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Measuring Environmental Compliance Assistance Outcomes: A Benefit Cost Analysis of the Kentucky Business Environmental Assistance Program

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

The 1990 Clean Air Act Amendments (CAAA) established, in section 507, the Small Business Stationary Source Technical and Environmental Compliance Assistance Program (SBTCP). SBTCPs under the CAAA are designed to provide small stationary air pollution sources with technical and compliance assistance, develop tools and disseminate information, communicate requirements under the Act, and assist small businesses with pollution prevention.

In Kentucky, the compliance and technical assistance program is known as the Kentucky Business Environmental Assistance Program (KBEAP). Since the program's inception, measures of performance have primarily focused on outputs. With the establishment of Goal 5 of the 2003-2008 Environmental Protection Agency Strategic Plan, the focus on a federal level has shifted to measuring compliance assistance outcomes rather than outputs. To date, no programmatic outcome evaluation of a SBTCP has been conducted. Nationally, measuring outcomes of a SBTCP is an even greater concern because currently there is no mechanism in place whereby to measure programmatic

A summative evaluation of KBEAP using Benefit-Cost Analysis establishes a standardized set of outcomes in terms of their dollar costs and benefits from fiscal year 1995-2004 as well as provides insights and recommendations for further study and programmatic improvements.

From the model, KBEAP exhibits positive net benefits as well as benefit to cost ratios greater than one. In fact, B/C ratios on average approximate 3:1 with net-benefits on average approximating $3,000,000 per fiscal year. The model does exhibit considerably more sensitivity to variations in variable assumption than discount rates and is limited from the standpoint that serious data gaps are observed and is only externally valid to those programs programmatically similar to KBEAP.

In conclusion, compliance assistance programs such as KBEAP have the opportunity to provide significant benefits to small businesses but the effort required to track these outcomes is still in its infancy both on a national and state level. It is hoped that this analysis will provide the impetus for other programs to explore outcome evaluation as well as lead to a national initiative to better understand the outcomes relating to environmental compliance assistance program and small businesses.

INTRODUCTION

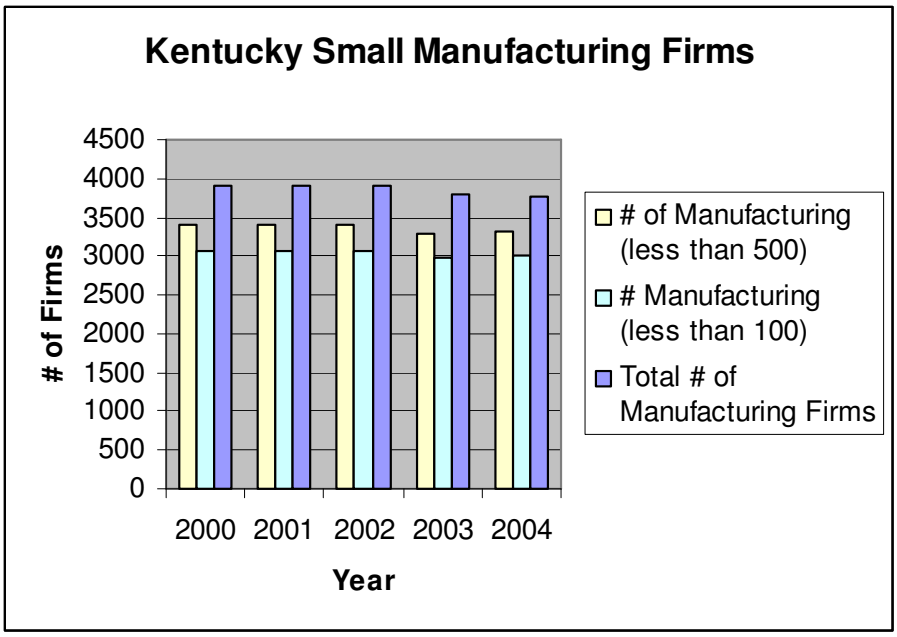
The State of Small Business

In 2000, federal regulations cost an estimated $843 billion with small businesses bearing a disproportionately large share of the burden. With Kentucky small businesses comprising 97% of all businesses in the state (SBA Profiles, 2004), the potential impact of regulatory burdens on the economy is significant. In fact, environmental regulations on a cost per employee basis are $1,213 and disproportionately higher ($3,328) for firms with less than 20 employees (Crain, p.3). Also, the manufacturing sector bears the highest total regulatory burden compared to other sectors with environmental regulations accounting for approximately 50-65% of the total costs per firm (Crain, Table 9A and B). With statistics like these, it is not surprising that traditional "command and control" enforcement techniques have yielded to more proactive mechanisms such as compliance assistance programs and market based incentives, but how do these new programs influence business operations and compliance rates from a cost benefit perspective? To answer this question, it is important to first understand the profile of Kentucky's manufacturing sector as well as that of an environmental compliance assistance program.

Kentucky's small manufacturing sector has remained relatively stable since 2000, according to profiles from the Small Business Administration's Office of Advocacy. This is illustrated in Figure 1. From the data, approximately 4-5% of

total businesses are manufacturing. Ninety percent (90%) of manufacturers with less than 500 employees employ less than 100 employees which exemplifies the importance of small businesses within the manufacturing sector.

Figure 1: Source: SBA Profiles



As far as the make up of Kentucky's small manufacturing sector (<100 employees), there are approximately 5 dominant sectors: Lumber Products, Printing and Publishing, Fabricated Metal Products, Industrial and Commercial Machinery & Computers, and Miscellaneous Manufacturing. Figure 2 gives the breakdown by Standard Industrial Classification Code. This is in comparison to Figure 3 which gives the breakdown of the entire manufacturing sector in Kentucky. Similarities of major industrial sectors exist in both figures.

Figure 2: Source: Kentucky Cabinet for Economic Development (www.thinkkentucky.com)

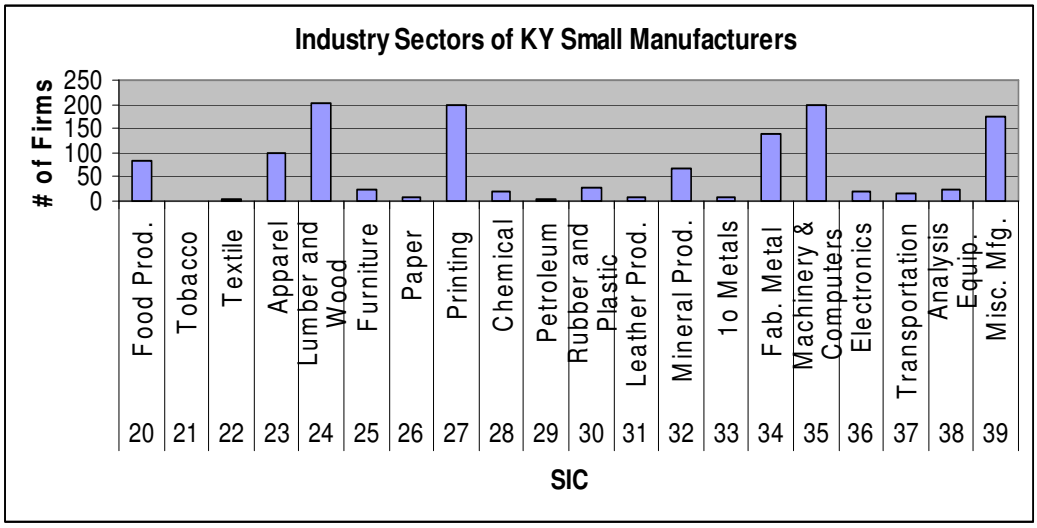
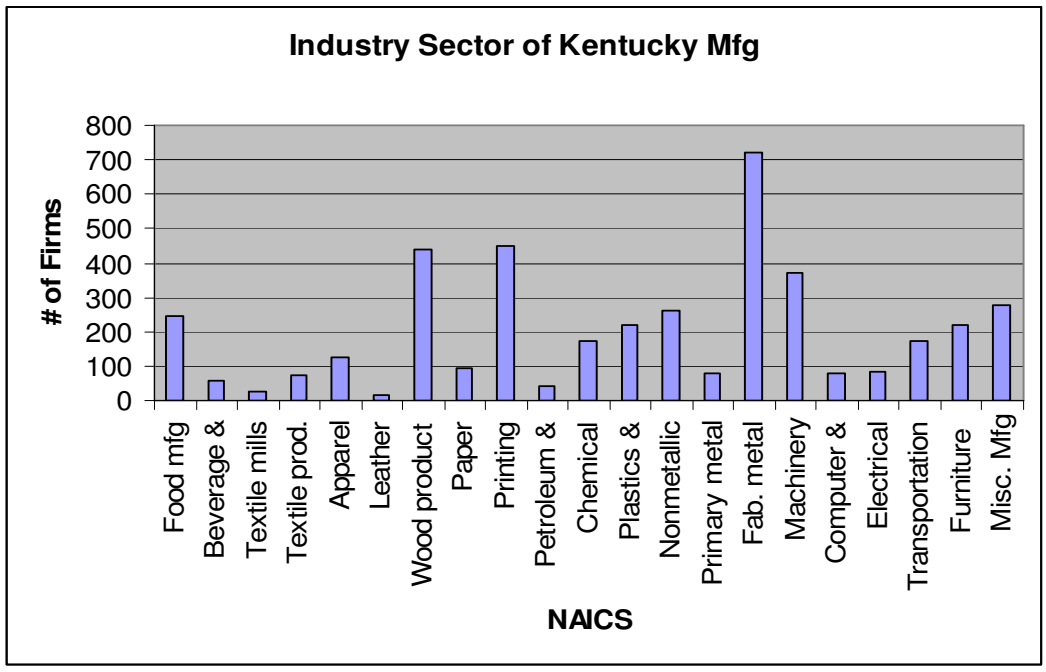


Figure 3: Source: Harris InfoSource (www.harrisinfosource.com)



Even though Kentucky's manufacturing sector comprises only a small percentage of total employer firms, the value added to Kentucky economy by this sector is estimated to be $38,377,622,000 according to the Kentucky Economic Development Cabinet (1997). In all, the manufacturing sector provides 288,405 Kentucky jobs. Accordingly, this translates to approximately twenty-seven percent (27%) of Kentucky's Gross Domestic Product.

