BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

PEOPLE OF THE STATE OF ILLINOIS	)	
	)	
Complainant,	)	
	)	
v.	)	PCB No. 04-016
	)	(Enforcement)
PACKAGING PERSONIFIED, Inc., an Illinois Corporation,	)	
	)	
	)	
Respondent.	)	

RESPONDENT'S EXPERT WITNESS DISCLOSURE

Packaging Personified, Inc. ("Respondent") by and through its attorneys, Drinker Biddle & Reath LLP, submits the following witness list and expert reports in accordance with the hearing officer's directive.

Respondent's Expert Witness List

1. Christopher McClure, of Navigant Consulting, will be testifying as the Respondent's expert witness in connection with the economic benefit penalty calculation. Mr. McClure's is expected to testify in accordance with his expert report which is enclosed herein, as Attachment A, which includes an analysis of the compliance alternatives available to Respondent and an analysis of the economic benefit associated with each respective alternative.

2. Richard Trzupek, Principal Consultant of Mostardi Platt Environmental, will be testifying as the Respondent's expert consultant witness in connection with the environmental compliance issues at the Respondent's facility. Mr. Trzupek is expected to testify in accordance with his expert report which is enclosed herein, as Attachment B, which includes the historical

analysis of the activities undertaken by Respondent to comply with the Flexographic Printing Rules.

Respectfully submitted,

PACKAGING PERSONIFIED, INC.

By: Y. Villasenor-Rdg.
One of Its Attorneys

Dated: February 4, 2009

Roy M. Harsch
Lawrence W. Falbe
Yesenia Villasenor-Rodriguez
Drinker Biddle & Reath LLP
191 North Wacker Drive - Suite 3700
Chicago, IL 60606-1698
(312) 569-1441 (Phone)
(312) 569-3441 (Facsimile)

CERTIFICATE OF SERVICE

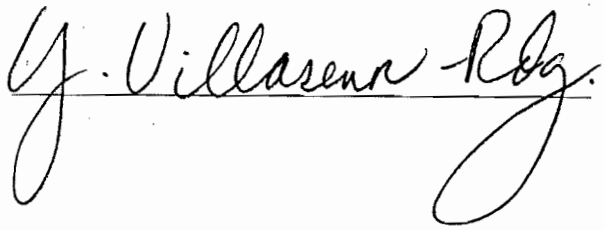
The undersigned certifies that copies of the foregoing were served upon:

Paula Wheeler
Assistant Attorney General
Office of the Illinois Attorney General
69 West Washington Street – 18th Floor
Chicago, IL 60602

Bradley P. Halloran
Hearing Officer
Illinois Pollution Control Board
James R. Thompson Center
100 W. Randolph Street - Suite 11-500
Chicago, IL 60601

John T. Therriault
Illinois Pollution Control Board
James R. Thompson Center
100 W. Randolph St. - Suite 11-500
Chicago, IL 60601

by Hand Deliver on this 4th day of February 2009.



IN THE MATTER OF:

PEOPLE OF THE STATE OF ILLINOIS

V.

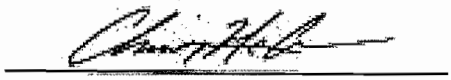
PACKAGING PERSONIFIED, INC.

PCB 04-16

EXPERT REPORT

OF

CHRISTOPHER MCCLURE



February 3, 2009

ATTACHMENT A

NAVIGANT
CONSULTING

INTRODUCTION & QUALIFICATIONS

My name is Christopher McClure. My business address is 30 South Wacker Drive, Suite 3100, Chicago, Illinois 60606. I am a Director at Navigant Consulting Inc., a CPA and hold a Master of Business Administration Degree. My curriculum vitae is found at Exhibit 1. My hourly billing rate for this engagement is $450. Navigant Consulting Inc. is an international consulting firm of approximately 2,000 professional which include Certified Public Accountants, Masters of Business Administration, engineers of various disciplines, information management professionals and others with accounting, economic and finance experience, including expertise in environmental matters.

Prior to joining Navigant Consulting Inc. in 2004, I was employed by LECG, a global expert services firm. Prior to LECG, I was employed by the international public accounting and consulting firm of Arthur Andersen.

I am experienced in the financial, economic, and accounting theories and methods necessary to perform the analysis in this matter. My experience includes compiling claims for litigation and contribution actions, developing cost allocation models, assisting parties in the recovery of remediation costs from their insurance companies, and performing a variety of other types of accounting and financial analyses. I have calculated economic benefit penalty amounts using the EPA BEN approach on three occasions and also testified at an Illinois Pollution Control Board hearing.

This report is limited to analyzing the potential economic benefit penalty component only to possibly be imposed by the Board pursuant to Section 42 (h)(3) of the Illinois Environmental Protection Act and does not address any potential gravity component.

The analysis presented in this report is based on currently available documents and information and is subject to change based on the review of additional information that may be provided. I reserve the right to revise this report. I understand depositions of witnesses may continue

beyond the date of this report. I understand that this report may be supplemented by deposition and trial testimony. If this matter proceeds to trial, selected pages of the documents and information relied upon may be used as exhibits. Additionally, I may prepare graphical or illustrative exhibits based on the documents and information relied upon and my analysis of those documents and information.

CASE BACKGROUND

Navigant Consulting Inc. was retained by Drinker Biddle & Reath LLP, outside counsel for Packaging Personified, Inc., ("Packaging") to provide analyses related to the amount of economic benefit penalty that could possibly be imposed on Packaging by the Illinois Pollution Control Board ("Board") in the enforcement action brought the Illinois Attorney General on behalf of the Illinois Environmental Protection Agency and the (collectively "Government") in the matter *People of the State of Illinois v. Packaging Personified, Inc., PCB 04-16.* The financial penalties could arise from the Government's allegation that Packaging enjoyed an economic benefit by delaying compliance with the Volatile Organic Material ("VOM") capture and control requirements outlined in 35 Illinois Administrative Code ("IAC") Section 218.401 - "Flexographic and Rotogravure Printing."

Packaging Personified is a printing company located in Carol Stream, IL. It utilizes printing presses with inks containing organic solvents that emit as VOM during the printing process. A Government inspection of Packaging Personified's facility in 2002 revealed that one of its four printing presses was non compliant. Packaging Personified decommissioned the non compliant press in December 2002 to reach compliance.

Packaging Personified should have been in compliance in January 1997. At that time, there were multiple compliance options available to the company. These compliance options and their associated costs are as follows:

Compliance Option #1 – Adjusted Standard

Pursuant to the authority of Section 28.1 of the Environmental Protection Act (415 ILCS 5/28.1(1998)), Packaging Personified could have applied for an adjusted standard that would have eliminated the need for a compliance system. Packaging Personified's competitors such as Formel Industries, Inc, BEMA, Inc, and Vonco Products, Inc, received adjusted standards. The total cost of receiving the adjusted standard is estimated at $30,000 (in 2007 dollars), consisting primarily of legal and consulting fees to complete the application process.

Compliance Option #2 – Install RTO

Packaging Personified ultimately spent $250,000 on an RTO in late 2003, but that device was substantially larger than needed for compliance because it was built in anticipation of future expansion and the installation of additional presses. The installed RTO was large enough to accommodate three presses. The lower cost compliance alternative for the company was to purchase and install a used RTO that could be obtained for $75,000 and maintained for an annual cost (labor, utilities) of $16,362, based on the best estimates of the company's engineering consultants, Mostardi Platt Environmental (in 2007 dollars).

Compliance Option #3 – Decommission / Relocate press to Michigan

Packaging Personified could have easily complied by decommissioning the non compliant press and moving it to the company's facility in Michigan. Packaging Personified ultimately did decommission the press in December 2002 and relocated it to the Michigan facility in December 2004. The estimated cost for this option is $15,000 (in 2007 dollars), based on Packaging Personified's actual expenditures.

The following table summarizes the economic benefit of non compliance Packaging Personified could have enjoyed under each of the three compliance options. The exhibits attached to this report provide greater detail of the economic benefit calculations of these three compliance options.

