessments.

Theory. Theoretical and empirical economists in the field of industrial organization, which seeks to explain the way firms and industries behave, are paying increasing attention to information about individual firms and even individual plants within firms. From a practical standpoint, such a focus is improved by recent availability of public sources of secondary data on activity at the plant and firm levels.[1]

Given the ability to analyze such data, researchers are now finding that there is extraordinary diversity among firms within a given industry in terms of size, age, investment, productivity and a host of other measures. Further, it appears that these differences are very important in explaining both how an individual firm and the industry as a whole respond to economic changes.[2] While these newer studies are making progress, much of the variation in firm behavior appears to remain attributable to factors that are not readily observable—such as the quality of management decisions.[3]

Recognizing the diversity of firms within any given industry, it is likely that new regulations will have varied affects among those firms. Facility-based assessment is a potential means of developing insight into distributional effects (e.g., winners and losers) within the regulated industry. The recognition and examination of such effects is now suggested in Federal analyses of regulatory impact.[4]

On a broader note, guidance documents from EPA's Innovative Strategies and Economics Group note that the goal of impact analysis in general is to supplement the information available to decision makers about the consequences of particular regulatory options.[5] This would appear to apply well to describing the benefits of facility-based assessments.

Practice. The perceived benefits of conducting facility-based assessments are seldom described in the assessment studies themselves. However, interviews by the study team with economic analysts at a range of regulatory agencies across the country elicited the following views on how facility-based assessment can improve the regulatory process:

- Facilitates engagement of the regulated industry and the public and can help improve the relationship between the regulator and industry;
- Can give business more forewarning about what to expect and can help the regulator better understand how businesses will adapt to the new regulation;
- Allows examination of how impacts may vary among the firms within the industry, and impacts on small businesses; and
- Can help in understanding the feasibility of the new regulation.[6]

When might it be feasible and appropriate to conduct facility-based assessments?

In addition to examining approaches to conducting facility-based assessments, AQMD is also interested in recommendations on when such assessments should logically be undertaken.

Theory. While the theoretical literature generally does not directly respond to this question, it does provide insight into the availability of appropriate secondary source data. Guidance as to the circumstances under which the information provided by facility-based analyses is most useful is also provided. Much of the recent industrial organization research into firm behavior and response to economic changes (such as air quality regulations) has focused on using relatively new Census Bureau data sets such as the Longitudinal Research Database (LRD)—which provide micro-level information on individual facilities.[7] The majority of this micro-level data is focused on the manufacturing industry. Comparative secondary source data on establishments in other sectors—such as services and retail—appears to be considerably more limited.

The issues most commonly examined in the recent micro-level industrial organization literature include differential effects within an industry and firm investment, closure and relocation decisions.[8] These areas of concentration suggest that facility-based analysis may be particularly appropriate when there appears to be considerable variation in the characteristics of firms within a given industry or when there appears to be potential risk of closure or relocation in response to a new regulation (perhaps identifiable from the magnitude of the costs involved).

Finally, like AQMD, other agencies often apply screening criteria based on whether a proposed action is expected to have "major" or "significant" impacts on key issues in determining the appropriate level of analysis.[9] While such standards are potentially subjective, relative standards might be developed based on a comparative assessment of past and potential future AQMD regulations.

Practice. Interviews with economic analysts at regulatory agencies again provide more insight into this question than the studies themselves. Several analysts noted that to conduct facility-based assessments, there must be a well-defined set of firms that would be impacted by the new regulation.

It is viewed as most important to conduct this type of analysis for regulatory strategies that are not well proven in prior experience and when there is considerable diversity among the firms subject to regulation. Several analysts further noted that data availability and cost are pragmatic considerations in determining whether to conduct assessments of facility level impacts.[10]

How to identify and project affected industries, firms and plants?

While most forms of regulatory impact assessment require identification of the affected industry(ies), facility-based assessment may require more detailed identification of the firms and plants that will be impacted by forthcoming regulations. This is not always a simple task—at least one previous study of the accuracy of regulatory cost estimates found that mistakes in predicting which facilities will be affected by a rule are a common cause of error in estimates of expected pollution reductions and costs.[11]

Theory. EPA guidance documents generally discuss how to identify and describe potentially regulated industries, entities and markets. EPA suggests developing an "industry profile," covering the affected industry, entities and markets, from information previously gathered by the agency itself, from publicly available sources, and from stakeholders.[12] EPA's ideal industrial profile is quite detailed:[13]

- A description of the source category, current economic conditions and trends for the category and the specific environmental concerns;
- A profile of the supply side in terms of production processes, major by-products and co-products, types of products and services and the costs of production;
- A profile of the demand side in terms of product characteristics, uses and consumers and substitution possibilities in consumption;
- An overview of the industry structure in terms of products and producers that constitute the "market," an inventory of plants and the characteristics of the potentially affected firms; and
- An historical and projected description of markets in terms of volumes and prices, including comparable data on international trade where applicable.[14]

EPA encourages information gathering from potentially affected parties, especially if stakeholder involvement in the assessment process is an agency objective.[15] EPA and several other sources also provide specific types of data available for industry profiling. Some of the suggested sources are listed here. However, BBC has not yet fully evaluated which of the sources AQMD might find most feasible for use in facility-based assessments:

- EPA Industry Sector Notebooks (available on-line);[16]
- U.S. Department of Commerce's *U.S. Industry and Trade Outlook;*
- Gale Research Company publications;

- Investor research reports from Standard and Poor's, Moody's and ValueLine Investments; and
- Trade associations and general literature and internet searches.[17]

There is little guidance in the literature on approaches to forecasting how the regulated community will grow and change in the future. EPA notes that "canned" future projections and forecasts often are available from trade associations, trade journals, government agencies like the U.S. Department of Energy or industry experts. An alternative is to develop projections in-house; whether this is done using simple or sophisticated techniques depends on the availability of data, time and budget.[18]

Practice. Review of studies by other regulators indicate that CARB frequently uses internal databases (such as the Consumer Products Registration Database) to identify affected firms. CARB supplements this information, where necessary, with data from other sources, such as trade publications and associations.[19]

Interviews with a range of regulators also indicate that internal databases are commonly employed and supplemented with ad-hoc research techniques, including contact with industry representatives and trade associations, internet and secondary source searches and public notices.[20]

How to project compliance strategies and associated costs?

Accurate assessment of the economic impacts of regulation requires a clear vision of the actions that will be undertaken to comply and the costs associated with those actions. Challenges in projecting the strategies and costs may arise when the compliance technology is relatively new or in a state of ongoing development, when the rule specifies outcomes rather than inputs, and when there is considerable variation among the firms that will be responding to the regulation. Incentive-based rules are especially challenging for prospective analyses because they are intentionally flexible and market-driven at the facility level.

Theory. Regulatory impact analysts generally take one of two alternative approaches in projecting the technology and costs of regulatory compliance. The first approach might be termed the "direct cost approach." This approach essentially culminates in attempting to identify the capital and operating costs that will be incurred by the firms subject to the regulation. Direct cost estimates are typically developed from either engineering estimates or surveys of control equipment vendors.[21] In some cases—particularly those involving increased use of existing compliance technologies or extensions of such technologies to new parties—the regulators own administrative records and permit databases may assist in developing cost estimates.[22]

The second approach carries the cost analysis at least one step further forward and might be termed the "ultimate burden approach." Under this approach, the firm's behavioral response to the regulation is also considered. Depending on market circumstances, the firm may pass at least a portion of the added cost forward to its customers or backward to its suppliers. Firms may also alter their inputs or their production in response to changes in regulations.[23]

Some form of survey research will likely be required if the analyst wishes to assess the ultimate cost burden, needs to develop direct cost estimates for a relatively untested compliance strategy, or is assessing a rule subject to compliance by more than one method. Options include surveys of affected

facilities and/or interviews with industry experts and trade associations.[24] [25] It has been noted that the potentially regulated parties may have better information about alternatives to meet regulatory requirements than the agencies themselves.[26]

Practice. CARB commonly uses a survey of potentially affected firms to identify capital investment, and subsequent annual costs for fuel, utilities, feedstocks, labor, overhead and other expenses for implementing the compliance equipment and operating changes.[27]

Other regulatory entities providing sample studies and interviews to the study team appear to follow approaches similar to AQMD in projecting compliance costs. Essentially, the cost projections begin (and sometimes end) with engineering estimates of capital and operating costs. Some regulatory agencies also seek input from industry in the cost estimation process. If a similar compliance approach has been used elsewhere for the same industry, previously developed cost estimates may be obtained and incorporated. Finally, some regulatory agencies contract for development of cost estimates with national emissions engineering firms—such as Argonne National Laboratories and EH Pechan and Associates.