Small Business Environmental Assistance

Given the impact of environmental regulations on small manufacturing firms and the composition of Kentucky manufacturing sector, Congress in 1990 had the foresight to understand that small businesses may not be equipped to comply with the requirements of the new Clean Air Act Amendments (CAAA). Section 507, established the Small Business Stationary Source Technical and Environmental Compliance Assistance Programs (SBTCP) (CAAA, Section 507). These SBTCP were mandated to contain three key components, located in various entities within each state.

Key Components:

- Small Business Ombudsman
- Compliance Assistance Program
- Compliance Advisory Panel
    - Two members selected by the Governor
    - Two members selected by the State Legislature
    - One member selected to represent the State Air Pollution Agency or equivalent

Location of Programs:

- Economic Development Agencies
- Commerce Departments

- Small Business Development Centers
- Universities
- Regulatory Agencies

Section 507 programs under the CAAA are designed to provide stationary sources with technical and compliance assistance, develop tools and disseminate information, communicate requirements under the Act, and assist small businesses with pollution prevention. To be eligible for the services of a section 507 program, a small business must meet certain eligibility criteria.

Eligibility Criteria:

- ✓ Employs fewer than 100 individuals
- ✓ Is a small business concern as defined in the Small Business Act
- ✓ Is not a major source
- ✓ Does not emit 50 tons or more per year of any regulated pollutant
- ✓ Emits less than 75 tons per year of all regulated pollutants.

Section 507 programs are funded primarily through Title V emission fees and most services are free to small businesses. In fact, states may reduce any fee required by the Act to take into account the financial resources of small business stationary sources.

Nationally, the state 507 programs coordinate with Environmental Protection Agency's Small Business Ombudsman to submit the SBTCP annual reports to Congress. Nationally, 507 programs on average have a budget of $145,000 with approximately 2.5 employees. The latest of these reports indicate that nationally, over 850,000 businesses have been assisted through various compliance

assistance media including: seminars/workshops, publications, on-site visits, web page development, and hotline calls (SBAP, 2000).

In Kentucky, the compliance assistance arm of the 507 Program or SBTCP is known as the Kentucky Business Environmental Assistance Program (KBEAP) and is housed with the Kentucky Small Business Development Center in the Gatton College of Business and Economics at the University of Kentucky. KBEAP has been in operation since 1994 and has operated under a Memorandum of Understanding with the Kentucky Division for Air Quality.

Since KBEAP's inception, the program has assisted over 500 small businesses in various manufacturing sectors as illustrated by Figures 4 and 5.

Figure 4 (Source: KBEAP Database)

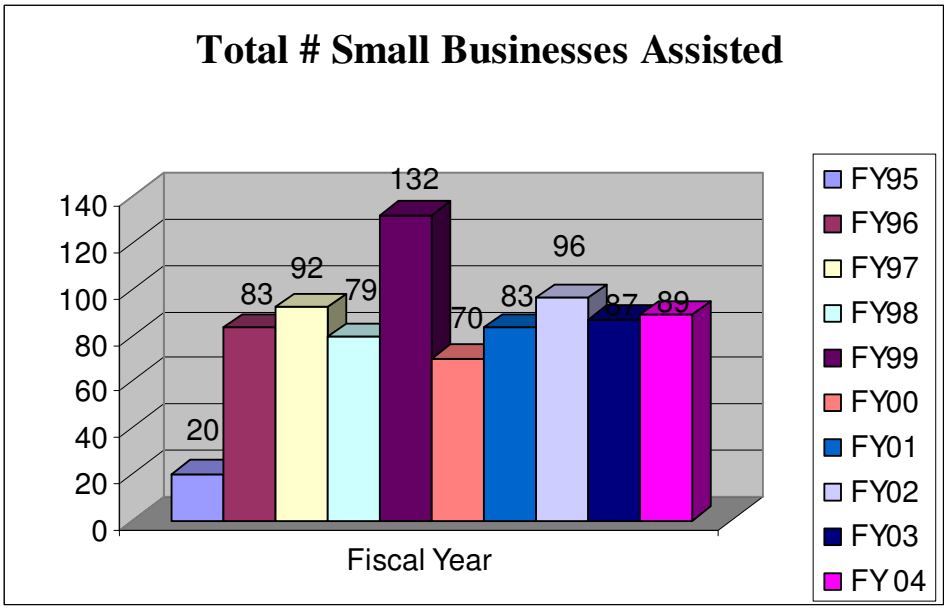
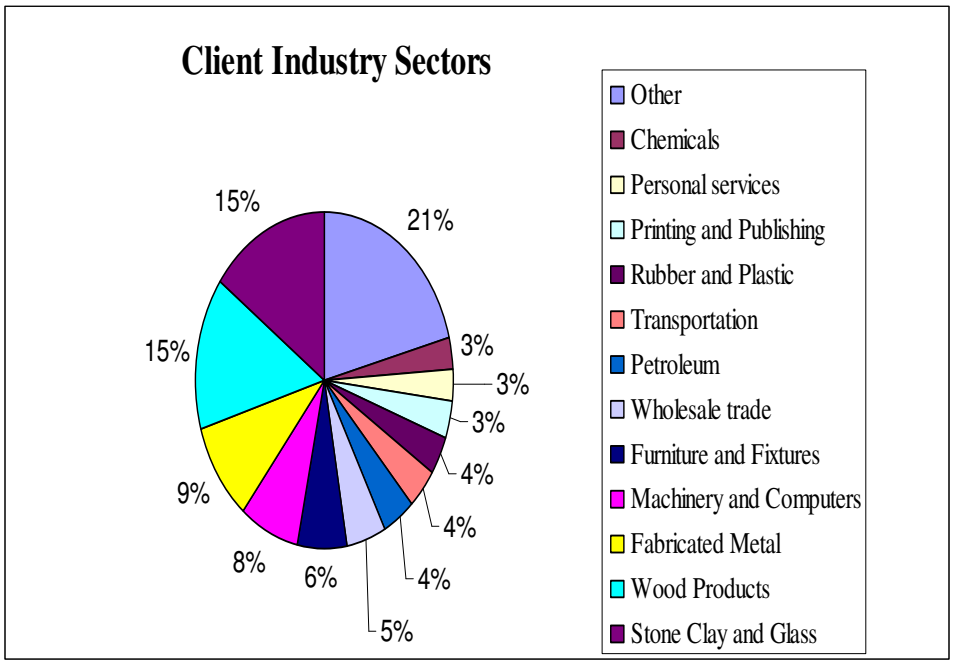
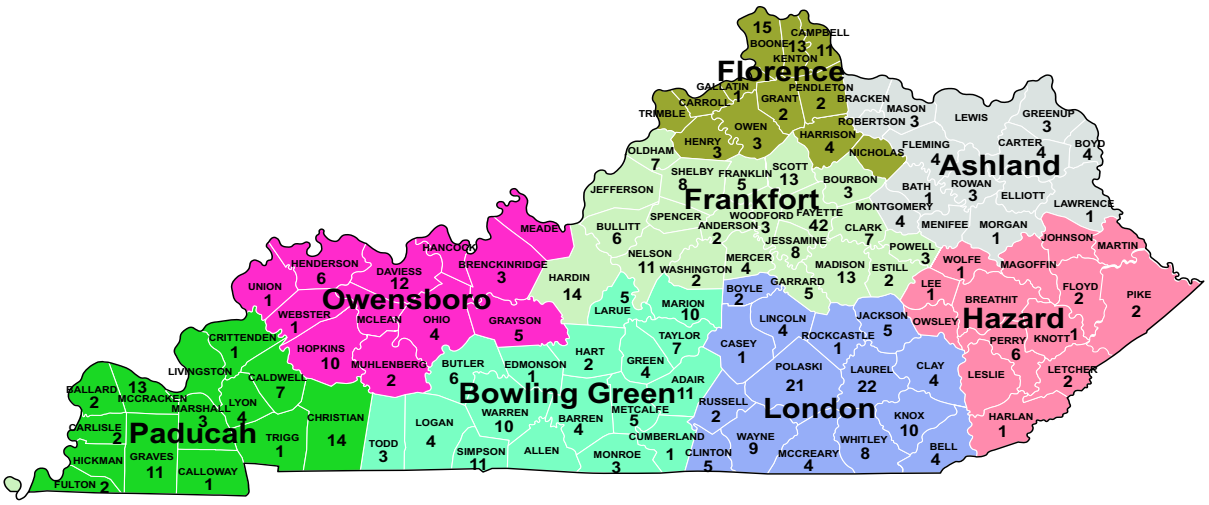


Figure 5 (Source: KBEAP Database)



Industry sectors served by KBEAP parallel the demographics of KY manufacturers outlined in figures 2 and 3. The average employment of a KBEAP client is 28 employees with a statewide distribution across most of the 120 counties as seen in Figure 6. KBEAP does not serve Jefferson county due to it's designation as an air quality management district separate from the rest of the state of Kentucky. KBEAP clients are primarily (45%) referred by Kentucky Division for Air Quality inspectors with the remaining referrals coming from various partner groups as well as small businesses themselves (KBEAP Database).