Compliance Option	Economic Benefit
1. Adjusted Standard	$33,707
2. Install RTO	$119,020
3. Decommission / Relocate press to Michigan	$16,853

DOCUMENTS CONSIDERED

The documents I considered in my analysis include:

- EPA BEN user manual
- Cost estimates prepared by Mostardi Platt Environmental for RTO purchase and annual operating costs
- Correspondence between Illinois EPA and Drinker, Biddle & Reath LLP dated June 12, 2007 and November 24, 2008
- Cases and literature addressing the use of discount rates in enforcement actions

ILLINOIS EPA REPORT

I have reviewed the November 21, 2008 Economic Benefit Analysis report prepared by the the Illinois EPA's analyst, Mr. Gary Styzens. Mr. Styzens estimated an economic benefit of $711,274, an amount which I find to be significantly overstated for several reasons, including:

- Mr. Styzens' analysis fails to consider that Packaging Personified had compliance alternatives in addition to the installation of an RTO, as I have outlined in this report.
- Mr. Styzens fails to consider that the RTO ultimately installed by Packaging Personified was three times larger than the one required to reach compliance so the cost estimate he uses for delayed capital expenditures is unduly high.
- Mr. Styzens incorrectly utilizes an unusually high avoided annual operating cost averaging $86,000 per year that he derived generically rather than researching more accurate costs that match the size of the RTO that Packaging Personified would have installed. The annual avoided costs actually approximate $16,000 per year.

- Mr. Styzens failed to terminate the period of non compliance at the end of 2002 when Packaging Personified decommissioned the press. Instead, he continues to penalize the company for an additional year and then calculates interest on this incorrect benefit amount.

ECONOMIC BENEFIT PENALTY BACKGROUND

The United States Environmental Protection Agency ("EPA") employs a civil penalty program to help ensure that regulated entities comply with environmental regulations. These civil penalty figures are based on the EPA's February 16, 1984, generic penalty policy which was codified in the General Enforcement Policy Compendium as P.T. 1-1 and P.T. 1-2. A copy of this is found as Exhibit 5.

These civil penalties seek to recapture the economic benefit that an entity may have gained from delaying or avoiding compliance with regulations. The EPA holds that economic benefit recapture helps level the economic playing field amongst all regulated entities, serve as incentives to protect the environment and public health, and help deter future violations.

EPA civil penalties have two main components: gravity and economic benefit.

The gravity component reflects the seriousness of the violation while the economic benefit component focuses on the violator's economic gain from noncompliance. This economic benefit can accrue to the violator in three basic ways: (1) delaying necessary pollution control expenditures; (2) avoiding necessary pollution control expenditures; and/or (3) obtaining an illegal competitive advantage.

The EPA designed the BEN computer model in 1984 to calculate the economic benefit from these first two types of economic gain. The EPA has solicited comments from the public on multiple occasions, acknowledging that the actual computer model is still being refined. As such, the EPA provides that experts calculating the economic benefit may use the BEN model or

other analytical tools (e.g. customized computer spreadsheets, calculators) as needed. The EPA is more adamant regarding the methodology for calculating economic benefit, stating in the Federal Register Volume 64, Number 117 dated June 18, 1999, that the EPA believes "that BEN is by far the best approach available for calculating economic benefit derived from delayed and/or avoided costs." A copy of this is found at Exhibit 6.

In addition to the Federal Register, the EPA publishes a BEN User Manual that provides guidance on the theory and methodology for calculating the economic benefit penalty as well as technical computer instructions for using the BEN Model. The EPA BEN User Manual outlines the variables required to calculate economic benefit. It also provides examples of a number of issues that can arise in the calculation of economic benefit, including offsets for byproduct recovery and certain types of good faith expenditures that did not lead to compliance. These examples are explored in more detail in the analysis section of this testimony.

It is important to note that the EPA BEN User Manual clearly distinguishes between the economic benefit and the gravity components of civil penalties. It explicitly states on page A-1 that "economic benefit is "no fault" in nature: a defendant need not have deliberately chosen to delay compliance (for financial or any other reasons), or in fact even have been aware of its noncompliance, for it to have accrued the economic benefit of noncompliance." It goes on provide an example on page 4-3 of how certain issues are "legal distinctions that may impact the gravity component but not the economic benefit." The distinction is a significant one and the EPA BEN User Manual highlights it to stress that the two penalty theories are separate and impressions regarding the gravity of the noncompliance should not influence the economic benefit calculation.

EXHIBIT 1

CHRISTOPHER T. MCCLURE

Christopher McClure
Director

Navigant Consulting
30 S. Wacker Drive #3100
Chicago, Illinois 60606

Tel: 312.583.6986

cmcclure@navigantconsulting.com

Professional History

- Navigant Consulting, Inc. 2004 to present
- LECG, LLC 2002 – 2004
- Andersen 1995 - 2002

Education

- M.B.A Kellogg School of Management Northwestern University
- B.S. Accounting/Finance Trinity University

Professional Certifications

- Certified Public Accountant (CPA)
- Certified Fraud Examiner (CFE)
- Certified in Financial Forensics (CFF)

Professional Associations

- Texas Society of CPAs
- AICPA
- ACFE

Christopher McClure is a Director in the Chicago office of Navigant Consulting, Inc. Mr. McClure's work focuses on forensic accounting investigations, insurance related matters, commercial litigation, and product liability matters. He has conducted forensic accounting investigations for numerous SEC registrants and quantified damages in commercial litigation. He has also supervised numerous engagements involving insurance policy analyses, allocation methodologies, economic benefit modeling for EPA negotiations, insurance carrier settlements, and other coverage issues.

Experience

Mr. McClure has been called upon to assist companies with independent investigations related to allegations of stock options backdating, earnings management, revenue recognition violations, and other accounting improprieties. In addition to his knowledge of accounting and general business issues, Mr. McClure has significant experience with various forensic database software packages and other methods of efficiently analyzing and disseminating important content from large populations of emails, electronic files, and recorded phone conversations.

Mr. McClure has developed significant expertise in insurance matters related to asbestos, environmental, other toxic torts. He has managed numerous engagements focused on insurance coverage litigation in various industries including manufacturing, energy, chemical, and utility. He has quantified the damages associated with a number of significant claims for the purposes of negotiating policy commutations, structured settlements, and coverage-in-place agreements, as well as establishing bankruptcy trust funds. Mr. McClure has also quantified damages in the context of business interruption, most recently for clients recovering from the events of the September 11 terrorist attacks on New York.

Mr. McClure also has extensive experience performing allocations of insurance damages to coverage under a variety of methodologies including All Sums, Carter-Wallace, Stonewall, and Owens-Illinois, as well as numerous other permutations. He has used various computer software tools and techniques to calculate and analyze allocation results using different

assumptions for trigger, occurrence, coverage defenses, and other important allocation variables.

Insurance, Environmental, and Product Liability Experience

» Analyzed historic and projected future asbestos liabilities for a boiler manufacturer in bankruptcy. Utilized client data and Manville Trust information to project future liabilities under numerous scenarios. Conducted hundreds of allocation sensitivities considering various product/non-product claim splits, state law changes, trigger periods, and liability amounts. Utilized the analysis in the negotiation of policy buybacks with several U.S. and foreign insurance carriers.

» Engaged by one of the world's largest oil companies to analyze the potential economic benefits resulting from delayed expenditures for environmental protection system implementations at a large refinery. Performed detailed cost modeling of time value of deferred capital expenditures, avoided operational costs, and foregone economic benefits to support client negotiations with the EPA.

» Assisted a Fortune 100 client seeking reimbursement from the US Government for over $100 million in remediation costs under CERCLA. Involved cost compilation, analysis, and presentation to the US Government as well as support of depositions and expert testimony.

» Analyzed historic and future asbestos and environmental exposures for a tire manufacturer for use in policy commutations. Gathered, organized, and allocated damages across hundreds of insurance policies under various scenarios. Conducted archaeology to locate critical insurance policy evidence. Formulated presentations given to the London Market Insurers as well as numerous domestic insurance carriers.

» Developed strategic operating scenarios, analyzed financial damages, and compiled business interruption claim for a World Trade Center banking client impacted by the events of Sept 11, 2001. Reviewed insurance coverage language, collected cost data, modeled lost revenue for various divisions, and developed numerous damage scenarios for use in settlement negotiations.

» Engaged by one of the world's largest petrochemical companies to pursue insurance recovery for historic environmental pollution claims. Involved the accumulation of invoices and creation of a cost database to support over $300 million in remedial expenditures. Also required projection of future cleanup costs at numerous sites as well as analysis of Natural Resource Damages and Property Value Diminution claims.

» Engaged by a major chemical company to review and forecast liabilities for asbestos, silica, and other products claims. Involved a comprehensive review of client's historic production as well as exhaustive corporate history research. Utilized Manville Trust and Nicholson study in the formulation of products and premises liability forecasts. Generated numerous liability scenarios and allocated the damages under several scenarios to client's historic insurance coverage to assist in negotiating a coverage-in-place agreement.