Cost estimates are then applied to model facilities. In the most comprehensive studies, the model facilities are designed to be representative of the range of different sizes of firms, industrial processes and equipment.[28] Other, less comprehensive studies may simply use a single model facility deemed typical or average.[29]

How to obtain data on affected firms and plants?

An objective of facility-based assessment is to place the effects of new regulations into the context of the overall operations and financial conditions of regulated facilities. By definition, such assessment requires baseline information describing the firms in the regulated industry. Essentially, options for acquiring such information boil down to original surveys or the use of secondary data sources.

Theory. The most direct way to collect firm and plant level data is through surveys of the affected firms. Primary data collected in this manner has the potential to be the most accurate, as it contains current information and can be geographically matched to the individual firms that will be affected by the rule. However, such surveys are difficult to perform as many businesses may be reluctant to share cost and operational data. Further, businesses may have incentives to respond strategically in the hope that the information will discourage additional regulations. Large, statistically valid surveys are also expensive and time-consuming. Some guidance on the state of the art in collecting such information from businesses can be found in Federal business surveys.[30]

There are a variety of secondary sources that provide differing types of information at the firm or plant level. EPA's Innovative Strategies and Economics Group identifies the following sources of facility and/or firm level information, which provide varied information ranging from ownership to revenues, employment, production capacity and other information:

- U.S. SEC/EDGAR database;
- Dun & Bradstreet Market Identifiers;

- American Business Disk;
- U.S. Manufacturers Database;
- InfoTrac – Information Access Company;
- Ward's Directory of U.S. Private and Public Companies;
- Standard and Poor's Stock Report Services; and
- Other sources including trade associations, company web sites, etc.

Most of the sources just listed provide more comprehensive information for larger and/or publicly held firms.[31] This may be one of the reasons that the Small Business Regulatory Enforcement Fairness Act requires that when EPA finds that a proposed rule will have a significant impact on small businesses, it must convene a "Small Business Advocacy Review Panel."[32]

More recently, there is also an increasing amount of firm or plant level "microdata" embodied in datasets compiled by the Bureau of Census. In the theoretical arena, in which research questions can be adjusted to fit the available data, these Census microdata files are providing the primary foundation for new research into the behavior of firms and industries. The majority of this data focuses on the manufacturing industry. In general, it is often possible to link information by establishment between the Census microdata files to provide a richer dataset. While there is now a Census Research Data Center at UCLA, AQMD's ability to access these special Census data files is uncertain at this time.

The following is an abbreviated description of the primary Census micro-databases.

- The *Longitudinal Research Database or LRS* includes establishment level data on manufacturers from Census of Manufacturers and Annual Survey of Manufacturers. Data include inputs, costs, outputs and location of firm.[33] The most recent data available at this time appears to be from 2000. Given the comprehensive scope of this database, it would appear to be possible to isolate firms within the AQMD.

- The *Characteristics of Business Owners Survey (CBO)* —The CBO includes establishment level data on the business owner and the firm collected during each fifth year economic census. Owner questions focus largely on demographic characteristics, while firm questions include business status, year established, sales, profits and more.[34] The most recent data available at this time appears to be from 1996. Very few firms have been surveyed in all three CBOs and a small percentage is surveyed in each CBO, so usefulness for AQMD's territory is unknown.

- *The Worker Establishment Characteristics Database* includes almost 200,000 manufacturing workers matched to just over 16,000 manufacturing establishments. It was constructed by matching 1990 decennial census information on workers to establishment data available in the LRD. Each linked record provides both cross-sectional demographic information for workers along with longitudinal information for

employers such as output value, input cost, investment and employment totals. Currently, the database only contains records for the manufacturing industry, although expansion to other sectors is under consideration.[35]

- *The Longitudinal Establishment and Enterprise Microdata* (LEEM) file contains the entire universe of private sector establishments with a positive payroll excluding farms and private households. Each record contains information on the establishment for all years that it was in existence between 1989 and 1996. The LEEM establishment file includes information on establishment location, annual payroll, employment at the establishment and firm level, industrial classification and start year for each establishment. LEEM facilitates measurement of changes in establishment structure over time, including births, deaths and growth/contraction.[36]

- *The Pollution Abatement Costs and Expenditures survey* (PACE) provides comprehensive data on pollution abatement expenditures by private industry. The database covers all manufacturing establishments with at least 20 employees, most large mining firms, selected large electric and gas utilities and some petroleum companies. The PACE data includes capital expenditures by type of pollutant abated and abatement technique, operating costs by form of abatement and costs recovered through abatement activities by form of abatement. The PACE survey has been conducted annually since 1973, with the exception of 1987. Due to sampling issues, regional subsets of the PACE datafile may not be representative.[37]

Practice. During interviews with the study team, regulatory agency staff with experience in collecting facility level data for assessments indicated they relied on a mix of secondary data sources, trade associations, firms willing to volunteer information and limited survey efforts. Specific secondary data sources mentioned included several of the databases recommended by EPA's Innovative Strategies and Economics Group (see above), as well as the Census of Manufacturers, Freedonia and SRI.[38]

A somewhat ad-hoc approach of seeking information from a variety of sources appears to be prevalent based upon the study team's review of prior studies by EPA and CARB. Facility and firm level data in EPA assessments appear to draw heavily from trade associations, as well as the secondary data sources described earlier. In addition, EPA includes survey data gathered through "Information Collection Requests" sent to individual firms in the industry of interest.[39] CARB commonly relies upon industry averages from public financial databases, including Dun & Bradstreet and Ward's Business Directory, as well as industry journals and literature, surveys of firms and discussions with industry representatives.[40]

In the next phase of this study, BBC plans to identify and evaluate the most accessible and applicable data sources for facility-based assessment. Such an evaluation has not been conducted at this time.

How to measure and evaluate affordability?

From AQMD's experience in conducting its own facility-based assessments, the staff has identified the question of how to evaluate the affordability of control measures has emerged as an important staff concern. To date, AQMD has principally relied on projected cost as a percentage of total sales or revenues. While the literature does not generally focus on this issue in exactly the same context, it does provide a number of general approaches to evaluating affordability from the firm's perspective.

Theory. The literature suggests several alternative ways to evaluate a firm's ability to afford major capital expenditures, likelihood of closure and investment decisions.

In terms of major capital expenditures, affordability can be viewed as the ability to internally finance new capital or the ability to borrow funds to finance new capital outlays. In this genre, suggested affordability measures include the firm's debt to capital ratio and/or the firm's debt service coverage ratio.[41]

An alternative affordability measure is suggested by recent studies examining firm performance, investment and closure decisions. Studies examining the likelihood of bankruptcy and plant level investment and exit decisions have identified cash flow as a key variable. In fact, firm level cash flow was found to be the strongest predictor of plant level investment and market exit decisions.[42]

EPA recommends that company level analyses of impacts of regulations on the health of the firm focus on changes in "key measures of profitability"—return on sales, return on assets and return on equity.[43] However, perhaps recognizing the more limited data likely to be available for small businesses, EPA has historically recommended the calculation of annualized compliance costs as a percent of sales as the quantitative criteria for evaluating impacts on small business entities.[44]

More recently, however, EPA has recognized that affordability—or the ability of business to withstand compliance costs without closure, layoffs or other undesirable actions—is more a function of impact on cash flows (in the short-term) and on profitability (in the long-term). Since different industries, and different firms within an industry, have different cash flow and profit-to-revenue ratios, EPA appears to be moving towards incorporating information on typical profit-to-revenue ratios along with the estimate of costs as a percentage of sales. Typical industry profit-to-revenue ratios at the national level may be available from a number of the data sources described elsewhere in this document, or from IRS publicly available summaries of corporate returns by industry and size class of firm.[45]

Practice. The measure used by AQMD thus far in previous facility-based assessments, compliance cost as a percent of sales, has also been used by others in examining the affordability of pollution control.[46] EPA's analysis of impacts on the cement industry examines this measure, as well as changes in pre-tax earnings, although results are only reported at the industry and aggregated small business levels.[47]

In at least one study, CARB looked at the following measures as indicators of ability to afford the control strategy: impact on liquidity ratios (as a measure of short-term affordability) and impacts on leverage ratios and profitability ratios (as measures of long-term affordability).[48] Other CARB studies focus on return on equity (ROE) as a measure of long-term affordability.[49] When employing the

latter measure, CARB typically uses a threshold of ten percent change in ROE (e.g., a reduction from 10% ROE to 9% ROE) as the measure to determine whether impacts on profitability are significant.[50]

When affordability is gauged based on changes in internal firm financial ratios, the ability of firms to pass along cost increases to their customers is a logical consideration. In practice, this can be a complex question to answer. Often a "worst case" simplifying assumption that the firms will have to absorb all of the cost is incorporated in this type of analysis.