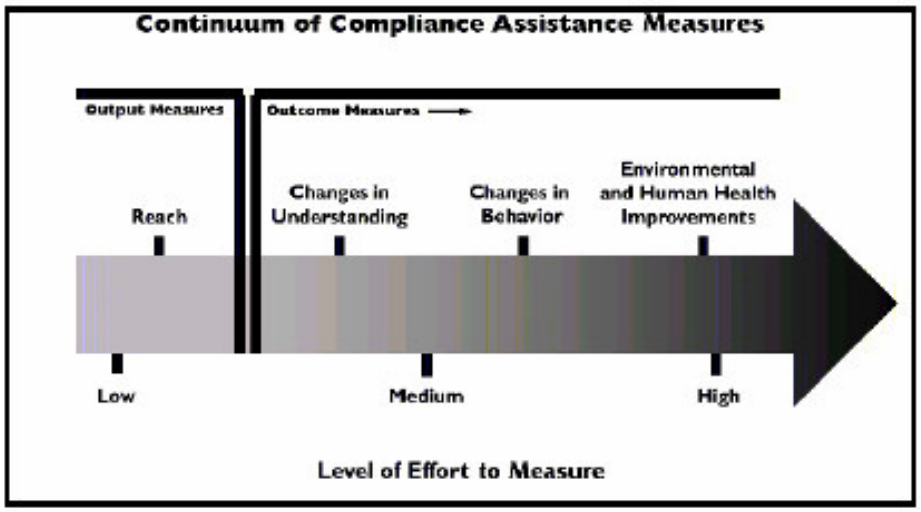
Figure 6: KBEAP Clients By County and DAQ Region
(KBEAP Database,Feb. 2004)



STATEMENT OF PROBLEM

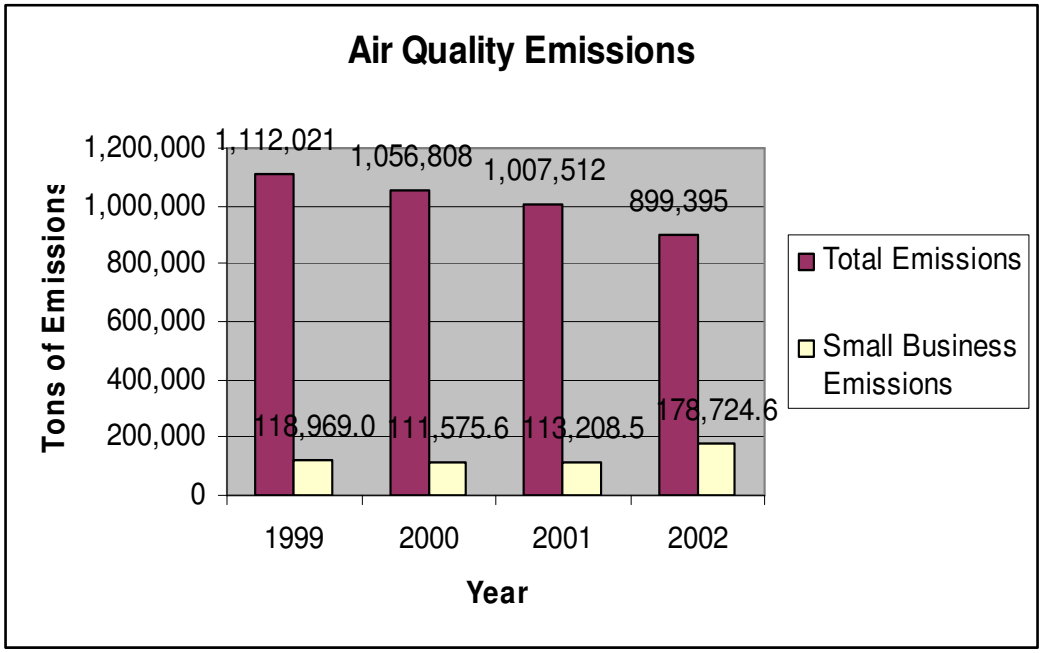
To date, KBEAP has focused on reporting outputs of the program; however, with the development of Goal 5 of the Environmental Protection Agency's 2003-2008 Strategic Plan, KBEAP's focus has shifted to outcomes rather than outputs as seen in Figure 7 (OECA, 2002).

Figure 7: Outcomes versus Outputs (OECA)



With 77% of air quality permitted sources being small businesses and 87% of Division for Air Quality minor source registrations being small businesses, it is not surprising that outcomes of compliance assistance activities are becoming a primary focus. However, small business from 1999-2002 accounted for <20% of the total air quality emissions (Figure 8).

Figure 8 (Source: KY Division for Air Quality)



In summary, Kentucky small businesses comprise the largest regulatory category but have the least impact on air quality emissions. Measuring outcomes of environmental compliance assistance programs, such as KBEAP, is essential to understanding compliance assistance programs impact on Kentucky small businesses and the small business impact on Kentucky's environment. Nationally, measuring outcomes of a SBTCP is an even greater concern because currently there is no mechanism in place whereby to measure programmatic environmental compliance assistance outcomes.

Therefore, a summative evaluation using benefit cost analysis is proposed to establish standardized outcome measures in terms of the dollar value costs and benefits. The purpose is to determine if the:

1) Net benefits of environmental compliance assistance program, such as KBEAP, will be positive
2) Benefit to cost ratio will be greater than 1:1.
3) Benefit Cost Model will identify areas of concern and lead to internal as well as external recommendations for programmatic improvements.

LITERATURE REVIEW

Outcome Measurement

The primary source of information regarding measurement of environmental compliance assistance program is from the Office of Enforcement and Compliance Assurance (OECA) which outlines survey methods and measures to use for measuring compliance assistance outcomes. The *Guide for Measuring Compliance Assistance Outcomes* outlines how program move from measuring outputs to outcomes using survey methodology. The guide does not speak to benefit cost analysis of compliance assistance program but does help frame the outcome measures.

The National Center for Environmental Innovation (NCEI) is comprised of an Evaluation of Environmental Programs (http://www.epa.gov/evaluate/) program that uses the Logic Model approach in its evaluation of environmental programs. More specifically, “This web site is designed as a web-based "gateway", linking to environmental program evaluation information within EPA and information resources beyond the Agency. It examines how EPA is using evaluation to reinforce and enhance many of the performance activities required under the Government Performance and Results Act (GPRA).” (NCEI, 2005)

The Compliance Assistance Advisory Committee (CAAC) of the National Advisory Council for Environmental Policy and Technology reviews EPA’s

compliance assistance programs and makes recommendation for improvement. One of the key recommendations from the CAAC to EPA relates to the measurement of the effectiveness of compliance assistance and enforcement at EPA. CAAC encourages the development of an effective way to track and report compliance trends and rates nationally.

Environmental Benefit Cost Analysis

While there has been much written about cost benefit analysis relating to the environment, one of the most accessible and interactive resources for using cost benefit for environmental decision-making comes from the Nation Center for Environmental Decision-Making Research (http://www.ncedr.org/tools/othertools/costbenefit/overview.htm). The interactive web site presents seven modules whereby the practitioner can learn the basic principles of cost benefit analysis and how they are applied to environmental decision-making.

Also of interest is the National Center for Environmental Economics (http://yosemite1.epa.gov/ee/epa/eed.nsf/Webpages/AboutNCEE.html) which provides benefit-cost research and techniques, economic impact models and measures, as well as economic incentive mechanisms.

Finally, Richard D. Morgenstern's *Economics Analysis at EPA: Assessing Regulatory Impact* provides a review of 12 case studies of regulatory impact

assessments prepared by EPA and other agencies.

(http://yosemite.epa.gov/ee/epalib/riaepa.nsf/ed707b14c8d6325e852565a500501ed4/4249439b57fc474185256757006e1841!OpenDocument) Specifically,

Morgenstern identifies three deficiencies

(1) "The underlying scientific and risk information was so uncertain that it provided an insufficient basis on which to conduct an economic analysis.
(2) The economic analysis itself was technically flawed in one or more critical ways.
(3) The economic analysis was not designed to address a sufficiently rich array of policy options and was thus rendered irrelevant to actual policy and regulatory decisions." (p. 472)

METHODS

Research Question

The purpose is to determine if the:

4) Net benefits of environmental compliance assistance program, such as KBEAP, will be positive
5) Benefit to cost ratio will be greater than 1:1.
6) Benefit Cost Model will identify areas of concern and lead to internal as well as external recommendations for programmatic improvements.