Accounting Investigations & Litigation Experience

» Assisted counsel in the defense of a multi-national professional services firm related to allegations of negligence in the performance of the annual financial audit at a Fortune 100 company at which one of the largest frauds in U.S. history occurred. Involved scrutinizing annual audit workpapers and procedures to fully analyze the complexity of the fraud and build a defense strategy for the services firm.

» Assisted counsel to numerous companies faced with both formal and informal SEC inquiries into historic option granting processes. These engagements involved interviews of company board members and executives, analysis of option granting procedures, and review of hundreds of thousands of emails and electronic documents. The results of these analyses were reported to the SEC, the companies' outside auditors, and the Board of Directors and also used in financial restatements. Remediation plans were also created to assist the companies with improving internal controls.

» Assisted counsel to an SEC registrant with an independent investigation of improper accounting entries and financial reporting errors and manipulations. This engagement focused on the analysis of numerous corporate reserve accounts across multiple years, interviews with management, and the review of over 50,000 emails to identify and quantify amounts for the restatement of the company's financials. The investigation involved significant interaction with the corporate management, auditors, and the SEC.

» Assisted counsel to the audit committee of an SEC registrant with an investigation of accounting, financial reporting, and operational issues raised by a corporate whistleblower. The investigation involved significant interaction with the company's outside auditor, the Illinois Commerce Commission, and the SEC. This engagement also required the analysis and organization of over 60,000 phone call recordings, 50,000 emails, and over 100,000 pages of hardcopy documents.

» Assisted counsel to the seller engaged in a post-acquisition dispute arbitration focusing on the calculation of annual revenue earn-out amounts in accordance with the provisions of the purchase agreement. Involved analyzing buyer's revenue recognition principles and methods for allocating expenses across multiple acquisitions.

» Assisted in the compilation and analysis of the books and records of ten acquisitions performed by an SEC registrant over the last five years. Responsible for identifying material accounting issues and reporting them to the CFO of the company for inclusion in the company's ongoing financial restatement process.

» Evaluated the financial implications of a multi-billion dollar international merger for one of the world's largest retailers – included revenue and cash flow projections, operational analyses, and sensitivity modeling that considered currency fluctuations and the impact of political and economic policy changes

» Engaged by a Fortune 50 energy firm to assist in the redesign of its executive staff following a major merger. Involved mapping and redesigning accounting and financial processes and internal controls and working with corporate executives to identify opportunities for greater efficiency. Project resulted in annual savings of over $200 million for the client.

Publications and Speaking Engagements

- Author of *"Coping with FASB Interpretation No. 47 – Accounting for Conditional Asset Retirement Obligations"*. American Bar Association, Fall 2007.
- Presenter of *"White Collar Investigations Update: Trends and Best Practices"* – AICPA webinar series, April 2008.
- Author of "Gatekeepers: *A Balancing Act for Corporate Counsel"* – Navigant Consulting Inc. Investigations Quarterly Magazine, Summer 2008.

Testimony / Alternative Dispute Resolution Experience:

- Provided deposition testimony and testimony at the Pollution Control Board hearing in 2008 in an Illinois EPA economic benefit penalty matter. (People of the State of Illinois v. Toyal America, Inc. f/k/a Alcan-Toyo America, Inc., PCB 2000-211)

Packaging Personified, Inc. Exhibit 2

Economic Benefit Calculation

Scenario: 1

Scenario Description **Adjusted Standard**

		A	B	C	D	E	F	G	H	I	J	K
Month - Year	Period	Expenditures	Avoided Annual Costs	Lost Annual Benefits	Depreciation	Total Annual Costs/ (Benefits)	Tax Adjust-ment @37.0%	After Tax Annual Cost/ (Benefit)	Actual Spending	Cumulative Deferred Spending	Applicable Interest Rate	Time Value of Deferred Spending
1997	1	0	28,258	0	0	28,258	(10,455)	17,803	0	17,803	5.63%	$1,002
1998	2	0	0	0	0	0	0	0	0	18,805	5.05%	$950
1999	3	0	0	0	0	0	0	0	0	19,755	5.08%	$1,004
2000	4	0	0	0	0	0	0	0	0	20,759	6.11%	$1,268
2001	5	0	0	0	0	0	0	0	0	22,027	3.49%	$769
2002	6	0	0	0	0	0	0	0	0	22,796	2.00%	$456
		0	28,258	0	0	28,258	(10,455)	17,803	0			$5,449

Total Avoided Operation Costs/(Benefits) $28,258 **L**

Total Economic Benefit / (Detriment) $33,707 **M**

KEY

- **A** The estimated capital expenditures deflated to 1997.
- **B** Costs permanently avoided by delaying compliance
- **C** Estimate of the monthly lost benefit not realized by delaying compliance
- **D** Depreciation that would have been taken on amount in column A
- **E** Sum of B+C+D
- **F** Tax impact of item E
- **G** E+F
- **H** Actual dollars spent
- **I** I = Previous (I + K) + Current (A + G - H)
- **J** Risk-free T-Bill rate to inflate dollars to the date of compliance
- **K** Amount earned on the cumulative deferred spending
- **L** Sum of columns B+C, represents the total avoided cost or (benefit) from the delay
- **M** Total economic benefit (delayed + avoided)

Packaging Personified, Inc.
Economic Benefit Calculation

Exhibit 2

Scenario: 2
Scenario Description Installation of a Regenerative Thermal Oxidizer (RTO)

		A	B	C	D	E	F	G	H	I	J	K
Month - Year	Period	Expenditures	Avoided Annual Costs	Lost Annual Benefits	Depreciation	Total Annual Costs/ (Benefits)	Tax Adjust-ment @ 37.0%	After Tax Annual Cost/ (Benefit)	Actual Spending	Cumulative Deferred Spending	Applicable Interest Rate	Time Value of Deferred Spending
1997	1	70,645	15,412	0	(9,419)	5,993	(2,217)	3,776	0	74,421	5.63%	$4,190
1998	2	0	15,504	0	(9,419)	6,085	(2,251)	3,834	0	82,445	5.05%	$4,163
1999	3	0	15,597	0	(9,419)	6,178	(2,286)	3,892	0	90,500	5.08%	$4,597
2000	4	0	15,691	0	(9,419)	6,272	(2,321)	3,951	0	99,048	6.11%	$6,052
2001	5	0	15,785	0	(9,419)	6,366	(2,355)	4,011	0	109,111	3.49%	$3,808
2002	6	0	15,880	0	(9,419)	6,461	(2,390)	4,071	0	116,989	2.00%	$2,340
		70,645	93,870	0	(56,516)	37,354	(13,820)	23,534	0			$25,150

Total Avoided Operation Costs/(Benefits) $93,870 **L**

Total Economic Benefit / (Detriment) $119,020 **M**

KEY

- **A** The estimated capital expenditures deflated to 1997.
- **B** Costs permanently avoided by delaying compliance
- **C** Estimate of the monthly lost benefit not realized by delaying compliance
- **D** Depreciation that would have been taken on amount in column A
- **E** Sum of B+C+D
- **F** Tax impact of item E
- **G** E+F
- **H** Actual dollars spent
- **I** I = Previous (I + K) + Current (A + G - H)
- **J** Risk-free T-Bill rate to inflate dollars to the date of compliance
- **K** Amount earned on the cumulative deferred spending
- **L** Sum of columns B+C, represents the total avoided cost or (benefit) from the delay
- **M** Total economic benefit (delayed + avoided)

Packaging Personified, Inc.
Economic Benefit Calculation

Scenario: 3
Scenario Description Decommission / Relocate Press

		A	B	C	D	E	F	G	H	I	J	K
Month - Year	Period	Expenditures	Avoided Annual Costs	Lost Annual Benefits	Depreciation	Total Annual Costs/ (Benefits)	Tax Adjust-ment @ 37.0%	After Tax Annual Cost/ (Benefit)	Actual Spending	Cumulative Deferred Spending	Applicable Interest Rate	Time Value of Deferred Spending
1997	1	0	14,129	0	0	14,129	(5,228)	8,901	0	8,901	5.63%	$501
1998	2	0	0	0	0	0	0	0	0	9,402	5.05%	$475
1999	3	0	0	0	0	0	0	0	0	9,877	5.08%	$502
2000	4	0	0	0	0	0	0	0	0	10,379	6.11%	$634
2001	5	0	0	0	0	0	0	0	0	11,013	3.49%	$384
2002	6	0	0	0	0	0	0	0	0	11,397	2.00%	$228
		0	14,129	0	0	14,129	(5,228)	8,901	0			$2,724