In our interviews with economic assessment staff at other regulatory agencies, we found common recognition that affordability is a key concern and principal reason for conducting facility-based assessment, but less specific guidance on how to assess affordability. In practice, there appears to be a focus on learning the extent to which firms can pass cost increases to consumers and an emphasis on evaluating the possibility that the rule will lead to firm closures, particularly amongst smaller businesses.[51]

How to estimate firm or plant level response?

Both AQMD and stakeholders have expressed interest in the potential for facility-based assessment to provide insight into how firms will respond to increased costs due to air quality regulations.

Theory. Recent studies focusing on micro, firm-level data tend to come to the conclusion that firms within the same industry adjust to economic shocks (such as new regulatory costs) differently.[52] In part, these differences have been attributed to differences in the size and age of firms within the industry (increases in both of which have been found reduce the likelihood of firm closure)[53] and/or level of plant utilization (higher utilization levels tend to mean lower control costs per unit of output).[54] EPA simply suggests that the analyst must identify which firms are likely to have problems meeting their debt obligations in the face of the regulation and might thus be forced to liquidate.[55]

While there is considerable focus in recent literature on the characteristics of individual firms, overall industry characteristics remain an important consideration in determining how firms will respond to changes in regulation. In particular, firms in more rapidly growing industries may be less likely to close or liquidate.[56]

A final consideration which is emphasized by micro, facility-level data is that many industries experience considerably more turnover than is evident from overall, industry statistics. For example, a study of Southern California's furniture industry and air quality regulations found that annual average firm turnover was ten percent.[57]

Practice. Sample EPA studies reviewed by the study team do not provide detail about differential firm responses within the industry, with a couple of exceptions. As noted elsewhere in this document, EPA does differentiate between average impacts on firms in the industry and impacts on small businesses. In addition, EPA analyzes potential closures in response to regulations. In the study of impacts on the Portland Cement industry, EPA projected that a number of kilns would close under certain regulatory alternatives—particularly those using older processes and those of smaller capacity. Such projections were based on a break-even analysis of individual kiln operations.[58]

While analysts interviewed by the study team indicated that recognizing variations in firms within the industry was important, they generally provided less specific guidance on how to estimate firm responses to regulation. EPA economics staff suggested a close examination of the competitive structure of the industry (e.g., number of firms and nature of competition) coupled with attempts to model the supply curve or estimate the elasticity of supply in order to determine changes in price and output.[59]

How to project impacts on regional competitiveness (e.g., market share, survival, births, relocations)?

Regulators and stakeholders identified the question of how to predict regulations' effects on competitiveness (especially regional competitiveness) as an important concern. The question of regional competitiveness is closely linked to the question of affordability. Some guidance as to how to predict these impacts was provided in the literature.

Theory. The literature suggested two primary measures through which AQMD could forecast a rule's impacts on regional competitiveness. The first is to analyze changes in productivity of the firm due to the regulation. In theory, productivity drives profitability, which in turn drives the firm's ability to survive in a competitive market. Companies often suggest, for example, that compliance costs "have caused the company to shift resources away from revenue-producing activities and toward regulatory compliance functions that have little or no productive value and constrain company growth."[60]

The theoretical literature contains examples of efforts to link compliance costs to effects on both total factor and labor productivity for the firm and corresponding impacts on regional competitiveness.[61] A relatively simple example of this type of competitiveness analysis in regard to the aerosol paint industry and selected other industries was developed for CARB using state-level data from the Census of Manufactures.[62] This study also tests other possible measures of impacts on statewide competitiveness, including changes in return on equity—based on Dun & Bradstreet data.

The second measure through which to study regulations' impacts on competitiveness is the birthing cycle of firms (i.e., the location decision). Each firm, when deciding where to locate for new operations or to relocate for continuing operations, must assess at which location the business will compete most profitably. Many studies have analyzed the effects differing levels of regulation have on a firm's decision to locate. The literature suggests that the best way in which to isolate compliance costs' impacts on a firm's location decision is by controlling for factors that may also play a role – wage levels, employment, characteristics of the capital market for investment, enforcement activity, abatement expenditures, taxes, factor prices, and other labor and factor market characteristics.[63]

Practice. CARB is required by state law (SB513/AB969) to assess the potential impact of their regulations on state competitiveness.[64] Although CARB's later guidance study appears to suggest a somewhat different approach (as described above), in an earlier actual study of impacts on the petroleum refining industry the focus of the competitiveness impact assessment was on whether the price increases resulting from compliance would exceed the threshold at which it would become viable to import gasoline to the state from other regions.[65]

Apart from possible increases in the competition from outside the region faced by existing firms, interviews with other regulatory agencies indicated that impacts on the ability to start or locate new firms in the regulated region were a competitiveness concern. This issue may become even more important when new regulations include "grandfathering" provisions that provide a different playing field for new firms relative to existing operators.[66]

What level of specificity is useful, or necessary, in conducting facility-based assessments?

In embarking upon facility-based assessments, a decision must be made regarding how (and if) data from individual firms will be aggregated or summarized for purposes of analysis and presentation. In the continuum of possible approaches, one extreme is to analyze and present the information on every affected firm—presumably substituting a pseudonym to protect the confidentiality of the individual enterprises involved. This is the approach AQMD has taken to date in most of its facility-based assessments. The other extreme is to describe the information and assessment in terms of the average, or typical firm in the industry—this is often termed "representative firm" analysis.

Theory. Not surprisingly, given the attention recently being paid to the variability (or "heterogeneity") of individual firms within a given industry and market, the more theoretical literature is critical of the historically common practice of describing businesses in a given industry in terms of the "representative firm." Perhaps the most compelling argument is made in an article summarizing recent studies of firm level behavior, which states that "to understand economic performance and competition, one must move beyond representative firm models."[67]

Although the use of a single, representative firm to represent characteristics of businesses within an industry may be an oversimplification, studies attempting to explain firm behavioral characteristics do inevitably search for common elements among groups of firms within the industry.[68] Close to home, an analysis of the impacts of AQMD regulations on the wood furniture industry principally grouped firms according to employment size and sales.[69]

The alternative, analyzing and reporting on each individual firm in the industry, appears to have two possible drawbacks. First, for industries with more than a handful of firms, the information (and data collection requirements) may become overwhelming and make it difficult to draw meaningful information from the assessment. Second, despite efforts to protect the identity of the individual firms, inside knowledge of local participants in the industry may allow them to identify at least some of the individual firms described in the analysis. This may raise concerns and make it even more difficult to obtain cooperation from the industry in performing the assessment.

Practice. Actual studies examining plant and firm level impacts of proposed regulations demonstrate a variety of approaches. AQMD's own previous facility-based assessments have typically sought to provide information for each firm in the industry (given that they have been conducted on rules affecting a relatively small number of operations).[70] EPA's examination of impacts on Portland cement manufacturers took a similar approach in describing baseline operating parameters (e.g., sales and employment), but aggregated the estimated impacts up to an industry average, an average among small businesses in the industry and averages by market area.[71] Some studies for CARB have looked at typical firms within industry segments (e.g., a typical small firm, medium sized firm and large firm).[72]

Interviews with economic analysts at other regulatory agencies indicated that developing and analyzing representative firms is the predominant approach to presenting results. The number of representative firms needed varies depending upon the structure of the industry, but the intent is to capture groups of real firms with relatively similar emissions, output, products and financial characteristics. One analyst noted that if there are a small number of firms impacted, they will at least try to obtain data from each of them.[73]

How to address impacts to small businesses and minority-owned businesses?

In part, AQMD hopes that facility-based assessment can be a tool for better identifying the impacts of regulations on small and minority-owned businesses. Most of the available theoretical literature focuses on small businesses in general, rather than isolating minority-owned businesses.