Population

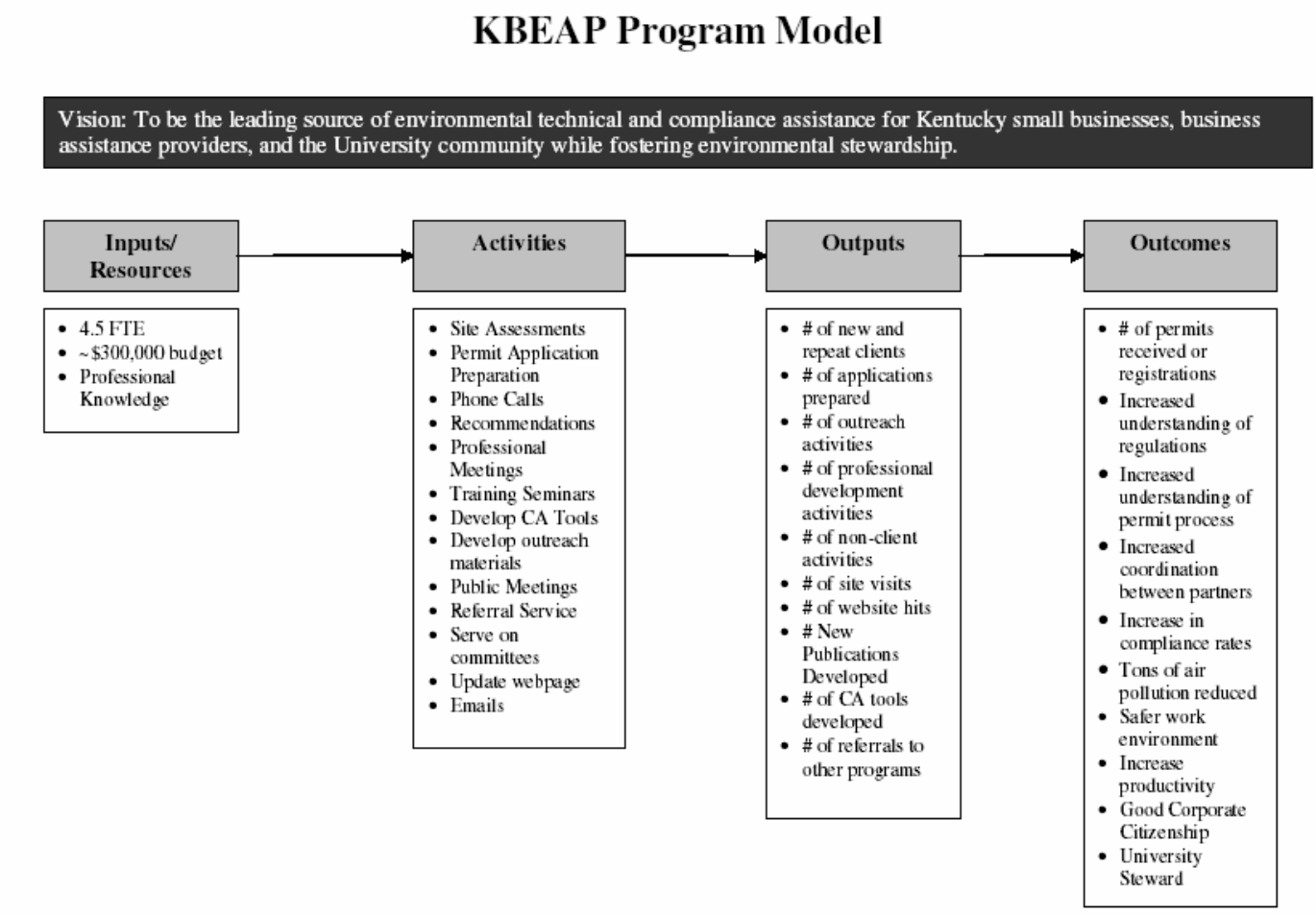
The sample of interest is KBEAP clients from fiscal year 1995-2004 and is the entire KBEAP client population from Fiscal year 1995-2004, totaling 831 separate assistance activities. Currently, KBEAP client data is housed in a Microsoft Access database. The data includes client contact information, geographic information, compliance activities, and client survey and evaluation information. Only the outputs of those firms assisted by KBEAP will be evaluated and included in the analysis.

Measures

Measures of environmental compliance assistance outcomes for this evaluation include the cost and benefits in dollar values. Costs and benefits under consideration in the Benefit Cost Model include those outlined in the KBEAP Logic Model presented in Figure 9. Outcomes beyond the firm or societal benefits and costs, such as reduction in healthcare costs due to pollution reductions,

aesthetic environmental improvements due to pollution reductions, less school or work absentees due to pollution reductions, and a possible decrease in economic development due to higher regional compliance costs, are **not** considered in this evaluation; however, for further readings on these types of costs and benefits see *Environmental Economics: An Introduction* by Barry C. Field and Martha K. Field and *Economics of the Environment* by Robert N. Stavins.

Figure 9: KBEAP Logic Model



Measures considered for the Benefit Cost Model are outlined below:

Benefit Measures:

(1) Value of Permitting Assistance = # of permit applications prepared * market cost ($) of application preparation by consultant

(2) Value of Non-permitting assistance = # of non-permitting clients* hours of assistance * $ consultant hourly rate.

(3) Value of non-client assistance = # of hours spent on non-client activities * hourly consultant rate. Non-clients include those businesses that do not meet KBEAP eligibility requirements for technical assistance but are eligible for information and office consultations and training.

(4) Air Quality Violations Avoided = # of permitting clients * # of permitting clients eligible for KBEAP "Protection" * Cost of violation. Clients not referred to KBEAP by Division for Air Quality Inspectors are eligible for reduced or eliminated fines when compliance problems are resolved through KBEAP. Therefore, businesses that work with KBEAP on compliance problems before a DAQ inspector finds the violation avoid potential fines.

(5) Value of KBEAP training programs = # of training programs * market value of training program * # of attendees

(6) Pollution prevention (P^2) savings = # of KBEAP clients participating in P^2 *tons of pollution reduced at each facility (air, water, hazardous waste, solid waste) * disposal fee/emission fee

(7) Energy efficiency (E^2) savings = (# of KBEAP clients participating in E^2 *Cost of energy at facility Pre-E^2) – (Cost of energy at facility Post-E^2 * # of KBEAP clients participating in E^2). Benefits due to energy efficiency are not realized until year 2000 due to KBEAP primary program focus not being on E^2 during startup. Full E^2 benefits are realized over the 5 year period from FY 2000 due to technology improvements in the E^2 area.

(8) Green productivity = Value per production man hour *# of KBEAP clients indicating productivity improvements * # of employees * # of hours worked * % increase in value per production man hour due to green practices resulting in less absenteeism, safer work environment, improved morale. Productivity benefits are not realized until FY 2000 when KBEAP's program focus began to shift to other compliance assistance areas.

Green Productivity (GP) is a concept illustrated by the Asian Productivity Organization (2005). In simplest terms Green Productivity (GP) is a strategy for enhancing productivity and environmental performance simultaneously for overall socio-economic development (http://www.apo-tokyo.org/gp/01about_gp.htm).

Sara A. Morris (1997) in "Environmental Pollution Prevention and Competitive Advantage: An Exploratory Study of U.S Industrial Goods Manufacturing" provides theoretical justification for the link between a firm's environmental performance and competitive advantage. Findings suggest a strong negative correlation between the pollution that a firm releases and the firm's cost advantage.

Gagnon and Judd (2003) (http://www.sfr.cas.psu.edu/FACULTY/michael.htm) in "Employee Strategic Alignment at a Wood Manufacturer: An Exploratory Analysis Using Lean Manufacturing" indicate that the inclusion of employees in the implementation of a new strategic initiatives such as lean manufacturing can result in employees exhibiting increased levels of commitment, job satisfaction, and trust.

Javier and Oscar Gonzalez-Benito (2005) illustrate in their work on environmental productivity and business performance that there is no single response for whether environmental performance has a positive effect on business performance but rather that disaggregation is necessary for more concrete relationships.

(9) Value of green image to marketing = % increase in profit of KBEAP clients offering green marketing of product or increase in market share due to green product branding. Jacquelyn Ottman (2005) is a pioneer in the concept of green marketing. The website www.greenmarketing.com offers insights into the link between environmental image and consumer behavior.

(10) Good Corporate Citizen Value = % change in shareholder value of those KBEAP clients who value corporate social responsibility. Harvey Meyer in "The Greening of Corporate America" illustrates through case studies that the "green bandwagon" can increase customer base, market share, add shareholder value, and increase employee motivation and pride resulting in productivity improvements. Meyer indicates a positive correlation between environmental performance and stock market performance.

(11) Reduction in insurance premiums due to green practices = insurance cost (workers compensation, fire, environmental liability) * # of KBEAP clients participating in green practices * % reductions in insurance premiums due to safer work environments.

Roelofs et al. (2000), in "Pollution Prevention and the Work Environment: The Massachusetts Experience" seek to understand to what extent worker health and safety issues have been integrated into toxic use reduction activities.

Washington State Department of Ecology (2005) explores the relationship between insurance costs and pollution prevention. By reducing environmental risk case studies show that insurance costs can be reduced. Specifically, "the use and generation of hazardous materials creates significant risks to the environment. It also creates major potential costs and liabilities for business. Insurance provides a means to protect business from some of these costs and liabilities. Most importantly, it can create strong incentives to implement pollution prevention." (http://www.ecy.wa.gov/biblio/99434.html)

Cost Measures:

(1) Program Budget

(2) Production Value lost due to environmental compliance activities = Value Added per production man hour * Time spent on compliance activities * # of employees * # of KBEAP clients with compliance responsibilities. Production value losses are not seen in the Benefit cost model until FY 2000 due to Title V permitting requirements. In other words, regulatory requirements due to Title V permitting became more constraining to small businesses beginning in FY 2000.

(3) Capital expenditures of compliance equipment such as add on control devices or equipment upgrades.

(4) Capital expenditures for pollution prevention equipment such as grinders, cardboard compactors, water flow regulators, motion sensors, etc.

(5) Production Value lost due to pollution prevention activities = Value Added per production man hour * Time spent on P^2 * # of employees * # of KBEAP clients participating in $P^{2.}$

Procedures

Information sources for the estimation of the benefits and costs outlined above for fiscal year 1995-2004 are outlined below.

- Bureau of Labor Statistics Data
- U.S Census Data
- Kentucky Economic Research Statistics
- Small Business Administration Data, Office of Advocacy
- State Data from the Energy Information Administration
- Kentucky State of the Environment Reports
- KBEAP Client Database
- KBEAP Compliance Assistance Outcome Survey Results
- KBEAP Client Evaluations

Once calculated, each benefit and cost for each fiscal year is converted to future values.

$$FV = PV\ (1 + i)^t$$

FV= future value from FY 95
PV = Present Value at time 2005
i = discount rate
t = time

Total benefits and costs are calculated for each fiscal year. Finally, benefit to cost (B/C) ratios and net benefits (total benefits-total costs) are calculated for each fiscal year and for the nine (9) year review period.