Total Avoided Operation Costs/(Benefits) $14,129 **L**

Total Economic Benefit / (Detriment) $16,853 **M**

KEY

- **A** The estimated capital expenditures deflated to 1997.
- **B** Costs permanently avoided by delaying compliance
- **C** Estimate of the monthly lost benefit not realized by delaying compliance
- **D** Depreciation that would have been taken on amount in column A
- **E** Sum of B+C+D
- **F** Tax impact of item E
- **G** E+F
- **H** Actual dollars spent
- **I** I = Previous (I + K) + Current (A + G - H)
- **J** Risk-free T-Bill rate to inflate dollars to the date of compliance
- **K** Amount earned on the cumulative deferred spending
- **L** Sum of columns B+C, represents the total avoided cost or (benefit) from the delay
- **M** Total economic benefit (delayed + avoided)

Packaging Personified, Inc

Economic Benefit Calculation

Inflation Calculations

PCI Inflation 0.60%

(Avg 1996-2002)

Year	Scenario 1 Adjusted Standard	Scenario 2 Installation of a Regenerative Thermal Oxidizer (RTO)		Scenario 3 Decommission / Relocate Press
	One-Time Expenditure	One-Time Expenditure	Annual Recurring Cost	One-Time Expenditure
2007	$ 30,000	$ 75,000	$ 16,362	$ 15,000
2006	$ 29,821	$ 74,553	$ 16,264	$ 14,911
2005	$ 29,643	$ 74,108	$ 16,167	$ 14,822
2004	$ 29,466	$ 73,666	$ 16,071	$ 14,733
2003	$ 29,291	$ 73,227	$ 15,975	$ 14,645
2002	$ 29,116	$ 72,790	$ 15,880	$ 14,558
2001	$ 28,942	$ 72,356	$ 15,785	$ 14,471
2000	$ 28,770	$ 71,924	$ 15,691	$ 14,385
1999	$ 28,598	$ 71,495	$ 15,597	$ 14,299
1998	$ 28,428	$ 71,069	$ 15,504	$ 14,214
1997	$ 28,258	$ 70,645	$ 15,412	$ 14,129

PCI Average		
Year	PCI Index	Percentage
2002	395.6	0.33%
2001	394.3	0.05%
2000	394.1	0.90%
1999	390.6	0.28%
1998	389.5	0.78%
1997	386.5	1.26%
1996	381.7	
	Average	**0.60%**

LEXSEE 72 F. SUPP. 2D 810

Caution
As of: Sep 05, 2008

UNITED STATES OF AMERICA, Plaintiff, v. WCI STEEL, INC., Defendant.

CASE NO. 4:98-CV-1082

UNITED STATES DISTRICT COURT FOR THE NORTHERN DISTRICT OF OHIO, EASTERN DIVISION

72 F. Supp. 2d 810; 1999 U.S. Dist. LEXIS 17436; 49 ERC (BNA) 1685; 30 ELR 20169

October 22, 1999, Decided
October 22, 1999, Filed

DISPOSITION: [**1] United States request for injunctive relief denied.

CASE SUMMARY:

PROCEDURAL POSTURE: Plaintiff United States filed a motion for injunctive relief against defendant steel company, alleging that defendant was subject to the Resource Conservation and Recovery Act, 42 U.S.C.S. § 6901 et seq., because it treated, stored, and disposed of hazardous waste at its steelmaking facility without a permit or interim status.

OVERVIEW: Plaintiff United States filed a motion for injunctive relief against defendant steel company, alleging that defendant was subject to Resource Conservation and Recovery Act (RCRA), 42 U.S.C.S. § 6901 et seq., because it treated, stored, and disposed of hazardous waste at its steelmaking facility without a permit or interim status. It was undisputed that defendant had neither a permit nor interim status, plus the court found that the wastewater treated, stored, and disposed of by defendant exhibited the hazardous waste characteristic of corrosivity; thereby, subjecting defendant to RCRA. In imposing a $ 1 million civil penalty upon defendant, the court considered the fact that defendant had made efforts to reduce pollution, no harm to human health or the environment had resulted, and plaintiff had unduly delayed the litigation. Moreover, because plaintiff failed to show any imminent threat to public health or the environment, its motion for injunctive relief was denied.

OUTCOME: The court denied plaintiff United States' motion for injunctive relief, because plaintiff failed to show any imminent threat to public health or the environment resulting from defendant steel company's noncompliance with the Resource Conservation and Recovery Act; however, it did impose upon defendant a civil penalty of $ 1 million.

CORE TERMS: pond, hazardous waste, wastewater, sampling, hazardous, steel, s.u, influent, waste management, probe, treatment plant, measurement, impoundment, corrosivity, surface, corrosive, sludge, economic benefit, closure, acid, grab, meter, solid wastes, inspection, box, pickle, liquor, clean, injunctive, disposed

LexisNexis(R) Headnotes

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Permits
Environmental Law > Hazardous Wastes & Toxic Substances > Treatment, Storage & Disposal
[HN1] 42 U.S.C.S. § 6925(a) prohibits the operation of any facility that treats, stores, or disposes of hazardous wastes, except in accordance with a permit. Moreover, a party receiving a permit to store or dispose of hazardous waste must thereafter comply with the requirements of the permits.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Enforcement > Civil Penalties
Environmental Law > Solid Wastes > Resource Recovery & Recycling
[HN2] If certain requirements are met, the Resource Conservation and Recovery Act, 42 U.S.C.S. § 6901 et seq., allows states to operate hazardous waste regulatory programs in lieu of the federal program. 42 U.S.C.S. § 6926(b). Even where a state is given authority to operate such a regulatory program, the United States retains the right to enforce the state-authorized programs. 42 U.S.C.S. § 6928(a)(2).

Civil Procedure > Remedies > Injunctions > Permanent Injunctions
Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Enforcement > Injunctive Relief
Environmental Law > Solid Wastes > Resource Recovery & Recycling
[HN3] Under 42 U.S.C.S. § 6928(a), the United States may file a civil action in federal district court to obtain appropriate relief, including a temporary or permanent injunction upon obtaining information that any person has violated or is violating any requirement of the Resource Conservation and Recovery Act, 42 U.S.C.S. § 6901 et seq. If a violation is shown, 42 U.S.C.S. § 6928(g) provides for a civil penalty in an amount not to exceed $ 27,500 per day of noncompliance for each violation.

Civil Procedure > Pretrial Matters > General Overview
Environmental Law > Solid Wastes > Resource Recovery & Recycling
Governments > Legislation > Statutes of Limitations > Pleading & Proof
[HN4] The United States has the burden to establish each of the elements of liability under the Resource Conservation and Recovery Act, 42 U.S.C.S. § 6901 et seq. In showing liability, the applicable statute of limitations, 28 U.S.C.S. § 2462, stops any claim for penalty for a violation before May 11, 1993.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > General Overview
Environmental Law > Hazardous Wastes & Toxic Substances > Treatment, Storage & Disposal
Environmental Law > Solid Wastes > Resource Recovery & Recycling
[HN5] To establish a violation of the Resource Conservation and Recovery Act (RCRA), 42 U.S.C.S. § 6901 et seq., the United States must prove four general elements: (1) that the defendant is a "person" within the meaning of the RCRA; (2) that the defendant has a "facility" within the meaning of the RCRA; (3) that the defendant did not have a permit or interim status for the treatment, storage, or disposal of hazardous waste; and (4) that the defendant treated, stored, or disposed of hazardous waste.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Identification & Listing of Hazardous Wastes
Environmental Law > Solid Wastes > Resource Recovery & Recycling
[HN6] The Resource Conservation and Recovery Act (RCRA), 42 U.S.C.S. § 6901 et seq., controls the release of a "hazardous waste." If a substance exhibits certain characteristics, industrial wastewaters are subject to regulation under the RCRA.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Identification & Listing of Hazardous Wastes
[HN7] 42 U.S.C.S. § 6921 provides two ways in which a waste will be considered "hazardous." First, a waste will be classified as "hazardous" where the Environmental Protection Agency (EPA) has specifically listed the waste as hazardous. By regulation, the EPA has listed a number of wastes as hazardous. 40 C.F.R. §§ 261.31-261.33 (1989). The EPA will also classify a waste as "hazardous" if it has one or more of the characteristics of ignitability, corrosivity, reactivity, or toxicity. 40 C.F.R. §§ 261.21-.261.24.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Identification & Listing of Hazardous Wastes
[HN8] Corrosiveness is the property that enables a substance to dissolve material with which it comes in contact. Improperly managed corrosive wastes can pose a substantial present or potential danger to human health and the environment. Under 40 C.F.R. § 261.22 and Ohio Admin. Code § 3745-51-22, a waste is corrosive if it is aqueous and has a pH of two standard units or less, or greater than or equal to 12.5 standard units. Where a surface impoundment contains aqueous water with a pH of two standard units or less, on at least one occasion, the water in the surface impoundment is hazardous waste.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Identification & Listing of Hazardous Wastes
[HN9] See 40 C.F.R. § 261.22(a)(1).