Theory. One source of guidance on how to address impacts on small businesses comes from requirements that Federal agencies consider a rule's effects on "small entities" under the Regulatory Flexibility Act (RFA) as amended (P.L. 96-354). The RFA requires that a regulatory flexibility analysis must be prepared if a screening analysis indicates that a regulation will have a "significant economic impact on a substantial number of small entities."[74] The RFA defines small business as in the Small Business Act, but allows agencies to establish alternative definitions if they are more "appropriate to the activities of the agency."[75] Similarly, the RFA provides no specific definition for the screening criteria of "significant impact" and "substantial number," and agencies approach these concepts in different ways.[76]

How thoroughly an agency studies the impacts on small entities depends almost entirely on agency policy. The RFA itself is very general: "An agency may provide either a quantifiable or numerical description of the effects of a proposed rule or alternatives to the proposed rule, or more general descriptive statements if quantification is not practicable or reliable."[77]

At the same time, SBA's guidance for implementation sets ambitious goals for an analysis of small business impacts. Some of these goals may be broadly applicable to any facility-based assessment:

- Profile all the different sized entities likely to be affected by the rule, including the number of each type of entity;
- Assess how each of the different-sized entities will be affected;
- Examine impacts to economic viability (including closure), competitiveness, productivity, and employment;
- Present information on the uncertainty of the analysis or include uncertainty explicitly within the analysis;
- Estimate long- and short-term compliance costs for engineering, hardware acquisition, maintenance and operation, employee skill and training, administrative burden (including record keeping and reporting), productivity and promotion;

- Compare impacts on different sizes and types of entities to evaluate whether there are disproportionate impacts on small entities or another targeted sub-sector;[78] and

- Analyze the ability of small entities to pass on costs and the effect on profitability.[79]

Specific databases owned by SBA and others are sources of statistics on small business. Some of these were discussed previously in more detail:

- SBA Office of Advocacy's Longitudinal Extended Establishment Microdata set (LEEM) measures firm births and deaths;

- SBA's Small Business Data Base contains enterprise and establishment data by firm size;[80]

- SBA Office of Advocacy's Census-Based Small Business Data Base includes number of establishments, firms, payroll and receipts for various size classes by firm employment size, location and industry;

- SBA Office of Advocacy, Characteristics of Small Business Owners and Employees, 1997, is a publication that describes sources of capital, profitability, employment, industry and home-based status of women- and minority-owned businesses, 85 percent of which are very small;

- Federal Reserve's National Surveys of Small Business Finances, which cover credit needs of small firms with employees as well as their sources and uses of funds, may apply to the analysis of capital costs of compliance;

- Census' Characteristics of Business Owners Survey is a nationally representative database of small businesses with some data items not available elsewhere;

- IRS's Source Book for Corporations contains balance sheet and income statement information for corporations by asset size class that allows calculation of rates of return on assets and profits of small business;

- Annual Statement Studies, published by The Risk Management Association (formerly Robert Morris Associates), constructs a set of representative financial profiles from actual credit applications of bank borrowers and prospects, with an emphasis on small to medium size companies. The data consist of a profile for each size class within about 600 industries;

- Census' Data on Self-Employed Persons from the March Current Population Survey covers weeks worked, income earned, demographics and industry;

- The Kauffman-Ernst and Young Data Base of Fast Growth Companies (KEYFGC) is a private database that includes actual financial data and details of location and industry on individual (but unidentified) companies; and

- SBA's Catalog of Small Business Research is a listing to 1995 of contract research reports on small business topics.[81]

In connection with the review of data sources for facility-based assessment, BBC plans to evaluate the data sources specific to the assessment of small business impacts. This evaluation has not been conducted at this time.

To implement the RFA, Federal regulatory agencies have published guidance documents and commissioned evaluation studies to address procedures for small business impact assessment. For example, EPA's guidance identifies a number of specific financial ratios useful in gauging the severity of impacts on small businesses subject to a rule.[82] The guidance document of the National Marine Fisheries Service of the Department of Commerce recommends focusing on "solvency," in terms of costs or revenue reductions that may threaten the ability of a small business to meet its debt obligations in the short or medium term.[83]

Practice. Led by the Federal precedent, many agencies' impact assessments now specifically recognize and attempt to isolate the issue of potential impacts on small businesses. Essentially, the response boils down to a two-step process. First, some sort of screening is applied to determine whether or not a regulation will have a "significant" impact on small businesses. Some Federal agencies set thresholds based on percentages or absolute numbers of businesses showing impacts on revenues or experiencing closures.[84] However, there is no universal or consistent definition of what is a significant impact, how many businesses is a significant number and even what is a small business. If it is determined that there may be a significant impact, the second step is some sort of assessment of the impact.

A study for EPA that reviewed 35 analyses from 20 Federal agencies and departments found a wide range of experience among the agencies in the use and methods of screening analysis. Some agencies use qualitative analysis for screening and some do not screen at all and simply routinely conduct a full assessment for all rules.[85]

Performance of the second step, assessment of impacts on small businesses, varies greatly from cursory efforts that recognize the concern to more systematic analyses. More systematic assessments of economic impact on small business include comparing compliance costs to revenues or profits, testing for the likelihood of facility closure, and determining whether the impact of compliance costs on small business are disproportionate to those on large business.[86]

How to present the results in a useful fashion?

Sound methods are the core of an economic analysis, but it is equally important to communicate effectively to decision makers and to stakeholders.

Theory. Generally, the more theoretical literature offers little on presentation. EPA appears to offer the only guidance from this group that specifically focuses on the role of communication in the regulatory process.

To leverage opportunities for communication, EPA suggests the following:[87]

- "Target the audience," which may range from work group meetings, to stakeholder interactions, to formal presentations;

- Determine whether the audience consists of decision makers or constituents, and convey information that the audience "needs to know;" and

- Make the economic analysis clear by avoiding "excessive use of jargon" and carefully explaining economic concepts that are difficult for lay audiences (e.g., "opportunity cost, values of statistical lives saves, and discounting future benefits and costs, among others").

To help present results, follow six key principles:[88]

1. Use clear and transparent language;

2. Identify data sources and assumptions. Subject to confidentiality constraints, references should facilitate outside analysts obtaining data and source materials;

3. Describe the modeling. Explaining a model's basic logic bolsters credibility for non-economists and ensures correct interpretation by decision makers;

4. Characterize uncertainty. This should be done by identifying significant uncertainties and explaining the implications of plausible alternative assumptions;

5. Make alternatives comparable. Alternatives should be clearly and consistently compared, and the comparison should be in dollar terms; and

6. Clearly identify non-monetized and non-quantified effects. A suggested approach is to present a table of all effects and a check-off of whether they were monetized, quantified or neither.

Finally, EPA encourages the use of graphical presentations of analytical findings, especially for oral presentations and lay audiences.

Practice. Review of actual studies by other regulatory agencies indicates a wide variety of presentation styles, from heavily narrative to more terse and graphics intensive. Some reports present the results much more clearly than others do. Practitioners interviewed by BBC suggested developing a common format for presenting the results of each study. Interviewees also indicated that technical reports,which provide the detail, andpolicy summaries, which are terse and oriented towards the information that decision makers and stakeholders need, should be produced as separate documents.[89]

AQMD stakeholders expressed a dislike for "boilerplate" analyses (as presented in the Task 1 Working Paper). Any change in how AQMD presents results will likely need to strike a balance between a consistent format, which guides the reader towards what to expect, and variety in language and analyses, which indicates to the reader a substantive inquiry into the issue at hand.

What does it require to do an FBA (resources/time)?

Theory. The theoretical literature and interviews did not address this question.

Practice. In interviews with the study team, practitioners with other regulatory agencies indicated that taking economic assessments to the firm level is often an expensive process. Focusing on rules with a relatively small number of affected firms and using simplified modeling approaches can help keep the costs more manageable. EPA sources, who typically are conducting such analyses at the national level, indicated potential cost ranges from about $50,000 to well over a $100,000, depending on the nature of the rule and the affected industry.[90]

Post-rule Assessment

As with facility-based assessment, the following key questions regarding post-rule assessments were developed from meetings with AQMD socioeconomic assessment staff, AQMD board members and stakeholders from regulated industry. For each question, BBC has attempted to identify the theory as well as the "state of the practice."

What are the potential benefits from Post-Rule Assessments (PRA)?

In broad terms, the lessons that can be learned and their application to improving existing and future rules, socioeconomic impact assessments and the rulemaking process are the most substantial benefits from PRA.

Theory. PRA is clearly a tool for addressing a concern frequently expressed about socioeconomic analysis in the rulemaking process: whether the cost elements that are estimated during regulatory procedures contain systematic errors, and if so, what the implications are for regulatory policy. Increasingly, experts are taking on the issue by doing systematic *ex ante-ex post* cost comparisons.[91] The findings appear to be that overestimation is more common, even when agency and industry assessments are both included in the analysis.[92]

The largest of recent studies of estimates in regulatory proceedings has delineated five main reasons for differences between *ex ante* and *ex post* cost estimates: ignoring the possibility of technological progress, inaccurately predicting emissions reductions, not incorporating effects of cost-saving rule changes, publishing “worst case” numbers, and more pressure during review to correct low estimates than high.[93] The promise of identifying underlying reasons for mistakes and ways to avoid them is the key potential benefit to an agency incorporating PRA more routinely into its rulemaking process.