Equations:

Benefit Cost Ratio (For each fiscal year) =

(Total Benefits Calculated in present day values)/ (Total Costs Calculated in present day values)

Benefit Cost Ratio (Total FY 95-05) =

$\sum$ (Total Benefits Calculated, present day values)/ $\sum$ (Total Costs Calculated, present day values)

Net Benefits (For each fiscal year) = (Total Benefits Calculated in present day values)-(Total Costs Calculated in present day values)

Net Benefits (Total FY 95-05) =

$\sum$ (Total Benefits Calculated, present day values)-$\sum$ (Total Costs Calculated, present day values)

Sensitivity Analysis

In order to evaluate the Benefit Cost Model, a sensitivity analysis is performed. The model is evaluated at discount rates of 5%, 7%, and 9%. A discount of 7% is recommended by the Federal Office of Management and Budget (OMB). Also, the model will be evaluated at the lower limit, moderate values, and upper limit for those instances where assumptions are made in calculating the benefits and costs for the various categories. The range of values is shown in Table 1.

Table 1: Variable Ranges

Variable	Lower Limit	Moderate	Upper Limit	Source
% KBEAP clients requesting permit	55%	75%	95%	KBEAP Database

assistance				
Permit Application Cost	$3,000	$7,500	$10,000	KBEAP Staff
Hourly Consultant Rate	$75	$100	$125	KBEAP Staff
% KBEAP client not referred by DAQ	35%	55%	75%	KBEAP Database
Operating without a permit fine	$2,500	$10,000	$32,500	Kentucky State of the Environment Reports & Civil Penalty Fines
% Outreach (Training)	5%	10%	25%	KBEAP Database
Cost of Training	75$	$120	$240	KBEAP Staff
# of attendees	5	10	25	KBEAP Database
% KBEAP clients participating in P^2	20%	31%	41%	KBEAP Measuring CA Outcomes Survey
% KBEAP clients participating E^2	5%	12%	25%	KBEAP Measuring CA Outcomes Survey
% E^2 reduction	1%	2.5%	5%	EPA Energy Star & KBEAP
% P^2 Solid Waste Reductions	15%	30%	50%	KBEAP Staff & KPPC
% P^2 Hazardous Waste Reductions	5%	10%	15%	KBEAP Staff
% KBEAP	25%	49%	70%	KBEAP

clients who are hazardous waste generators				Measuring CA Outcomes Survey
$ Increase in productivity	0.5%	1.0%	1.5%	KBEAP Staff
% KBEAP clients realizing work environment improvements	10%	22%	50%	KBEAP Measuring CA Outcomes Survey
Employee time spent on compliance activities	8 hours	33 hours	50 hours	KBEAP Measuring CA Outcomes Survey
Production down time for compliance activities	8 hours	20 hours	40 hours	KBEAP Staff
Time client spends working with KBEAP	5 hours	15.56 hours	25 hours	KBEAP Measuring CA Outcomes Survey
% KBEAP clients making compliance improvements	20%	39%	60%	KBEAP Measuring CA Outcomes Survey
% workforce off due to compliance improvements	5%	25%	50%	KBEAP Staff

CA = compliance assistance

LIMITATIONS

The major limitation with the benefit cost model and the measures outlined above is the lack of appropriate data. KBEAP's current evaluation and measurement metrics do not include several of the measures outlined above. Nationally, there has been no comprehensive study on compliance assistance outcomes of the SBTCPs and there is no known outcome metrics established for the SBTCPs. Based on this data gap, the following measures were unable to be calculated due to lack of appropriate baseline data statewide as well as nationally.

Benefits (not calculated):

- Pollution prevention benefits due to air and water pollution reductions
- Good Corporate Citizen Value
- Value of Green Image to Marketing
- Insurance Reductions due to safer work environments

Costs (not calculated):

- Capital expenditures due to pollution prevention and compliance equipment
- Production value lost due to P^2 activities

The second limitation is one of external validity. The benefit cost model outline above is only valid to other SBTCPs that are programmatically similar in structure and services offered. Those SBTCPs include Nevada, Idaho, Pennsylvania, and Iowa in that these SBTCPs are located at a non-regulatory unit such as a

University or Small Business Development Center and conduct onsite technical and compliance assistance. For the other SBTCPs nationwide, the benefit cost model provides a good foundation for development but should not be duplicated without careful consideration of the outcomes and how those outcomes relate to the structure and function of the SBTCP.

RESULTS

B/C ratios and Net Benefits

Table 2 and Table 3 illustrate the sensitivity of the model with respect to discount rates using the moderate model values. From the standard deviations, it is apparent that the model is not sensitive to discount rate when looking at B/C ratio and net benefits; however the variability does appear to decrease through time for both B/C ratio and net benefits. This indicates that discount rates are not significant variables in the model due to the relatively short period of time over which the model runs.

Table 2: B/C ratios at Various Discount Rates by Fiscal Year

i	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	Total 95-05	SD	AVE
0.05	2.25	3.82	3.62	3.00	3.55	2.33	2.68	2.62	2.57	2.69	2.84	0.56	2.91
0.07	2.11	3.64	3.48	2.9	3.46	2.28	2.64	2.59	2.54	2.68	2.79	0.53	2.83
0.09	1.99	3.48	3.35	2.81	3.38	2.23	2.6	2.56	2.52	2.67	2.74	0.5	2.76
SD	0.13	0.17	0.14	0.10	0.09	0.05	0.04	0.03	0.03	0.01	0.05	0.05	0.08
AVE	2.12	3.65	3.48	2.9	3.46	2.28	2.64	2.59	2.54	2.68	2.79	0.53	2.83

See APPENDIX A for sample data representing moderate values at 7% discount rate.

Table 3: Net benefits at Various Discount Rates by Fiscal year ($000)

i	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	Total 95-05	SD	AVE
0.05	390	1,907	2,055	1,604	2,985	1,897	2,513	2,728	2,592	2,693	21,364	759	2,136
0.07	415	2,072	2,202	1,694	3,131	1,948	2,576	2,774	2,615	2,706	22,134	766	2,213
0.09	443	2,263	2,370	1,796	3,292	2,002	2,643	2,821	2,639	2,719	22,990	779	2,299
SD	26.5	178.2	157.6	96.1	153.6	52.5	65.0	46.5	23.5	13.0	813.4	61.4	81.2
AVE	416	2,081	2,209	1,698	3,136	1,949	2,577	2,774	2,615	2,706	22,163	766	2,216

See APPENDIX A for sample data representing moderate values at 7% discount rate.

Table 4 and Table 5 demonstrate the sensitivity of the benefit cost model to the lower, moderate, and upper limits of the model assumptions using a discount rate of 0.07.

Table 4: B/C Ratio at Various Limits by Fiscal Year

Limit	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	Total 95-05	SD	AVE
Low	0.69	1.19	1.23	1.08	1.51	1.83	2.19	2.25	2.26	2.33	1.68	0.59	1.66
Mod	2.11	3.64	3.48	2.9	3.46	2.28	2.64	2.59	2.54	2.68	2.79	0.53	2.83
High	5.86	9.32	8.2	6.72	7.03	2.17	2.62	2.63	2.49	2.79	3.41	2.73	4.98
SD	2.67	4.17	3.56	2.88	2.8	0.23	0.25	0.21	0.15	0.24	0.88	1.64	1.72
AVE	2.83	4.58	4.12	3.39	3.7	1.63	1.93	1.92	1.86	2.01	2.19	0.92	3.16

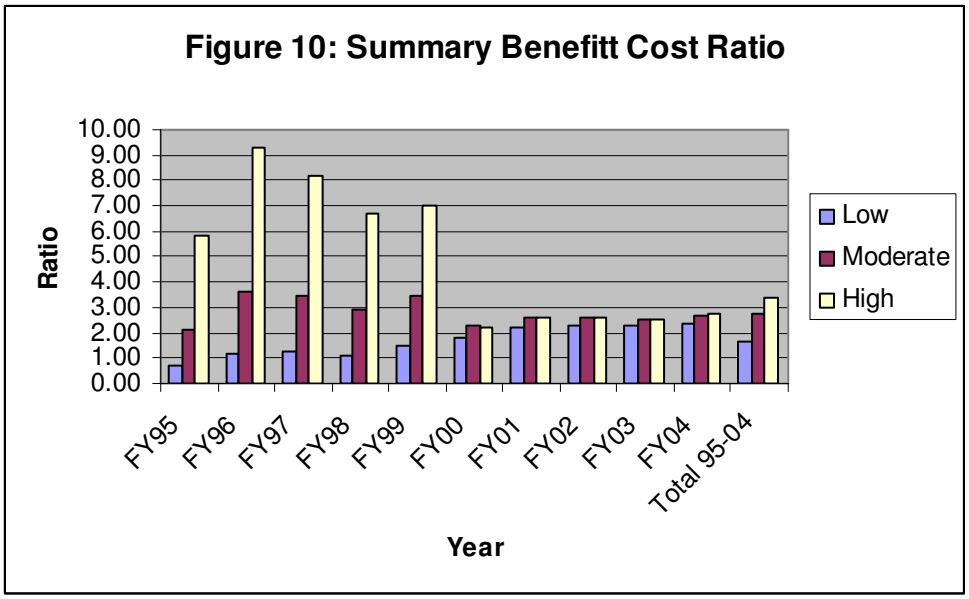
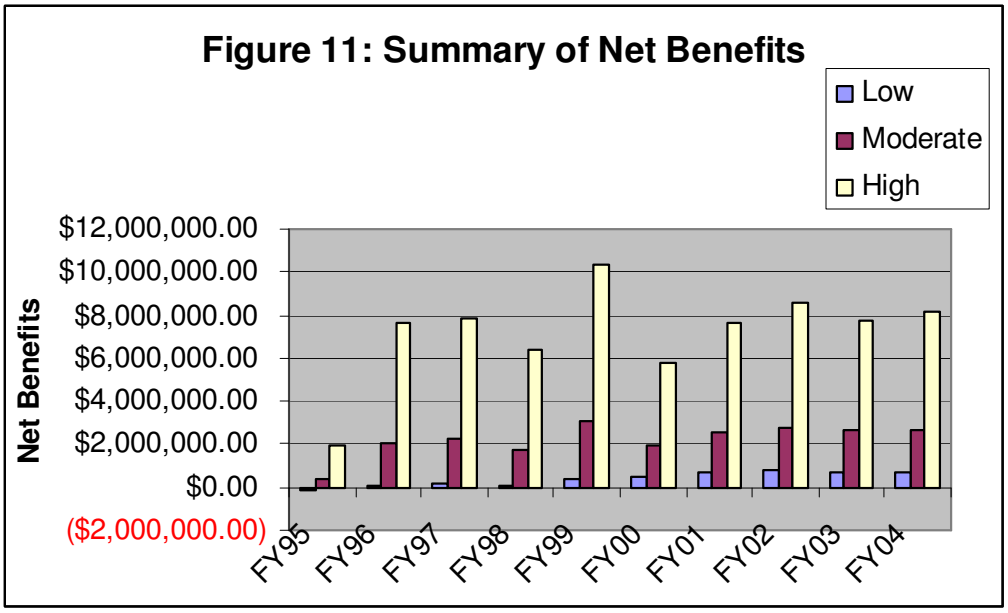