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Identification & Listing of Hazardous Wastes
Environmental Law > Solid Wastes > Resource Recovery & Recycling
[HN10] Under the regulations, the United States must show that a defendant violated the Resource Conservation and Recovery Act (RCRA), 42 U.S.C.S. § 6901 et seq., via a "representative sample" of the water. RCRA regulations define "representative sample" as a sample of a universe or whole (e.g., waste pile, lagoon, groundwater) which can be expected to exhibit the average properties of the universe or whole. 40 C.F.R. § 260.10.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Enforcement > Criminal Prosecutions
[HN11] While an Environmental Protection Agency-approved test of a material will be persuasive evidence as to whether the material is hazardous waste, the United States is not required to prove this element through test data.

Environmental Law > Hazardous Wastes & Toxic Substances > CERCLA & Superfund > General Overview
Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > General Overview
[HN12] Failure to adhere to Environmental Protection Agency (EPA)-approved test methods does not stop a finding of hazardous substances. Furthermore, failure to rigidly adhere to EPA-approved test methods does not render the sampling evidence inadmissible. Any deviation from EPA guidelines goes to the weight of the evidence and not its admissibility.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Identification & Listing of Hazardous Wastes
Environmental Law > Solid Wastes > Resource Recovery & Recycling
[HN13] To show that wastewater contains hazardous substances and is, as a result, subject to the cradle-to-grave restrictions of the Resource Conservation and Recovery Act, 42 U.S.C.S. § 6901 et seq., the United States must show, via representative samples, only that the surface impoundment contained aqueous water with a pH of two standard units or less, on at least one occasion.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > General Overview
[HN14] In order to be valid, sampling must show that it is random, that is, that every unit of the population (e.g., every location in a lagoon used to store a solid waste) has a theoretically equal chance of being sampled and measured, thus ensuring that the sample is representative of the population.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Identification & Listing of Hazardous Wastes
Environmental Law > Solid Wastes > Resource Recovery & Recycling
[HN15] Lime-neutralized spent pickle liquor is exempt from the Resource Conservation and Recovery Act's, 42 U.S.C.S. § 6901 et seq., hazardous waste regulations under the iron and steel industry exemption in 40 C.F.R. § 261.3(c)(2)(ii)(A).

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > General Overview
[HN16] See 40 C.F.R. § 260.10.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Identification & Listing of Hazardous Wastes
Environmental Law > Solid Wastes > Resource Recovery & Recycling
[HN17] Under 42 U.S.C.S. § 6925(a), (e) and Ohio Rev. Code §§ 3734.02(F), 3734.04, the owner and operator of a hazardous waste management unit is prohibited from operating a hazardous waste management unit except in accordance with a permit issued pursuant to the Resource Conservation Recovery Act, 42 U.S.C.S. § 6901 et seq., unless the facility has interim status.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Enforcement > Civil Penalties
[HN18] Under 42 U.S.C.S. § 6928(a) and 40 C.F.R. § 270.1(b), a party may not store hazardous waste in a surface impoundment without a permit or interim status.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > General Overview

[HN19] Under 42 U.S.C.S. § 6925(j), surface impoundments existing on November 8, 1984, were required to meet minimum technological requirements unless granted an exemption by the Environmental Protection Agency or the state.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > General Overview

[HN20] Under 40 C.F.R. § 264.112 and Ohio Admin. Code § 3745-55-12, the owner or operator of a hazardous waste management unit is required to have a written closure plan. The closure plan must identify the steps needed to perform a partial or final closure of the facility.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > General Overview

Environmental Law > Water Quality > Safe Drinking Water Act > National Drinking Water Regulations

[HN21] Under 40 C.F. R. §§ 264.140 - 264.151 and Ohio Admin. Code §§ 3745-55-40 to 3745-55-51, the owner or operator of a hazardous waste management facility is required to have a detailed written estimate in current dollars of the cost of closing hazardous waste management units.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > General Overview

Real Property Law > Water Rights > Groundwater

[HN22] The owner or operator of a surface impoundment is required to install, operate, and maintain a groundwater monitoring system which satisfies the criteria contained at 40 C.F.R. pt. 264, subpt. F, and Ohio Admin. Code §§ 3745-54-90 to 3745-54-99, 3745-55-01 to 3745-55-02.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Enforcement > Civil Penalties

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Enforcement > Injunctive Relief

Environmental Law > Solid Wastes > Resource Recovery & Recycling

[HN23] Under 42 U.S.C.S. § 6928(a), (g), a United States district court has the power to enjoin a defendant and to impose civil penalties for each violation of the Resource Conservation and Recovery Act, 42 U.S.C.S. § 6901 et seq., and the hazardous waste management program for the state. The district court can impose penalties of up to $ 25,000 per day for each day of violation prior to January 30, 1997 and $ 27,500 for each day of violation thereafter. In determining the appropriate civil penalties, the district court considers the seriousness of the violation, what efforts were made to comply with regulations, the harm caused by the violation, the economic benefit derived from noncompliance, the defendant's ability to pay, the United States' conduct, and the clarity of the obligation involved. In determining the penalty, the district court exercises its discretion.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Enforcement > Civil Penalties

Environmental Law > Solid Wastes > Resource Recovery & Recycling

[HN24] Where a proven violation of the Resource Conservation and Recovery Act, 42 U.S.C.S. § 6901 et seq., does not result in the creation of a situation with the potential to seriously harm the environment, civil penalties have been substantially reduced.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > General Overview

Environmental Law > Solid Wastes > Resource Recovery & Recycling

Governments > Legislation > Statutes of Limitations > Time Limitations

[HN25] The Resource Conservation and Recovery Act, 42 U.S.C.S. § 6901 et seq., encompasses both current and continuing violations, even if the latter originated in activities occurring before the applicable date of the statute. However, the assessment of a civil fine for a violation occurring prior to May 11, 1993, is limited by the federal statute of limitations found in 28 U.S.C.S. § 2462.

Environmental Law > Litigation & Administrative Proceedings > General Overview

Governments > Legislation > Statutes of Limitations > Time Limitations

[HN26] See 28 U.S.C.S. § 2462.

Environmental Law > Litigation & Administrative Proceedings > General Overview

[HN27] Courts shall respond to the Environmental Protection Agency's undue agency delay by reducing penalties in an enforcement action in order to counteract any incentive the agency might have to place itself in a superior litigating position.

Civil Procedure > Equity > Adequate Remedy at Law
Civil Procedure > Remedies > Injunctions > Elements > Irreparable Harm
Environmental Law > Litigation & Administrative Proceedings > General Overview
[HN28] Normally, to obtain injunctive relief, a party must prove that there is no adequate remedy at law, that the plaintiff may suffer an irreparable injury if an injunction is not granted, and that the balance of the equities justifies an injunction. However, when the United States brings the action and shows that an activity endangers public health, injunctive relief is proper without undertaking a balancing of the equities. In cases of public health legislation, the emphasis shifts from consideration of irreparable injury to concern for the general public interest.

Environmental Law > Hazardous Wastes & Toxic Substances > Resource Conservation & Recovery Act > Enforcement > Injunctive Relief
Environmental Law > Litigation & Administrative Proceedings > General Overview
Environmental Law > Solid Wastes > Resource Recovery & Recycling
[HN29] In deciding whether the strong remedy of injunctive relief shall be given, a United States district court is most concerned with whether this relief is necessary to stop the danger that might result from violations of the Resource Conservation and Recovery Act, 42 U.S.C.S. § 6901 et seq.

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JUDGES: Hon. James S. Gwin, U.S. District Court Judge.