Practice. On the relatively rare occasions that PRA’s are conducted in practice, their focus appears to be more oriented toward answering big picture policy questions than towards refining future prospective assessments. Examples of the questions that post-rule assessments have endeavored to address typically include whether the benefits of the rule have exceeded the costs and whether or not the rules have led to business closures or declines in specific industries or diminished overall economic performance.

Given this focus, the principal benefits sought from PRA’s in practice have been to attempt to learn what the actual costs of compliance have been over the period of time since the rule was enacted and who has borne the burden of compliance,[94] and/or to attempt to isolate the impact of compliance on performance of the affected industry or broader economy.[95]

When might it be feasible and appropriate to conduct PRA?

PRA is clearly valuable for many regulations, but it requires resources that could be used to develop new rules or to monitor implementation of current rules. It is important then to assess the suitability and feasibility (both financial and operational) of PRA before embarking upon such analyses.

Theory. Experts in the field conclude that there are four types of regulations that are ideal candidates for PRA: rules believed to have had large impacts; controversial regulations; innovatively written or implemented rules; and rules for which PRA would be feasible. Generally, the greater the rule's perceived impact, the more interest it will draw from affected parties and the public to motivate assessment of actual compliance costs over time. Controversial rules similarly demand ex-post assessment in order to validate the views of one group or the other on either side of the fence of controversy. Regulators have great incentive to study in retrospect the costs and impacts of innovative rules in order to evaluate the success or failure of their innovations. Finally, rules that are easily or cheaply studied do not demand as many resources to study them after implementation.[96]

What makes a rule feasible to study retrospectively? Some researchers have described a "target of opportunity" rule—essentially focusing on rules for which data can be readily collected or compiled. If the impacted firms are already surveyed annually in the Pollution Abatement Costs and Expenditures survey, for example, then those firms may be more readily studied. Consistent reporting or data collection on the same firms over the period of the regulation assists in developing an accurate picture of compliance costs since the regulation was adopted. Finally, some have noted that if post rule assessment can be anticipated, it can be greatly facilitated by institutionalizing processes to collect data from affected firms at the outset.

Choosing a representative sample to survey or to gather secondary data for can greatly enhance the financial feasibility of post rule assessment. It is usually not feasible to study every impacted firm individually.

Practice. Relative to forward-looking impact assessments of prospective rules and regulations, PRA's are very rare. In practice, such assessments appear to most often be conducted on a broad scale—such as looking at the overall impacts of air quality regulations on an industry or region—rather than focused on specific, individual regulations.[97] This likely reflects the considerable challenges in isolating costs and impacts of environmental compliance requirements, challenges which might be even greater in attempting PRA of a specific rule or regulation.

At least three types of circumstances appear to have prompted post-rule assessments in practice:

1. General concern about the overall performance of the economy—as in CARB's examination of the impact of air quality regulations on the California economy during the early 1990s;

2. Concerns about the performance of particular sectors that may have been both heavily regulated and are showing marked decline—as in the post-rule assessment of the impacts of AQMD's rule on the furniture industry; or

3. Regulations that are simply believed to have had a relatively large cost—as in EPA's retrospective assessment of the costs of the Clean Water Act.

As noted earlier, PRA's are widely considered a good idea, but seldom actually conducted. Study team interviews with economic assessment staff at a range of regulatory agencies did not identify any agencies that internally conducted formal PRA's. We did interview a consulting firm that has performed several PRA's for EPA, but did not elicit specific responses regarding the circumstances that prompted those studies.[98]

How can accurate and reliable data be obtained on the actual, realized costs of regulation over time?

Obtaining accurate and reliable information on actual compliance costs incurred by regulated entities offers some of the same challenges found in seeking data on firms for a prospective, facility-based assessment. With the possible exception in limited circumstances of using the PACE database, the most likely options for non-market-based regulations include surveying impacted firms or mandating ongoing record keeping and reporting as part of the rule.

For market-based trading programs, costs are either indicated by the volume of market trading activity and the price of credits or they are specified in the rule. It is easier to obtain *ex post* information on rules involving market-based incentives, "which account for only a tiny fraction of total regulatory activity in the U.S. and elsewhere."[99] In a marketable emission permit system, the market-clearing permit price may be observed *ex post* and taken "with some qualifications, as the marginal cost of abatement. For an emission fee, the marginal cost—that is, the plant-level abatement cost—is specified *ex ante*, and so there is very little uncertainty about what the marginal cost will be. Thus, the *ex ante* estimate that is of most interest is the quantity of emission reductions."[100]

PRA may provide a better opportunity than prospective impact assessment for examining the changes in compliance technologies and costs over time. Identifying these changes could not only help provide a better understanding of changing impacts over time, but may also provide insight for future prospective assessments.

Theory. The theoretical literature includes a number of analyses that have focused on retrospective assessment of regulations on manufacturing industries at the national level—and thus been able to use the PACE data collected by the Census Bureau. For firms and pollution controls to which it applies, PACE likely provides the most effective and economical way to track changes in compliance technologies and associated costs for individual firms across time. PACE is the only secondary data source in which compliance costs are calculated *by abatement procedure* so that if a company changes the procedure through which it abates its pollution, those changes in technology and costs will be recorded with PACE.[101]

In a review of 25 more *ad hoc* post rule assessments, Harrington et al. do not describe how the researchers collected *ex post* costs for these analyses. The authors' only reference to methodology occurs as an allusion to a hypothetical "industry trade association ... survey to estimate the real cost of [a hypothetical] regulation."[102] However, in a personal interview, Morgenstern, one of the authors, suggested that optimally the data collection and reporting requirements for PRA would be built into the rule from the beginning. Collection procedures might include mandatory reporting, or at least appropriate record keeping requirements. Either of these may be politically difficult. Other options for accessing information include direct surveys or passing results through industry and trade association intermediaries to assure anonymity.

Morgenstern also noted that despite potential benefits in the long-run, there is little natural incentive for regulated entities to join such a process.[103] Case studies of representative, willing firms coupled with interviews with industry experts may be another, more viable alternative.

Practice. The primary approaches to identifying actual compliance costs incurred have been to either draw information from the Census Bureau's PACE database or to attempt to survey impacted firms.[104] Two of the most ambitious post-rule evaluations were conducted by EPA in their attempt to quantify the benefits and costs of the Clean Air Act and the Clean Water Act over multiple decades. In developing their retrospective assessment of the costs of the Clean Water Act, EPA was able to use PACE data to develop estimates of the net costs of pollution control measures.[105]

In estimating the direct costs of the Clean Air Act, EPA used PACE data but also relied substantially on the agency's own previous estimates of *prospective* costs for air quality regulations, contained in numerous Regulatory Impact Assessments.[106] Obviously, if prospective cost estimates are used in PRAs, such assessments do not really offer improved information on the costs of compliance at the facility level – though they may still be useful in aggregating costs and estimating actual economic impacts that have occurred in response to the regulations. In the next phase of this study, BBC may evaluate the utility and accessability of PACE data for post-rule assessment, but such an evaluation has not been conducted at this time.

Certain limitations of the PACE dataset—including its national focus, lag time in becoming available and lack of data for smaller firms and for some entire sectors—might appear to argue for the survey approach. However, before presuming that surveys are the best approach, CARB's experience in attempting to conduct such a survey in the mid-1990s should not be overlooked.

In this case, CARB was only able to obtain slightly better than a ten percent response rate from among the firms it endeavored to sample. CARB also found that many of the firms that would respond to the overall survey would not provide cost data or provided inaccurate data. Finally, CARB had concerns about the likelihood of selective response bias in their final dataset.[107]

How to identify and isolate impacts from the regulation?

Given appropriate data, changes in the conditions and performance of firms and industries as a whole can be readily measured in a post rule setting. However, the key challenge in post-rule assessment is to identify what that performance *would have been* absent the regulation being assessed. This alternative view is typically termed the baseline in economic impact analysis.

Theory —"The construction of baselines is one of the most difficult and contentious parts of regulatory cost analysis," but both *ex post* and *ex ante* cost estimates are based upon a comparison of conditions with and without the proposed rule being analyzed.[108] Baselines, as projections of a starting situation into the future, must be assumed, estimated or "modeled" because they cannot be observed.

There are a number of approaches used in the effort to estimate the baseline in post rule assessments. Perhaps the simplest approach is extrapolation of trends from the period proceeding the enactment of the regulation. Somewhat more complex approaches include efforts to factor in prevailing industry trends (from national data or from regions outside the regulated area) and/or changes in local market

conditions. An analysis of impacts on the Southern California furniture industry provides examples of the latter approach.[109] A host of studies in the economic development literature have taken this approach a step further in using regression analysis in attempts to isolate and determine the statistical significance of the impacts of programs such as enterprise and empowerment zones.[110] Similar statistical approaches are also found in the body of work exploring the impact of regulations on firm births, described elsewhere in this report.