Table 5: Net benefits at Various Limits by Fiscal year ($000)

Limit	FY 95	FY 96	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03	FY 04	Total 95-05	SD	AVE
Low	110	114	145	50	343	483	697	749	708	732	3,909	326	391
Mod	415	2,072	2,202	1,694	3,131	1,948	2,576	2,774	2,615	2,706	22,134	766	2,213
High	1,893	7,604	7,861	6,374	10,365	5,746	7,651	8,528	7,776	8,152	71,951	2,231	7,195
SD	1,038	3,885	3,996	3,281	5,173	2,716	3,597	4,036	3,657	3,843	35,222	1,072	3,522
AVE	733	3,263	3,403	2,706	4,613	2,726	3,641	4,017	3,700	3,863	32,665	1,060	3,266



Based on Tables 4 and 5 and Figures 10 and 11, the benefit cost model is considerably more sensitive to the variation in assumption used within the model. Standard deviations of the B/C ratios vary considerable early on (Pre FY2000) and then become stable in the later years (post 2000). This indicates that as KBEAP developed programmatically, estimates of benefits and costs as well as realized benefits and costs were uncertain but as the program became more established so to did the ability to realize benefits and costs as well as estimate those benefits and costs. In other words, as KBEAP's services developed so did the benefits, which is evident by the net benefits in Table 5. Early net benefits are less than later net benefits.

Secondly, when the lower limits are used in the model, costs early on (pre FY 2000) are a more substantial influence than post FY 2000 when benefits become

more prominent. The opposite is true when using the higher limits of the variables.

In summary, Table 6 and Table 7 show the average B/C ratios and standard deviations for the variation in discount rates and variable limits per fiscal year as well as the overall program B/C ratio and net benefits.

Table 6: Summary of Results (per fiscal year)

	Variation Discount Rate	**Variation Limits**
B/C Ratio per fiscal year	2.83 ± 0.53	3.16 ± 0.92
Net benefit per fiscal year ($000)	2,216 ± 766	3,266 ± 1,060

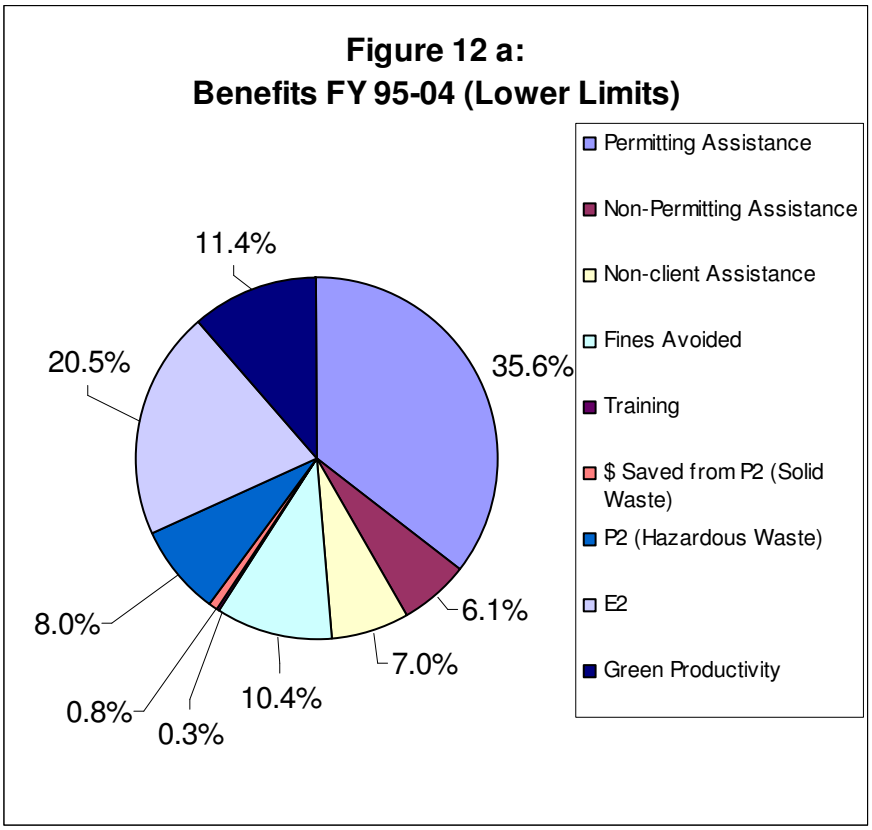
Table 7: Overall Results

	Variation Discount Rate	**Variation Limits**
Overall B/C ratio	2.79 ± 0.05	2.19 ± 0.88
Overall Net benefit ($000)	22,163 ± 813	32,665 ± 35,222

From the tables, the original proposition is supported that KBEAP does have a benefit to cost ratio great than one (>1) and that the net benefits of the program are positive.

Benefits and Costs Examined

For a greater understanding of programmatic changes as the variables change within the benefit cost model, it is worth examining the overall benefits and costs by category. Figures 12 a, b, and c illustrate the changes in benefits as the variables range to low to high.



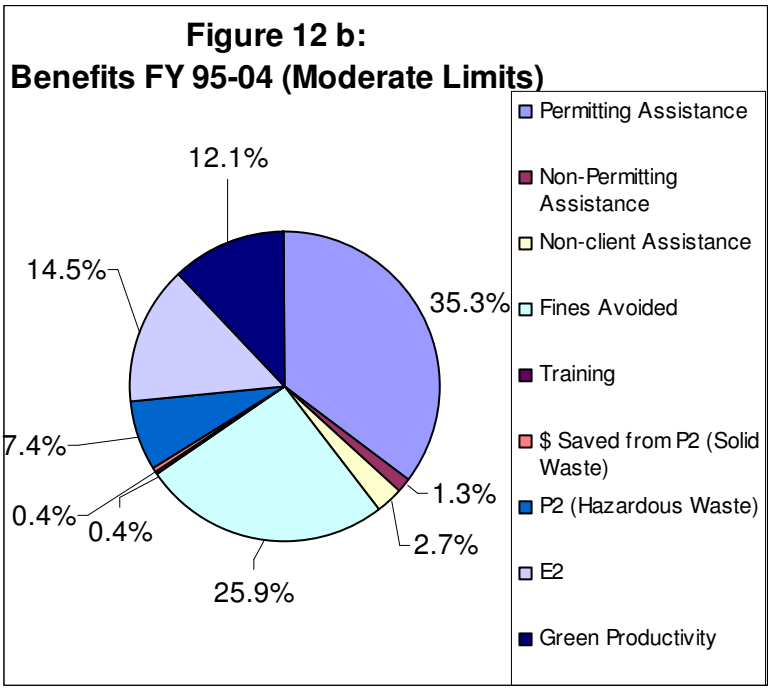


Figure 12 b:
Benefits FY 95-04 (Moderate Limits)
12.1%
14.5%
35.3%
7.4%
1.3%
0.4%
0.4%
2.7%
25.9%
Permitting Assistance
Non-Permitting Assistance
Non-client Assistance
Fines Avoided
Training
$ Saved from P2 (Solid Waste)
P2 (Hazardous Waste)
E2
Green Productivity