OPINION BY: James S. Gwin

OPINION

[*812] FINDINGS OF FACT AND CONCLUSIONS OF LAW

In this action, the Plaintiff United States alleges that three wastewater ponds at [*813] Defendant WCI Steel's Warren, Ohio steelmaking facility (Ponds 5, 6, and 6A) are hazardous waste units, and as such are subject to regulation under the Resource Conservation and Recovery Act ("RCRA"), [**2] 42 U.S.C. § 6901 *et seq.* As grounds for this allegation, the United States claims that Ponds 5, 6, and 6A once contained wastewater having a pH [1] of 2.0 standard units ("s.u.") or lower, and thus had a corrosive characteristic. [2]

1 The measure of pH provides an estimate of the acidic agent (hydrogen ion) and the basic agent (hydroxide ion).

2 The United States' complaint alleges, in part:

> 24. One or more of the surface impoundments at the facility, including Ponds 5, 6 and 6A, have contained wastewaters which exhibited a pH of 2 or less during the time period relevant to this Complaint.
>
> 25. Wastewaters flowing into, contained in, or flowing out of Ponds 5, 6 and 6A have exhibited the characteristic of corrosivity and are a hazardous waste within the meaning of 40 C.F.R. § 261.20 and 261.22.
>
> 26. Ponds 5, 6 and 6A at the facility are hazardous waste management units as defined by 40 C.F.R. § 260.10, and O.A.C. § 3747-50-10(A)(49) and are subject to regulation as hazardous waste management units subject to the provisions of RCRA and the O.A.C.
>
> Complaint, PP 24-26.

[**3] Plaintiff United States filed this action on May 11, 1998. To establish WCI's use of corrosive substances, the United States principally relies upon sampling it did in May and June 1993 and upon data supplied by WCI in early 1994.

The parties having waived a jury, this matter went to trial before this Court. After observing the demeanor of the witnesses and considering the parties' evidence and arguments, the Court makes the following findings of fact and conclusions of law.

I. FINDINGS OF FACT

A. History of WCI Steel

The Defendant WCI Steel, Inc. ("WCI") is an Ohio corporation with its principal place of business at 1040 Pine Avenue, Warren, Ohio. [3] At this facility, Defendant WCI operates the last remaining integrated steel mill in the Mahoning River Valley.

> 3 All of the United States' claims relate to WCI's Warren facility.

WCI Warren facility manufactures hot rolled strip steel, pickled and oiled hot rolled steel strip, cold rolled steel, and coated flat steel products. Employing approximately 2,200 [**4] employees, WCI is the largest steel employer in the Mahoning Valley.

Steel production began at the Warren facility in 1912. Beginning in the 1930s, Republic Steel Corporation owned the facility. In 1984, Republic Steel Corporation merged with J&L Steel Corporation to form LTV Steel Company. In 1988, LTV Steel Company went into bankruptcy. With little potential to operate profitably, the bankruptcy trustee decided to sell the Warren facility to Defendant WCI for an insignificant price compared with the facility's physical assets. [4]

> 4 On August 31, 1988, Warren Consolidated Industries, Inc., acquired the facility from LTV Steel Company. In December 1991, Warren Consolidated Industries, Inc. changed its corporate name to WCI Steel, Inc.

In August 1988, Defendant WCI purchased the Warren facility during a time of major decline in United States integrated steelmaking production. [5] By saving the facility from shutdown, WCI greatly benefitted its workers and the Warren, Ohio, community.

> 5 Product had declined by nearly 50% in a decade. The year WCI purchased the Warren facility marked the seventh consecutive year of loss for the steel industry.

[**5] After purchasing the Warren facility, Defendant WCI made major investments in production equipment and facilities. WCI spent more than $ 300 million on capital improvements. These capital expenditures also reduced the amounts of pollution.

[*814] B. Wastewater System

At its Warren Ohio, facility, WCI has a system for the collection and treatment of wastewater generated in its steel production. The WCI steel facility first collects wastewater from manufacturing areas. This wastewater is then distributed to Pond 5 through a system of underground sewers, pumps, and pipes.

After settling and oil separation processes take place in Pond 5, WCI conveys the wastewater to Pond 6. From Pond 6, WCI pumps the wastewater across the Mahoning River to a central treatment plant.

In 1986, LTV installed Pond 6A to intercept and collect seepage from Pond 6 before it reached the Mahoning River. The seepage collected in Pond 6A is pumped back into Pond 6.

WCI primarily intends the pond system to equalize flow to the central treatment plant, to give storm water surge protection, and to allow the skimming of a substantial portion of oil from the wastewater. Taken together, the areal extent of the Ponds is [**6] slightly more than one acre.

This wastewater treatment system was constructed before WCI purchased the Warren facility in 1988. Ponds 5 and 6 have been in use at the Defendant's facility since before 1950. Pond 6A was added in 1986. Ponds 5, 6, and 6A have been in continuous use to the current date.

Ponds 5, 6, and 6A are each unlined earthen surface impoundments. [6] At relevant times, these surface impoundments were not equipped with impermeable liners.

> 6 40 C.F.R. § 260.10, defines a "surface impoundment" as:
>
> > a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials), which is designed to hold an accumulation of liquid wastes of wastes containing free liquids, and which is not an injection well. Examples of surface impoundments are holding, storage, settling, and aeration pits, ponds and lagoons.

Spent pickle liquor is listed by U.S. EPA as a corrosive [**7] and toxic hazardous waste under RCRA regulations at 40 C.F.R. § 261.32. However, if the acid was

neutralized by the addition of lime, then the pickle liquor would be exempt from RCRA's hazardous waste regulations under the iron and steel industry exemption in 40 C.F.R. § 261.3(c)(2)(ii)(A). [7]

7 40 CFR § 261.3(c)(2)(ii) provides, in part:

(ii) The following solid wastes are not hazardous even though they are generated from the treatment, storage, or disposal of a hazardous waste, unless they exhibit one or more of the characteristics of hazardous waste:

(A) Waste pickle liquor sludge generated by lime stabilization of spent pickle liquor from the iron and steel industry (SIC Codes 331 and 332).

By its nature, the steel industry often uses corrosive materials. WCI uses spent hydrochloric pickling acids, acidic rinse waters, and acidic fume scrubber wastewaters. Occasionally, WCI would inadvertently release quantities of these substances. When such spills occurred, they more often occurred near the [**8] picklers than anywhere else. The picklers provided secondary containment for the acid tubs, designed to retain acid leaks or spills. WCI experienced leaks from the acid tubs on an infrequent basis. When such leaks occurred, WCI sought to isolate and neutralize the spilled acid, or "pickle liquor."

Before 1993, WCI used a procedure of manually adding lime to the wastewaters when the wastewater pH fell to between 3 and 4 s.u. as measured by the influent probe at the central treatment plant. Under this procedure, employees would add a certain number of 50-pound bags of lime to the wastewater. As to this decision, Environmental Engineer Richard Gradishar usually decided how many bags to add based upon the pH of the wastewater. However, WCI did not conduct any testing to learn whether the lime succeeded in neutralizing the acid.

[*815] In the early 1990s, WCI considered replacing Ponds 5, 6, and 6A with a second-hand four million gallon above-ground tank. WCI obtained a permit from the EPA to install the tank. After obtaining this permit, WCI discovered that the tank was no longer in usable condition. Defendant WCI therefore did not complete the project.

C. History of Environmental Review

[**9] With this action, the Plaintiff United States alleges that WCI was subject to RCRA because it dealt with hazardous substances without a permit. Defendant WCI does not have a permit issued pursuant to 42 U.S.C. §§ 6925 and 6926 to manage, treat, or store hazardous wastes in Ponds 5, 6, and 6A. Nor does WCI qualify for interim status under § 6925, which would temporarily exempt WCI from the permit requirement. [8]

8 In order to qualify for such interim status, a facility had to demonstrate that: 1) it was in existence on November 19, 1980; 2) it had complied with Section 3010(a) of RCRA concerning notification of hazardous waste activity; and 3) it had made an application for a permit, Section 3005(e) of RCRA, 42 U.S.C. § 6925(e). Here, WCI neither provided notice of its hazardous waste activity nor made an application for a permit.

Shortly after purchasing the WCI facility in 1988, Defendant WCI applied for a National Pollutant Discharge Elimination System Permit. [**10] After approving this application, the Ohio EPA allowed WCI to use Ponds 5, 6, and 6A as sedimentation units under the Clean Water Act. However, the permit did not authorize WCI to treat, store, or dispose of hazardous wastes in Ponds 5, 6, or 6A.

Defendant WCI next applied for and received an EPA Part B permit, authorizing the storage of spent pickle liquor processed through tanks. The EPA Part B permit required WCI to manage hazardous waste only according to the permit's provisions. The Part B permit forbade any management of hazardous waste not authorized by the permit or otherwise exempted by law. In particular, the Part B permit did not authorize WCI to treat, store or dispose of spent pickle liquor or corrosive characteristic wastes in Ponds 5, 6, or 6A.