Practice. Essentially, there are two alternative ways to estimate economic impacts in a post-rule setting. As noted above, the study of impacts on the wood furniture industry performed for AQMD provides a good example of the first approach of evaluating the performance of the affected industry relative to other, less regulated regions and/or pre-regulation conditions.[111]

The second alternative involves more complex macroeconomic modeling in an effort to derive the baseline in the absence of the regulation. This is the approach that EPA has taken in PRAs, perhaps because comparative regional performance evaluations are not really an option given the national scope of EPA regulations. The use of more elaborate modeling appears to introduce a large number of assumptions into the post-rule assessment process, which may eliminate some of the perceived benefits of this process.

How to estimate impacts on competitiveness (e.g., market share, business cycle)?

Regulators and stakeholders identified the question of how to evaluate regulations' effects on firm-level competitiveness and regional competitiveness as an important concern.

Theory. The theoretical literature focuses on productivity, firm birthing patterns and firm survival as ways in which to retrospectively evaluate changes in firms' competitive behavior and in a region's competitive advantage.

A common indicator in the theoretical literature of changes in competitiveness is estimated change in productivity. Such an analysis begins with data on firm level compliance costs. Then, controlling for compliance enforcement efforts, firm investment levels, and actual changes in the firm's pollutant emissions, modeling based on compliance cost data (from LRD or PACE) has been used to estimate those costs' effects on both total factor and labor productivity for the firm as tracked over time. Researchers have then translated those effects on productivity into an estimate of the regulation's impacts on each firm's competitive capabilities.[112]

To focus on regulations' effects on *regional* competitiveness, AQMD can study firm birthing cycles (i.e., location decisions) and firm survival rates for the LA Basin, as influenced by air quality regulations. There is some disagreement, but much of the literature suggests that, depending on the industry, more stringent environmental regulations may have a negative impact on birthing cycles and survival rates.[113] In theory, more restrictive regulations may motivate new firms to locate in regions with lower compliance costs, may reduce firm survival or may encourage new firms to locate elsewhere. If older, more polluting firms are grandfathered when new regulations are passed, they may be provided a non-market-based advantage over newer firms that face expensive compliance measures—which can harm the overall competitiveness of the regional industry.[114]

The literature further suggests that the best way in which to isolate compliance costs' impacts on regional competitiveness is by controlling for factors that may also play a role—wage levels, employment, characteristics of the capital market for investment, enforcement activity, the government's pollution abatement expenditures, taxes, factor prices, and other labor and factor market characteristics. In the theoretical literature, efforts to control for such factors include:

- Level of regulation and political support for the environment using the Green Index ranking and membership in large environmental organizations;[115]
- Enforcement activity using EPA's Compliance Data System;
- State environmental expenditures using reports from the Council of State Governments;
- Industries' share of states' total employment from the Census of Manufacturers;
- Environmental support using the League of Conservation Voters' politicians' environmental scorecard;
- Factor prices such as energy (Energy Information Administration), land (City and County Databook) and wages (Statistical Abstract);
- Labor market characteristics such as unionization, unemployment rate, income per capita, educational attainment, population density, and the number of sites available for new plants (US Census Bureau); and
- County specific characteristics, such as employment, wages, and salaries using the LRD.[116]

Practice. In their 1995 assessment of the impact of air quality regulations on business location in California, CARB examined the following potential linkages: California job growth/losses to business location decisions to the business climate and to air quality regulations. CARB was unable to draw specific quantitative conclusions from this approach, but drew the overall conclusions that:

- Relatively little of the early 1990s employment downturn in California was related to business location decisions;
- The business climate (or perceptions of the climate) did have an important effect on business location decisions; and
- Air quality regulations were a significant factor in the business climate, but were likely less significant than other factors such as workers compensation costs, state business taxes, the cost of housing and the cost of labor.[117]

Are there ways to identify intra-industry effects in a post-rule assessment?

The earlier portion of this section, describing facility-based assessment, emphasized the importance that researchers are beginning to place on micro-analysis and evaluation of varied effects *within* a given industry. Conceptually, the same considerations apply to PRA as to prospective, facility-based evaluations. Holding all else equal, it would likely be advantageous to be able to examine retrospective effects on firms within an industry, as well as on the industry as a whole.

Theory. Most retrospective evaluations of the economic effects of regulations appear to have primarily focused their analysis at the industry level. Such an approach can facilitate efforts to control for other factors by, for example, allowing comparisons between growth rates for the same industry in the region with controls versus the national average.[118]

The most common exception to the industry level focus of post-rule, or retrospective, assessment may be the series of studies that have attempted to analyze the effects of regulations on new firm births. Such studies have typically examined data on new manufacturing plants and made comparisons between more heavily regulated areas (e.g., non-attainment areas) and other locales.[119] However, studies such as Ong and Thomas' examination of the Southern California home furniture industry have sought a broader perspective on intra-industry effects by reviewing changes in the industry in terms of the size and age of firms before and after regulation.[120]

Practice. The retrospective, or post-rule, impact studies that have been conducted generally try to determine the distribution of effects within the regulated industry. This is either done by direct analysis of the cost burden (using PACE data or survey data), or by analysis that seeks to reveal the impact based on post-rule comparison of industry structure (e.g., the number of firms by size) with the industry structure prior to the rule. CARB's effort to examine the impact of air quality regulations on the overall economy in the early 1990s did document, through review of business climate surveys, that smaller firms exhibit greater concerns about air quality regulations than larger businesses, suggesting that intra-industry effects are an important consideration for future post-rule assessments.[121]

How should we compare a PRA to a corresponding prospective impact analysis?

An *ad hoc* PRA may succeed in only approximate estimates of actual outcomes to compare to prospective predictions about a rule's effects. More rigorous PRA, and stronger comparison to prospective projections, may be obtained if there is advance preparation for post rule data collection or an institutionalized process to integrate the District's *ex ante* assessments and *ex post* evaluations.

Theory. In the implementation of a rule, "actual outcomes can deviate from predicted ones in so many ways that it is not easy to know what is comparable."[122] Harrington et al. identify a range of key values to estimate: number of plants, emissions before implementation, emissions after implementation, cost per plant, and emissions reductions. The aggregate total cost of the rule and the cost per unit of emissions reduction are derived from these values.[123]

The direct capital and operating costs of compliance are always estimated in major regulatory impact analyses. A few other cost categories, like legal or other transactional costs, waiting time, changes in maintenance requirements of other equipment, worker health or impacts to other natural resources, are sometimes addressed. Unemployment and plant closure costs are also occasionally addressed.[124]

Practice. Since comprehensive PRA's are so infrequently performed by state and regional regulatory agencies, there are very few examples in practice of comparisons between post-rule and prospective impact evaluations. Consultants who have performed post-rule evaluations for EPA indicated that they found that actual impacts most often were less than prospective estimates developed by the regulated industries themselves. In some cases the impacts were more than the prospective estimates developed by regulators, in some cases less.[125]

How to present the results in a useful fashion?

Post-rule assessment has occurred less often, so there are fewer choices of exemplary presentation in the practical literature. As noted above in the corresponding section for facility-based assessment, theoretical studies suggest a variety of approaches and styles that apply to the presentation of post-rule assessment. EPA's economic analysis guidance document provides a number of pointers regarding communication and presentation, but most of these are commonly accepted guidelines for clear business communication. Perhaps more useful are two suggestions that emerged from the study team's interviews with staff at a range of regulatory agencies.

- Separate technical reports, which provide the detail, from policy-level summaries, which should effectively stand alone and be clearly tailored to information the audience needs to know.

- Especially in technical reports, adopt a standard format and outline for the presentation, though not necessarily common language.

Key Findings of the Literature and Methodology Review

BBC's review of the literature and interviews with experts on the application of socioeconomic assessment within the regulatory process has focused on two topics of concern to AQMD, facility-based assessment and post-rule assessment. In the preceding sections, we addressed current theory and the state of the practice surrounding in each of these topics, organizing the information and our interpretations in the form of a series of questions and responses.

Based on the interviews and documents reviewed during this task, is clear that careful consideration of benefits and costs is warranted before AQMD adopts facility-based assessment or post-rule assessment as an integral part of the socioeconomic assessment protocol. In large part, this is because neither enquiry has been formalized as a fixed set of procedures relying on a single, ideal data source. Although a systematic outline can provide a specific scope and content for facility-based and post-rule assessments, it is likely that AQMD would have to rely on a combination of secondary data sources and primary data that will vary depending on the nature and circumstances surrounding each proposed rule.

AQMD—having incorporated facility-based analysis in recent socioeconomic assessments and undertaken post-rule assessment for the RECLAIM program, among other rules—is already far ahead of most other state and regional regulatory agencies. In fact, other agencies contacted during the study are nearly unanimous in their view of AQMD as a leader in the field.