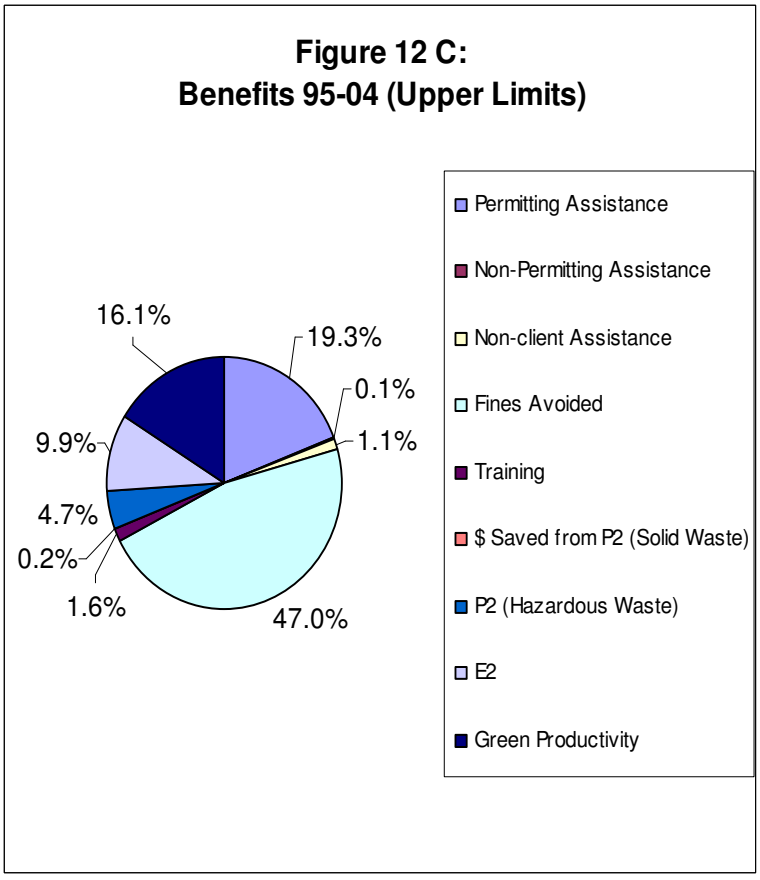
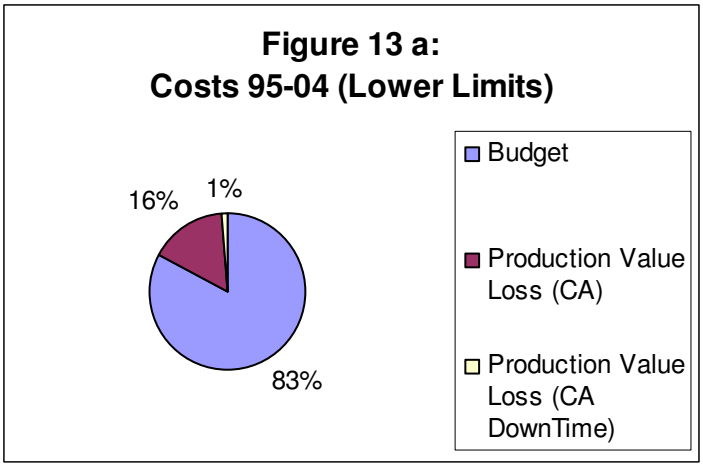
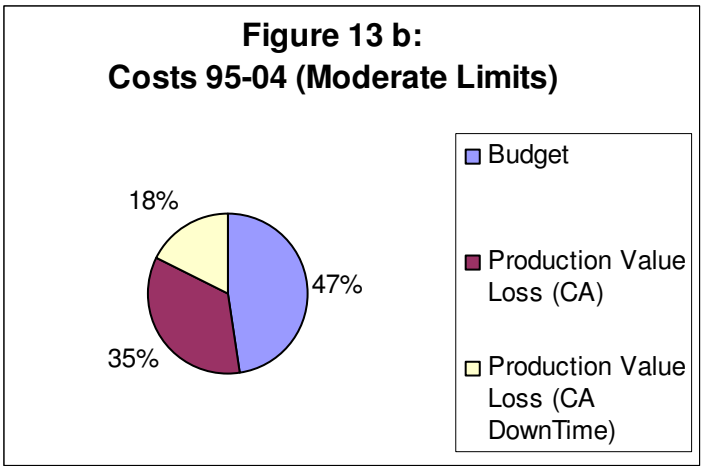


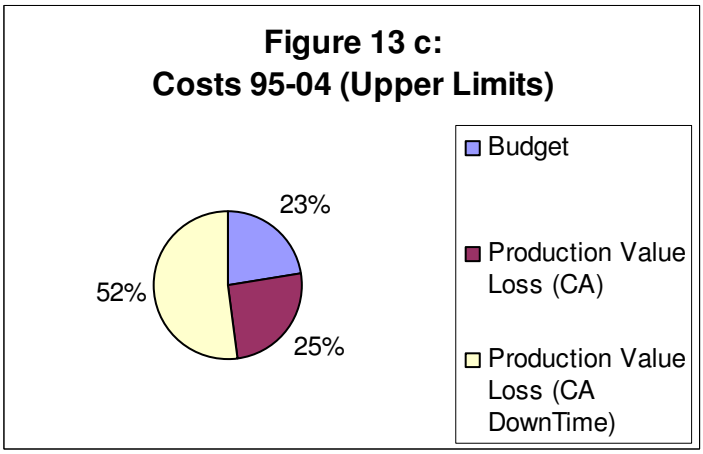
Figure 12 C:
Benefits 95-04 (Upper Limits)
16.1%
19.3%
0.1%
1.1%
9.9%
4.7%
0.2%
1.6%
47.0%
Permitting Assistance
Non-Permitting Assistance
Non-client Assistance
Fines Avoided
Training
$ Saved from P2 (Solid Waste)
P2 (Hazardous Waste)
E2
Green Productivity

Interesting enough, is the visual representation that with lowing limits permitting assistance and energy efficiency dominate the benefits but with moderate values one sees that permitting assistance remains dominant however fines avoided becomes the second dominate benefit. With the upper limits in place, the measure fines avoided becomes the overall dominant benefit. Making the transition from lower to upper limits with the model variables one also sees that energy efficiency benefits decrease but productivity benefits increase. These observations are important from a programmatic perspective because given the environment in which the program develops; services can be tailored in an efficient manner to maximize benefits to the consumer (small businesses). Often, energy efficiency and productivity improvements from a service provider's perspective yield the greatest benefits with the least amount of input (resource allocation).

In examining the costs, it is not surprising that as one moves from lower to upper limits of the model variables, the dominant cost moves from budget to production value losses due to compliance down time (Figures 13 a b c).







This is important from a service provider's perspective in that as regulatory requirements develop and become more labor intensive for the small business, compliance assistance providers should develop services that enable the small business to minimize down time and compliance activities which inhibits production time.

CONCLUSION/RECOMMENDATIONS

Based on the benefit cost model developed and the results, the original research question that KBEAP has a benefit to cost ratio greater than 1 and that the net benefits are positive is supported by the analysis and the analysis has lead to the development of several recommendations.

Internal Recommendations

1) Based on the information from the benefit cost analysis, KBEAP should develop a standardized set of metrics in the outcomes areas of (a) Increased Awareness (b) Increased Understanding and (c) Behavior Change: Environmental Change, Process Change, Management Change
2) KBEAP should incorporate those metrics identified into a standardized client evaluation form in order to track outcomes and report outcomes in the future
3) From previous evaluations, approximately 65% of KBEAP clients do not understand the value of the compliance assistance services offered by KBEAP. With the benefit cost analysis showing that overall client net benefits of ~ $3,000,0000 per fiscal year and a benefit to cost ratio of ~3/1, KBEAP should look into service changes that incorporate educating the client on the monetary benefits of compliance assistance.

Those KBEAP clients that are proactive and whose working environment is conducive to change will exhibit the largest net benefits. Typically, these clients seek out KBEAP's services rather than being referred. They request

information beyond basic compliance, take an active role in their facility's environmental compliance, train employees on the importance of environmental compliance, place environmental compliance as a business priority, and are willing to make changes based on KBEAP recommendations.

Those KBEAP clients who exhibit the lowest net benefits will be those who are referred by an inspector and who are reactive rather than proactive based on that referral. These clients want the "bare minimum" and want to fix the immediate problem rather than fix the systemic issues. They are resistive to change and are not engaged in nor do they prioritize their facility's environmental compliance status.

In all, client's who are receptive to compliance assistance programs will reap the highest net benefits. Those clients who do not may be better served by traditional command and control approaches to environmental compliance.

4) KBEAP's marketing plan should incorporate the use of the benefit cost information in order to educate potential clients and draw potential clients to KBEAP.
5) As KBEAP develops programmatically, services should include the development of compliance tools to minimize small business activities that reduce production time. Often small businesses do not have a

dedicated environmental compliance staff; therefore it is often the case that production foremen, accountants, office assistants, human resource personnel, others must take time to do environmental compliance work. These individuals are not focusing on their primary job function and productivity could suffer as a result.

6) KBEAP should also reevaluate its services offered and focus on promoting those that yield the highest benefits. Traditionally, permitting services and fines avoided have been the largest selling point of the program; however, E^2 and Green Productivity initiatives can yield large benefits with limited program resource inputs. Partnerships/referral networks on these initiatives have the potential to yield results in the least amount of time. Potential partners could include the Kentucky Pollution Prevention Center and the UK Center for Manufacturing's Lean Manufacturing Program.
7) In order to address data gaps presented during the benefit cost analysis, an experimental design is proposed for KBEAP.

INTERNAL RECOMMENDATION #7: EXPERIMENTAL DESIGN

Population

The population under evaluation for the Environmental Compliance Assistance Experiment are (1) small businesses with less than 100 employees, (2)who have no previous working relationship with KBEAP, (3) who fall into standard industrial classification codes (SIC) for Division D and Major Groups 20-39, and (4) who are willing to participate in the study.

Sample

A total of 30 businesses should be evaluated. The 30 business should be divided into two groups of 15 businesses with each group of 15 businesses being randomly distributed among the top 5 standard industrial classification codes of Kentucky Small Manufacturers. Those codes represent Major groups 24 (Wood Products), 27 (printing and Publishing), 34 (Fabricated Metal Products), 35 (Industrial Machinery), and 39 (Miscellaneous Manufacturing). Also, each group of 15 businesses should also be randomly distributed throughout the three main regions of Kentucky (West, Central, and East).

Measures

Three measurement tools have been developed by KBEAP to be used during the experiment to measure compliance rates, benefit/costs, and pollution prevention implementation. The three tools are the KBEAP Environmental Compliance Checklist, KBEAP Benefit Cost Questionnaire, and Standards and Measurements outlined in the proposed Kentucky Green Certified Small Business Program.

Also, interviewers will include KBEAP environmental consultants who have professional knowledge of environmental compliance assistance and who have been trained on the use of the three tools outlines above as well as the experimental design of the project.

Design and Procedures

The design of the experiment is best illustrated by the following matrix.

Group	Baseline Evaluation	Hands-on Compliance Assistance Intervention	Midterm Follow Up	Hands-on Compliance Assistance Intervention	Final Follow-up
A	Yes	No	Yes	Yes	Yes
B	Yes	Yes	Yes	No	Yes

The total experimental timeframe should be 2 years. At the beginning of year 1, evaluators/interviewers will be sent to both group participants and the Environmental Compliance Checklist, Benefit Cost Questionnaire as well as the Pollution Prevention Checklist will be administered (in person) on site. Following the evaluation, Group A will receive information and resources from the Kentucky Department of Environmental Protection on Permitting Programs. Group B will receive an onsite environmental compliance audit from a KBEAP environmental consultant, an environmental audit report stating compliance findings and recommendations, KBEAP Environmental Basics for Small Business training to all employees, application preparation from KBEAP, as well as a Pollution Prevention/Energy Efficiency Audit from the Kentucky Pollution Prevention Center.