As part of its Part B permit, Defendant WCI installed groundwater monitoring wells near Ponds 5, 6, and 6A in April 1998. The results from these wells do not indicate that the Ponds adversely affect the groundwater.

Within Ohio, the Ohio EPA administers the RCRA hazardous waste management program as the U.S. EPA's delegee under authorization by the U.S. EPA. [9] As the U.S. EPA's authorized delegee, the Ohio EPA had authority [**11] to inspect WCI's facility and to decide whether WCI met the standards of RCRA and analogous Ohio law.

9 On June 30, 1989, the Ohio EPA was granted final authorization to administer and enforce the RCRA program as the U.S. EPA's authorized delegee pursuant to Section 3006 of RCRA.

Since 1981, the Ohio EPA has conducted at least twelve hazardous waste compliance inspections of the facility. In conducting these inspections, the Ohio EPA had access to all WCI facilities. At the time of the inspections, WCI told the Ohio EPA that these surface impoundments were used as solid waste management

units for waste waters from the cold rolling, coated products, and pickling operations. [10] After conducting these reviews, the Ohio EPA has never alleged or determined that the Ponds were hazardous waste units under RCRA.

10 Testimony of Ohio EPA employee Kristen Switzer at 27-28.

[**12] II. Sampling

A. Consultant Sampling

As indicated, the Plaintiff United States alleges that WCI handled corrosive wastes that were hazardous. Because it has scant sampling data of its own, the United States [*816] relies upon studies undertaken by others at various times.

Defendant WCI employed engineers who took samples on at least two occasions. On June 20, 1989, Duncan, Lagnese & Associates conducted hourly sampling of the wastewater in the surface impoundments. [11] Of twenty-four grab samples collected by these engineers, twenty-one had a pH value of 2.0 s.u. or below. These samples were not taken as part of a sampling plan of the whole ponds.

11 One sample was gathered every hour for twenty-four hours.

In 1990, WCI's contractor, Remcor, Inc., sampled the sludges in Ponds 5 and 6 following a formal sampling plan. After conducting this sampling, Remcor found the sludges were not corrosive or hazardous.

In October 1993, engineers Killam Associates conducted a study for WCI. While doing this study, Killam collected [**13] three grab samples from the bosh box that channels wastewater to the surface impoundments. The three samples collected by Killam had pH values of 1.3, 1.7 and 2.0 s.u., respectively. After completing this sampling of the bosh box, Killam Associates gave the opinion that the pH of the wastewater in the surface impoundments was between 1.9 and 2.0 s.u. These Killam Associates samples were not taken as part of a sampling plan that sought to find the average properties of the whole ponds.

B. 1993 U.S. EPA Multimedia Inspection

Beginning on May 12, 1993, the U.S. EPA conducted a "multimedia" inspection of WCI's facility under the Clean Water Act, the Clean Air Act, RCRA, and the Toxic Substances Control Act. During this inspection, the U.S. EPA collected a grab sample of wastewater being pumped from Pond 6A to Pond 6. U.S. EPA took the sample from the flow of the wastewater as it entered Pond 6. The field measurements of this sample revealed a pH of 1.81 s.u., below the regulatory limit of 2.0 s.u.

On June 15, 1993, the U.S. EPA inspectors returned and took another grab sample of water from Pond 6A. The sample's pH was above 2.0 s.u.

During this June 1993 inspection, the U.S. EPA also [**14] collected a sample of wastewater from a process that uses acid pickle liquor to treat steel. The U.S. EPA field measurements of this sample showed a pH of 1.65 s.u. The U.S. EPA also collected a grab sample from wastewater flowing from Pond 6 at the point where it commingles with wastewater from the Basic Oxygen Furnace. The field measurements of the sample showed a pH of 1.67 s.u.

C. Central Treatment Plant Aeration Influent Probe

WCI's wastewaters are pumped from Pond 6 to an inlet box outside the central treatment plant. In support of its claim that WCI's wastewater was corrosive, the United States principally relies upon WCI's own pH readings taken at the influent probe outside the central treatment plant.

While EPA regulations did not require WCI to monitor the pH at the central treatment plant, it nonetheless did so. To treat its wastewater, WCI has measured the pH of the wastewater as it flows through the central treatment plant. At this point, the influent box receives wastewater from Pond 6 and other process sources.

To make these measurements, WCI uses several pH probes that continuously monitor the pH of the wastewater as it flows through the central treatment plant. [**15] WCI put one inflow pH probe at the aeration influent box.

The pH meter at the aeration influent box measures the pH of the wastewater as it flows from Pond 6 into the central treatment plant. WCI submerges this probe in the flow of the wastewater as it enters the aeration influent box. [12]

12 The pH meter used by WCI to measure the pH of Pond 6 influent wastewater is a glass membrane electrode selective for hydrogen ion in combination with a pH meter. The pH meter used by WCI to measure Pond 6 influent pH is equipped with a microprocessor that handles the mathematics of the measurement. The pH meter used by WCI to measure the pH of Pond 6 influent wastewater displays the numerical pH value.

[*817] At least once a week, WCI Combustion Department personnel calibrate the pH meter used to measure the pH of Pond 6 influent wastewater. Defendant

WCI argues that the method used to calibrate this probe resulted in inaccurate.

EPA guidelines recommend a two-standard calibration technique to calibrate pH meters. To calibrate [**16] the probe, the Combustion Department personnel use two buffer solutions with specified pH. Typically, they use buffer solutions with pH of 2.0 and 4.0. In contrast, pH calibration is better done using a neutral buffer solution of 7.0 with a second solution with pH of either 4.0 or 10.0. It is unlikely that the maintenance crew could achieve completely accurate probe calibrations using the buffer solutions with pH of 2.0 and 4.0.

Amounts of oil and grease were usually in the wastewater influent as it enters the central treatment plant. The oil and grease can quickly coat a pH probe, rendering its readings less accurate. Oil and grease can foul a probe if they are present in sufficient concentration.

Because of the presence of oil and grease in the wastewater flowing into the central treatment plant, plant operators cleaned the influent pH probe by removing the submerged probe from the flow of the wastewater and dipping the probe in acid. The operators cleaned the influent pH probe in an acid solution once per shift, or three times per day. Though a brief exposure to an acid solution can effectively clean mineral deposits from a pH electrode, it is not an effective cleaning agent for [**17] oil and grease deposits. These problems make the influent probe readings less accurate.

Defendant WCI recorded the readings from the pH meters at the aeration influent box every two hours from September 1, 1988 to February 22, 1995, and every hour from February 23, 1995 to July 31, 1998.

Between September 1, 1988 and July 31, 1998, WCI's central treatment plant operators recorded more than 11,000 pH values of 2.0 s.u. or less for Pond 6 wastewater entering the central treatment plant. Such readings occurred on 1,361 different days. At least one reading of 1.7 s.u. or less occurred on 577 different days. Also, the central treatment plant operators recorded at least 31 pH measurements of 12.5 s.u. or above for Pond 6 wastewater entering the central treatment plant. Taken as a whole, these measurements did not significantly vary from 1989 to December 1993.

In December 1993, WCI installed an automated lime slurry injection system at the No. 9 Lift Station. For a period, this lime injection system reduced, but did not completely stop pH readings of 2.0 s.u. or less. [13] The system has now eliminated measurements with a pH of 2.0 s.u. or less at the influent probe to the central treatment [**18] plant.

13 After installation of the lime injection system in December 1993, central treatment plant operators recorded an additional 358 measurements on 77 separate days of 2.0 s.u. or less for the wastewater in Pond 6 over the next two years.

D. Grab Samples

Beyond measurements made with the influent probe, the central treatment plant operators also recorded grab sample pH measurements for Pond 6 wastewater as it entered the aeration influent box at the central treatment plant. WCI made 197 pH measurements via such grab samples. Operators took these samples by placing a laboratory beaker in the flow of the wastewater as it enters the aeration influent box. The central treatment plant operators then measure the pH of the grab samples with a bench meter in the central treatment [*818] plant office. The taking of grab samples is a method for checking the accuracy of in-line pH probes.

These grab samples showed pH readings of 2.0 s.u. or less on many occasions.

E. Sludge Sampling

Several samples of sludge from Pond [**19] 6 were also tested for pH values. In October 1985, an LTV contractor tested 30 samples of sludge from Ponds 5 and 6 and found an average pH of the sludges to be 6.3, with all measurements falling within the range of 5.5 to 7.5.