Still, where other agencies have used differing approaches, the experience of AQMD's peers at the state and national level can offer additional insights. Among state agencies, the California Air Resources board offers prior experience that is directly relevant to AQMD. At the national level, the theoretical and applied studies undertaken by the U.S. Environmental Protection Agency in the field of air quality regulation contain many references to useful data, standards and methods.

The key benefits sought by most in facility-based assessment are to measure impacts to small business as directly as possible, impacts like affordability that may affect firm creation, mortality and migration, and impacts to the performance of major facilities that may affect decisions on expansion or closure. There is also broad agreement in principle that facility-based assessment, perhaps because it tends to rely on interaction with firms to collect information, can enhance stakeholder involvement in the regulatory process.

Both the literature and personal interviews indicated that there is growing interest in facility-based assessment among economists at academic institutions, at policy centers, and within the more theoretically oriented branches of regulatory agencies. In particular, the mandate of the Regulatory Flexibility Act, as amended, to assess impacts to small business has helped stimulate a body of new theoretical and practical work on facility-based data and methods.

In contrast, post-rule assessment is relatively rare, is almost never conducted "in-house" by regulatory agencies, and seems to be most frequently undertaken by academicians and public policy centers. (Here again AQMD stands out as being in the lead, and the RECLAIM and other retrospective studies by AQMD are principal exceptions to the rule.) The relative scarcity of post-rule assessments may be attributable to several factors. Post-rule assessment actually comprises two different types of study that focus on two distinct objectives: the determination of the actual cost of compliance versus the estimation of direct impacts to the industry or the firm. By choosing to study one or the other of these objectives, the agency commits to a different set of data and analytical requirements and perhaps a different level of effort. Finally, among regulatory agencies, post-rule assessment consumes resources that an agency could otherwise apply to forward-looking assessments of *upcoming* policy decisions.

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[1] See Jensen and McGuckin, October 1996, page 1-4.
[2] See Jensen and McGuckin, October 1996, page 6 and Dunne and Roberts, June 1992, page 2 and 25.
[3] See Jensen and McGuckin, October 1996, page 4.
[4] GAO Methods, page 24.
[5] *OAQPS Economic Analysis Resource Document*, USEPA Innovative Strategies and Economics Group, April 1999, page 2-9.
[6] Interviews with Arlene Schmidt (NY Department of Environmental Conservation); Laura Yannayon (San Diego APCD); Anastacia Nutt (Colorado Department of Health and Environment); Tyler Fox, Bryan Hubbell and Larry Sorrels (EPA); Bill Guy (Bay Area AQMD); and Rich Adams (Oregon State University).
[7] See Jensen and McGuckin, page 4.
[8] For examples, see Jensen and McGuckin, List and McHone, 2000, Maksimovic and Phillips, 1996, Winter, 1999 and Dunne and Roberts, 1992.
[9] See, for example, USEPA - ISEG, April 1999, page 2-10.
[10] Interviews with Bryan Murray (Research Triangle Institute); Arlene Schmidt (NY Department of Environmental Conservation); Laura Yannayon (San Diego APCD); Anastacia Nutt (Colorado Department of Health and Environment); Tyler Fox and Larry Sorrels (EPA); and Rich Adams (Oregon State University).
[11] Morgenstern, et al./RFF. *On the Accuracy of Regulatory Cost Estimates.* 1999. Pages 11 and 14.
[12] EPA. *EPA Guidelines for Implementing the Regulatory Flexibility Act.* 1992. Page 7.
[13] USEPA-ISEG, Table 4-1.
[14] USEPA-ISEG. *OAQPS Economic Analysis Resource Document.* 1999. Section 3.2.1.
[15] EPA. *EPA Guidelines for Implementing the Regulatory Flexibility Act.* 1992. Appendix E, page 1.
[16] http://es.epa.gov/oeca/sector/index.html
[17] USEPA - ISEG, April 1999, page 4-7 through 4-9.
[18] USEPA-ISEG. *OAQPS Economic Analysis Resource Document.* 1999. Section 4.3.

[19] See, for example, *Initial Statement of Reasons for Proposed Amendments to the California Consumer Products Regulation*. California Air Resources Board, September 10, 1999 and *Proposed Amendments to the California On-road Motorcycle Rgulation*, California Air Resources Board, October 1998.
[20] Interviews with Bryan Murray (Research Triangle Institute); Arlene Schmidt (NY Department of Environmental Conservation); Laura Yannayon (San Diego APCD); Anastacia Nutt (Colorado Department of Health and Environment); and Tyler Fox and Larry Sorrels (EPA).
[21] South Coast. *Socioeconomic Report for LAER/BACT for Spray Booths.* 1998. Ex-1, page 3.
[22] South Coast. *Final Socioeconomic Impact Assessment, Proposed Amended Rule 1401 (toxics)*. 1998. Page 20.
[23] USEPA-ISEG. *OAQPS Economic Analysis Resource Document.* 1999.
[24] South Coast. *Socioeconomic Report for LAER/BACT for Spray Booths.* 1998. Page 4.
[25] USEPA-ISEG. *OAQPS Economic Analysis Resource Document.* 1999.
[26] Resources for the Future. *On the Accuracy of Regulatory Cost Estimates.* 1999.
[27] See *Proposed Regulations for California Phase 2 Reformulated Gasoline, Technical Support Document*. California Air Resources Board, October 4, 1991 and *Staff Report for the Proposed Suggested Control Measure for Architectural Coatings*. California Air Resources Board, June 2000.
[28] See, for example, Economic Analysis of Air Pollution Regulations: Portland Cement – Final Report USEPA - ISEG, March 1999, Section 3.
[29] For an example of the simplified approach, see *Estimates of the Probable Costs and Benefits of the Amendments to the Model Toxics Control Act Cleanup Regulation Chapter 173-340 WAC*. Washington State Department of Ecology Toxics Cleanup Program, February 12, 2001.
[30] For another example of a survey of firms, please see GAO 1996 (Regulatory Burden).
[31] USEPA - ISEG, April 1999, page 4-6 through 4-19.
[32] USEPA - ISEG, April 1999, page 2-12.
[33] McGuckin and Pascoe, 1988.
[34] Headd, 1992, p1.
[35] Troske, 1995.
[36] Robb, 1999.
[37] Streitwieser, 1995.
[38] Interviews with Laura Yannayon (San Diego APCD); Anastacia Nutt (Colorado Department of Health and Environment); Tyler Fox and Larry Sorrels (EPA) and Bill Guy (Bay Area AQMD).
[39] USEPA - ISEG, March 1999, Section 2.
[40] See, for example, *Initial Statement of Reasons for Proposed Amendments to the California Consumer Products Regulation*. California Air Resources Board, September 10, 1999 and *Proposed Amendments to the California On-road Motorcycle Rgulation*, California Air Resources Board, October 1998.
[41] See Singhvi, June 1996, page 75.
[42] See Maksimovic and Phillips, 1996, pages 29 and 30 and Winter, 1999, page 19.
[43] USEPA - ISEG, April 1999, page 5-44.
[44] USEPA - ISEG, April 1999, page 6-6.
[45] Information provided by Anne Wittenberg, ICF Consulting, 2001.
[46] For example, see Goodstein, 1999, page 48.
[47] USEPA - ISEG, March 1999, Section 4.
[48] CARB, 1991, page 6-22.
[49] *Initial Statement of Reasons for Proposed Amendments to the California Consumer Products Regulation*. California Air Resources Board, September 10, 1999.
[50] *Initial Statement of Reasons for Proposed Amendments to the California Consumer Products Regulation*. California Air Resources Board, September 10, 1999, Volume II, Chapter VIII, page 201.
[51] Interviews with Arlene Schmidt (NY Department of Environmental Conservation); Anastacia Nutt (Colorado Department of Health and Environment); and Tyler Fox and Larry Sorrels (EPA).
[52] See Jensen and McGuckin, 1996, page 6.
[53] See Jensen and McGuckin, 1996.
[54] See Burtraw, Krupnick and Mansur, 1997.
[55] USEPA - ISEG, April 1999, page 5-44.
[56] See arguments in Maksimovic, 1996 regarding bankruptcy and disposal of assets.
[57] See Ong and Thomas, 1998, page 9.
[58] USEPA - ISEG, March 1999, Section 4-27 through 4-29.
[59] Interview with Tyler Fox (EPA).