A midterm follow-up will be conducted by an evaluator/interviewer at the end of year 1 using the measurement tools outlined above. At the beginning of year 2, Group B will receive no additional assistance; however, Group A will receive the onsite environmental audit, KBEAP Environmental Basics for Small Business training to all employees, application preparation from KBEAP, as well as a Pollution Prevention/Energy Efficiency Audit from the Kentucky Pollution Prevention Center. Finally, at the end of year 2, a final follow up will be conducted by an evaluator/interviewer with the measurement tools outlined above and any non-compliance situations will be resolved following the close of the experiment.

External Recommendations

1) Nationally, through the SBTCP's Steering Committee (http://www.smallbiz-enviroweb.org/sba/steering_committee.html) and the Environmental Protection Agency's (EPA) Small Business Ombudsman (SBO) (http://www.epa.gov/sbo/), environmental compliance outcomes should be discussed and prioritized as an agenda item in the overall development of the SBTCPs.
2) If prioritized, nationally, the SBTCPs should develop a standardized set of environmental compliance outcome metrics whereby each individual program could establish protocols for measurement. Metrics reported back to the national steering committee and the SBO should be reported

annually. These metrics once translated into benefit cost terms have the potential to be used for national educational campaigns, developing program support, and as a tool for national program development and organizational change.

3) As an alternative to external recommendation #2, EPA's SBO could develop a national SBTCP environmental compliance outcome survey whereby each state would be responsible for administering the survey to their clients. The survey could be administered every 5 years and would be based on the metrics developed in external recommendation #2.
4) The benefit cost model has the potential to be used as a learning tool for other compliance assistance programs in their development phase such as the new Kentucky Division for Compliance Assistance (DCA) located in the Kentucky Department for Environmental Protection. The model has the potential to help identify metrics and also how to best allocate resources given programmatic design. The model however is not externally valid to DCA so any use of the model results should be cautioned.
5) The benefit cost model should be transferred to other SBTCPs that are programmatically similar to KBEAP such as Nevada, Pennsylvania, Idaho, and Iowa in an effort to replicate the model and test for validity.
6) The benefit cost model also presents an opportunity for research into the relationships between small business environmental responsibility and

financial performance as well as how the "green image" is valued among the small manufacturing firm. While studies on large firms have been conducted (See Literature Review), there appears to be gaps in the understanding of environmental performance and financial performance among the small business owner as well as how "green images" are valued from a marketing perspective as well as from a community perspective.

In summary, compliance assistance programs such as KBEAP have the opportunity to provide significant benefits to small businesses but the effort required to track these outcomes is still in its infancy both on a national and state level. It is hoped that this analysis will provide the impetus for other programs to explore outcome evaluation as well as lead to a national initiative to better understand the outcomes relating to environmental compliance assistance program and small businesses.

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APPENDIX A: SAMPLE DATA

Time Reference	Discount Rate	Total Client Assistances	# Permitting Assistance	$ Saved on Permitting Assistance	Current Value	Non-Permitting Assistance	$ Saved on Non-Permitting Assistance	Current Value	$ Saved Non-client Assistance	Current Value	Fines Avoided	Current Value	Outreach Activities
FY95	0.07	20.00	15.00	$112,500.00	$221,304.53	5.00	$4,160.00	$8,183.35	$ 35,000.00	$68,850.30	$82,500.00	$162,289.99	19.00
FY96		83.00	62.25	$466,875.00	$858,330.64	20.75	$17,264.00	$31,739.16	$ 35,000.00	$64,346.07	$342,375.00	$629,442.47	44.00
FY97		92.00	69.00	$517,500.00	$889,161.35	23.00	$19,136.00	$32,879.21	$ 35,000.00	$60,136.52	$379,500.00	$652,051.66	40.00
FY98		79.00	59.25	$444,375.00	$713,569.14	19.75	$16,432.00	$26,386.20	$ 35,000.00	$56,202.35	$325,875.00	$523,284.04	52.00
FY99		132.00	99.00	$742,500.00	$1,114,292.29	33.00	$27,456.00	$41,204.05	$ 35,000.00	$52,525.56	$544,500.00	$817,147.68	81.00
FY00		70.00	52.50	$393,750.00	$552,254.74	17.50	$14,560.00	$20,421.15	$ 35,000.00	$49,089.31	$288,750.00	$404,986.81	41.00
FY01		83.00	62.25	$466,875.00	$611,977.89	20.75	$17,264.00	$22,629.58	$ 35,000.00	$45,877.86	$342,375.00	$448,783.78	45.00
FY02		96.00	72.00	$540,000.00	$661,523.22	24.00	$19,968.00	$24,461.66	$ 35,000.00	$42,876.51	$396,000.00	$485,117.03	78.00
FY03		87.00	65.25	$489,375.00	$560,285.44	21.75	$18,096.00	$20,718.11	$ 35,000.00	$40,071.50	$358,875.00	$410,875.99	
FY04		89.00	66.75	$500,625.00	$535,668.75	22.25	$18,512.00	$19,807.84	$ 35,000.00	$37,450.00	$367,125.00	$392,823.75	
		831.00			$6,718,367.99			$248,430.32		$517,425.98		$4,926,803.19	
			% of KBEAP clients requesting permitting assistance	Cost of Permit Application		% of KBEAP Clients requesting Non-permitting Assistance	Hourly Consulting Rate			% KBEAP Clients not referred by DAQ	Operating without a permit fine value		% Outreach Training
			75.00%	$7,500.00		25.00%	$100.00			55.00%	$10,000.00		10.00%

Time Reference	$ Saved on Training	Current Value	$ Saved from P2 (Solid Waste)	Current Value	$ Saved from P2 (Hazardous Waste)	Current Value	$ Saved from E2	Current Value	Green Productivity	Current Value	Totals (FY95-04)
FY95	$2,280.00	$4,485.11	$44.68	$87.89	$21,693.12	$42,673.65	$0.00	$0.00	$22,346.15	$0.00	$788,458
FY96	$5,280.00	$9,707.06	$2,718.18	$4,997.27	$87,355.60	$160,599.71	$0.00	$0.00	$141,721.34	$0.00	$2,857,962
FY97	$4,800.00	$8,247.29	$4,124.47	$7,086.60	$88,557.78	$152,158.75	$0.00	$0.00	$240,786.37	$0.00	$3,091,350
FY98	$6,240.00	$10,020.08	$3,679.84	$5,909.02	$82,541.94	$132,544.31	$0.00	$0.00	$203,769.38	$0.00	$2,586,038
FY99	$9,720.00	$14,587.10	$8,583.68	$12,881.79	$170,652.53	$256,103.44	$0.00	$0.00	$555,433.56	$0.00	$4,402,933
FY00	$4,920.00	$6,900.55	$3,778.11	$5,298.99	$84,455.79	$118,453.61	$337,732.61	$473,687.46	$338,682.96	$338,682.96	$3,471,586
FY01	$5,400.00	$7,078.30	$6,213.55	$8,144.70	$103,068.08	$135,101.22	$498,420.49	$653,327.59	$371,350.33	$371,350.33	$4,150,449
FY02	$9,360.00	$11,466.40	$9,598.31	$11,758.34	$122,440.54	$149,994.92	$464,580.23	$569,130.76	$482,559.90	$482,559.90	$4,518,666
FY03	$6,000.00	$6,869.40	$9,486.28	$10,860.84	$113,755.70	$130,238.91	$445,136.03	$509,636.24	$571,863.58	$571,863.58	$4,309,182
FY04	$3,600.00	$3,852.00	$11,360.33	$12,155.55	$119,102.39	$127,439.55	$513,791.50	$549,756.90	$534,410.65	$534,410.65	$4,317,070
		$83,213.29		$79,180.99		$1,405,308.08		$2,755,538.95		$2,298,867.42	$34,493,692
	Number of Attendees	Price of Training									
	10.00	$120.00									

Time Reference	Discount Rate	Budget	Current Value	Production Value Lost due to Employee Compliance Activites	Current Value	Production Value Loss due to Down Time for Compliance Improvements	Current Value	Totals
FY95	0.07	$175,000.00	$344,251.49	$9,954.80	$19,582.60	$0.00	$0.00	$373,788.89
FY96		$300,000.00	$551,537.76	$82,624.84	$151,902.40	$0.00	$0.00	$786,065.00
FY97		$300,000.00	$515,455.85	$137,376.24	$236,037.96	$0.00	$0.00	$888,870.05
FY98		$300,000.00	$481,734.44	$157,285.84	$252,566.69	$0.00	$0.00	$891,586.97
FY99		$300,000.00	$450,219.11	$328,508.40	$493,002.53	$0.00	$0.00	$1,271,730.03
FY00		$300,000.00	$420,765.52	$209,050.80	$293,204.56	$250,163.55	$350,867.32	$1,524,051.75
FY01		$300,000.00	$393,238.80	$275,949.27	$361,713.20	$235,108.17	$308,178.85	$1,574,188.29
FY02		$300,000.00	$367,512.90	$351,642.24	$430,776.86	$267,327.22	$327,487.33	$1,744,746.56
FY03		$300,000.00	$343,470.00	$348,103.53	$398,543.73	$281,599.49	$322,403.26	$1,694,120.01
FY04		$300,000.00	$321,000.00	$386,210.16	$413,244.87	$236,841.08	$253,419.96	$1,610,716.07
			$4,189,185.88		$3,050,575.40		$1,562,356.71	$12,359,863.61