[60] See GAO 1996 (Regulatory Burden) page 102.
[61] See Gray and Shadbegian 1993 and Gray and Shadbegian 1994 for models and further explanations.
[62] *Development of a Methodology to Assess the Economic Impact Required by SB513/AB969 - Final Report.* Peter Berck, Department of Agricultural and Resource Economics, University of California, August 1995.
[63] See Gray 1997, Becker 1999, and Becker and Henderson 2000 for models and more information.
[64] Berck, 1995, page 1.
[65] CARB, 1991, page 6-14 and 6-15.
[66] Interview with Brian Murray, Research Triangle Institute.
[67] Jensen and McGuckin, 1996.
[68] For examples, see Dunne and Roberts, 1992, Winter, 1999 and Maksimovic and Phillips, 1996.
[69] Ong and Thomas, 1998.
[70] (Cite to AQMD studies of impacts on spray booths, for example)
[71] USEPA - ISEG, March 1999.
[72] See, for example, *Proposed Amendments Pertaining to Hairspray In the California Consumer Products Regulation*. Stationary Source Division, Air Resources Board, February 1997 and *Initial Statement of Reasons for Proposed Amendments to the California Consumer Products Regulation*. California Air Resources Board, September 10, 1999.
[73] Interviews with Laura Yannayon (San Diego APCD); Larry Sorrels (EPA); and Rich Adams (Oregon State University).
[74] USEPA, EPA Guidelines for Implementing the Regulatory Flexibility Act, prepared by Office of Regulatory Management and Evaluation, Office of Policy Planning, and Evaluation (revised April 1992), p. 1, App. E-1; Wittenberg, Anne, and Frank Arnold, ICF Consulting, Review of Small Entity Economic Impact Analyses, prepared for Office of Policy, USEPA (February 2000); OMB, Economic Analysis of Federal Regulations Under Executive Order 12866 (1996).
[75] Section 601(3)
[76] U.S. Small Business Administration, Office of Advocacy, The Regulatory Flexibility Act: An Implementation Guide for Federal Agencies (1998), p.18-19
[77] Section 607; U.S. Small Business Administration, Office of Advocacy, The Regulatory Flexibility Act: An Implementation Guide for Federal Agencies (1998), p.29
[78] U.S. Small Business Administration, Office of Advocacy, The Regulatory Flexibility Act: An Implementation Guide for Federal Agencies (1998), p.26-27, 29
[79] U.S. Small Business Administration, Office of Advocacy, The Regulatory Flexibility Act: An Implementation Guide for Federal Agencies (1998), p.30
[80] *www.sba.gov/ADVO/stats*
[81] *www.sba.gov/ADVO/research*
[82] USEPA, Office of Regulatory Management and Evaluation, EPA Guidelines for Implementing the Regulatory Flexibility Act, App. E-3.
[83] National marine Fisheries Service, Office of Sustainable Fisheries, Guidelines for Economic Analysis of Fishery Management Actions (2000), p. 29-30.
[84] Wittenberg, Anne, and Frank Arnold, ICF Consulting, Review of Small Entity Economic Impact Analyses, prepared for Office of Policy, USEPA (February 2000), p.6
[85] ICF/EPA. *Review of Small Entity Economic Impact Analyses.* 2000. Page 3.
[86] See USEPA - ISEG, March 1999, Section 4-34 through 4-37 for one example.
[87] USEPA, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, OAQPS Economic Analysis Resource Document (April 1999), sec. 9.1. Published on the Web at www.epa.gov/ttn/ecas/econdata/Rmanual2/manual_m.htm.
[88] USEPA, Office of Air Quality Planning and Standards, Innovative Strategies and Economics Group, OAQPS Economic Analysis Resource Document (April 1999), sec. 9.2. Published on the Web at www.epa.gov/ttn/ecas/econdata/Rmanual2/manual_m.htm.
[89] Interviews with Anastacia Nutt (Colorado Department of Health and Environment); Tyler Fox (EPA); and Rich Adams (Oregon State University).).
[90] Interviews with Tyler Fox and Larry Sorrels (EPA); Laura Yannayon (San Diego APCD); Anastacia Nutt (Colorado Department of Health and Environment); and Rich Adams (Oregon State University).
[91] See Harrington, Winston, Richard D. Morgenstern, and Peter Nelson, On the Accuracy of Regulatory Cost Estimates, Resources for the Future Discussion Paper 99-18 (January 1999), p. 23; p. 7, for a literature review.

[92] Goodstein, Eban, and Hart Hodges, "Polluted Data," *The American Prospect*, no. 35 (November-December, 1997), pp. 64-69, cited in Harrington, Winston, Richard D. Morgenstern, and Peter Nelson, On the Accuracy of Regulatory Cost Estimates, Resources for the Future Discussion Paper 99-18 (January 1999), p. 7

[93] Harrington, Winston, Richard D. Morgenstern, and Peter Nelson, On the Accuracy of Regulatory Cost Estimates, Resources for the Future Discussion Paper 99-18 (January 1999), p. 22

[94] See *A Retrospective Assessment of the Costs of the Clean Water Act: 1972 to 1997*. U.S. Environmental Protection Agency, Office of Water, October 2000.

[95] See *Significance of California Air Pollution Control Regulations for Business Location Decisions*, California Air Resources Board, May 1995 and *Southern California's Home Furniture Industry and Air Pollution Regulations*. Paul Ong and Ward Thomas, August 10, 1998.

[96] See interview with Morganstern.

[97] See, for example, *Significance of California Air Pollution Control Regulations for Business Location Decisions*, California Air Resources Board, May 1995 and *A Retrospective Assessment of the Costs of the Clean Water Act: 1972 to 1997*. U.S. Environmental Protection Agency, Office of Water, October 2000.

[98] Interview with Bob Unsworth, Industrial Economics.

[99] Harrington, Morgenstern, and Nelson, p. 15-16.

[100] Harrington, Morgenstern, and Nelson, p. 12.

[101] Streitwieser, Mary L. *Evaluation and Use of the Pollution Abatement Costs and Expenditures Survey Micro Data.* CES 96-1. November 1995.

[102] Harrington, Winston, Richard D. Morgenstern, and Peter Nelson, On the Accuracy of Regulatory Cost Estimates, Resources for the Future Discussion Paper 99-18 (January 1999), p. 14

[103] Personal communication with Richard Morgenstern, Senior Fellow, Resources for the Future, February 2, 2001.

[104] PACE data was used CARB's assessment of the significance of California Air Pollution Control Regulations on business location decisions and state economic performance, in EPA's retrospective assessment of the costs of the Clean Water Act and in a number of assessments that have looked at the costs of the Clean Air Act – especially for electric utilities. Some of the latter are discussed in Goodstein, 1999.

[105] See EPA, October 2000, pages 4.3 and 5-7.

[106] EPA. *The Benefits and Costs of the Clean Air Act, 1970 to 1990*. October, 1997.

[107] *Significance of California Air Pollution Control Regulations for Business Location Decisions*, California Air Resources Board, May 1995.

[108] Harrington, Winston, Richard D. Morgenstern, and Peter Nelson, On the Accuracy of Regulatory Cost Estimates, Resources for the Future Discussion Paper 99-18 (January 1999), p. 7

[109] For Southern California furniture industry example, see Ong and Thomas, 1989.

[110] See the body of work by Dr. Leslie Papke in this vein.

[111]

[112] See Gray and Shadbegian 1993 and Gray and Shadbegian 1994 for models and further explanations.

[113] Becker and Henderson 1999 and 2000, Gray 1997.

[114] Becker and Henderson 1999 and 2000.

[115] See Hall and Kerr, 1991.

[116] See Gray 1997, Becker 1999, and Becker and Henderson 1999 and 2000 for models and more information.

[117] *Significance of California Air Pollution Control Regulations for Business Location Decisions*, California Air Resources Board, May 1995.

[118] See Ong and Thomas, 1998, pages 11 and 12, for example.

[119] See Becker and Henderson, 1997 (cited in Goodstein). and List and McHone, 1999.

[120] See Ong and Thomas, pages 7-9.

[121] See *Significance of California Air Pollution Control Regulations for Business Location Decisions*, California Air Resources Board, May 1995.

[122] Harrington, Winston, Richard D. Morgenstern, and Peter Nelson, On the Accuracy of Regulatory Cost Estimates, Resources for the Future Discussion Paper 99-18 (January 1999), p. 14

[123] Harrington, Winston, Richard D. Morgenstern, and Peter Nelson, On the Accuracy of Regulatory Cost Estimates, Resources for the Future Discussion Paper 99-18 (January 1999), p. 11

[124] Harrington, Winston, Richard D. Morgenstern, and Peter Nelson, On the Accuracy of Regulatory Cost Estimates, Resources for the Future Discussion Paper 99-18 (January 1999), p. 9

[125] Interview with Bob Unsworth, Industrial Economics, March 2001.

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