In 1990, a WCI contractor sampled the sludges in Ponds 5 and 6 and found they were nonhazardous. And in 1996 and 1998, sampling performed by a WCI consultant again found the pH of the Ponds' sludges ranged between 5.4 s.u. and 10.9 s.u.

Thus, there is no evidence that any sludge from Ponds 5 or 6 was ever hazardous. Only wastewater measurements indicate potential corrosiveness.

Having set forth relevant findings of fact, the Court now offers its conclusions of law.

III. CONCLUSIONS OF LAW

A. Overview of RCRA

The Resource Conservation and Recovery Act, 42 U.S.C. § 6901 et seq. ("RCRA") was enacted in 1976 to regulate the treatment, storage, transportation, and disposal of hazardous wastes. RCRA seeks to ensure that such wastes are "managed in a manner which protects human health and the environment." 42 U.S.C. § 6902(a)(4) and (b). Subtitle C of RCRA establishes a comprehensive federal regulatory program for [**20] the management of hazardous waste. 42 U.S.C. §§ 6921-6939.

[HN1] 42 U.S.C. § 6925(a) prohibits the operation of any facility that treats, stores, or disposes of hazardous wastes, except in accordance with a permit. *United States v. Heuer*, 4 F.3d 723, 730 (9th Cir. 1993) ("It is fundamental that an entity which performs a hazardous waste activity for which a permit is required under RCRA may not legally perform that activity unless it has a permit for the relevant activity."). Moreover, a party receiving a permit to store or dispose of hazardous waste must thereafter comply with the requirements of the permits.

[HN2] If certain requirements are met, RCRA allows states to operate hazardous waste regulatory programs in lieu of the federal program. 42 U.S.C. § 6926(b). Even where a state is given authority to operate such a regulatory program, the United States retains the right to enforce the state authorized programs. 42 U.S.C. § 6928(a)(2). On June 30, 1989, the U.S. EPA granted final authorization to the State of Ohio to administer and enforce the State's hazardous waste program in [**21] the State of Ohio. 42 U.S.C. § 6926(b). The Ohio EPA administers the RCRA program within Ohio.

[HN3] Under 42 U.S.C. § 6928(a), the United States may file a civil action in federal district court to obtain appropriate relief, including a temporary or permanent injunction upon obtaining information that any person has violated or is violating any requirement of RCRA. If a violation is shown, 42 U.S.C. § 6928(g) provides for a civil penalty in an amount not to exceed $ 27,500 per day of noncompliance for each violation. [14]

14 42 U.S.C. § 6928(g) provides for a civil penalty in an amount not to exceed $ 25,000 per day of noncompliance for each violation. This amount has been adjusted pursuant to the U.S. EPA Civil Monetary Penalty Inflation Adjustment Rule, to $ 27,500 per day.

[HN4] The Plaintiff United States has the burden to establish each of the elements of liability under RCRA. In showing liability, the applicable statute [**22] of limitations, 28 U.S.C. § 2462, stops any claim for penalty for a violation before May 11, 1993. [15]

15 Pretrial Order, Uncontroverted Fact No. 3.

[*819] [HN5] To establish a violation of RCRA, the United States must prove four general elements: (1) that WCI is a "person" within the meaning of RCRA; (2) that WCI's Warren, Ohio steel plant is a "facility" within the meaning of RCRA; (3) that WCI did not have a permit or interim status for the treatment, storage, or disposal of hazardous waste in the ponds; and (4) that WCI treated, stored, or disposed of hazardous waste in the ponds. *United States v. T & S Brass & Bronze Works, Inc.*, 681 F. Supp. 314, 317 (D.S.C. 1988); *United States v. Conservation Chemical Co.*, 733 F. Supp. 1215, 1220 (N.D. Ind. 1989).

Defendant WCI acknowledges that it is a "person" within the meaning of 42 U.S.C. § 6903(15) and that WCI's integrated steel plant, and all buildings, structures, and surface impoundments [**23] located there, comprise a "facility" within the meaning of 40 C.F.R. § 260.10. WCI also concedes it did not have a permit for the treatment, storage, or disposal of hazardous waste. WCI disputes only that it treated, stored or disposed of hazardous waste.

The Court now addresses the standards by which hazardous waste is identified. The Court then determines whether, upon applying these standards, WCI has violated RCRA.

B. Standards for Determining "Hazardous Waste"

1. Regulatory Classification and Corrosivity

[HN6] RCRA controls the release of a "hazardous waste." If a substance exhibits certain characteristics, industrial wastewaters are subject to regulation under RCRA. [HN7] *United States v. Dean*, 969 F.2d 187, 194 (6th Cir. 1992).

42 U.S.C. § 6921 provides two ways in which a waste will be considered "hazardous." First, a waste will be classified as "hazardous" where the EPA has specifically listed the waste as hazardous. By regulation, the EPA has listed a number of wastes as hazardous. 40 C.F.R. §§ 261.31-261.33 (1989). For example, spent pickle liquor, which the United States claims WCI discharged into Ponds 5, 6, and 6A, is a listed hazardous [**24] waste under 40 C.F.R. § 261.32.

The EPA will also classify a waste as "hazardous" if it has one or more of the characteristics of ignitability, corrosivity, reactivity, or toxicity. 40 C.F.R. §§ 261.21-.24. Here, the United States claims that WCI stored or disposed of corrosive waste.

[HN8] Corrosiveness is the property that enables a substance to dissolve material with which it comes in contact. Improperly managed corrosive wastes can pose a substantial present or potential danger to human health and the environment.

As explained in further detail below, under 40 C.F.R. § 261.22 and O.A.C. § 3745-51-22, a waste is corrosive if it is aqueous and has a pH of 2.0 s.u. or less or greater than or equal to 12.5 s.u. Where a surface impoundment contains aqueous water with a pH of 2.0 s.u. or less, on at least one occasion, the water in the surface impoundment is hazardous waste. The United States here principally contends that substances in Ponds 5, 6, and 6A are corrosive, as having had pH of 2.0 s.u. or less.

As noted above, 42 U.S.C. § 6925(a) prohibits the operation of any facility that treats, stores, or disposes of hazardous wastes, except in accordance with [**25] a permit. *United States v. Heuer*, 4 F.3d 723, 730 (9th Cir. 1993). Moreover, a party receiving a permit to store or dispose of hazardous waste must thereafter comply with the requirements of the permits.

If WCI treated, stored, or disposed of waste at the Warren facility, it was required under RCRA to have a permit to do so. It is undisputed that WCI had no permit to treat, store, or dispose of hazardous waste. Therefore, if the Court finds WCI maintained hazardous waste at its Warren facility, WCI has violated RCRA and is subject to fines under RCRA.

[*820] The parties offer differing views regarding how the Court should determine whether hazardous waste is treated, stored, or disposed of at WCI's Warren facility. Defendant WCI says the evidence offered by the United States is insufficient to support a finding that WCI maintains hazardous waste at the facility because the substances at the site were improperly sampled. The United States contends that even if the available samples do not conform to a specific methodology described in RCRA's regulations, the weight of evidence supports its contention that WCI treated, stored, or disposed of hazardous waste at the Warren [**26] facility.

The Court now examines whether RCRA's regulations require a particular sampling methodology.

2. Sampling Methodology

The United States claims WCI violated RCRA's prohibitions against hazardous waste by maintaining "corrosive" waste at the Warren facility. The regulations currently define "corrosivity" in the following way:

[HN9] Sec. 261.22 Characteristic of corrosivity.

> (a) A solid waste exhibits the characteristic of corrosivity if a *representative sample* of the waste has either of the following properties:
>
> (1) It is *aqueous and has a pH less than or equal to 2* or greater than or equal to 12.5, as determined by a pH meter using Method 9040 in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA Publication SW-846, as incorporated by reference in Sec. 260.11 of this chapter.

40 C.F.R. § 261.22(a)(1) (emphasis added). Plaintiff United States asserts that WCI violated RCRA by maintaining wastewater with a pH of less than or equal to 2. [HN10] Under the regulations, the United States must show such violation via a "representative sample" of the water.

RCRA regulations define "representative sample" as "a sample of a universe or whole (e. [**27] g., waste pile, lagoon, groundwater) which can be expected to exhibit the average properties of the universe or whole." 40 C.F.R. § 260.10. This definition has remained unchanged since originally promulgated by U.S. EPA in 1980. 45 Fed. Reg. 33066, 33075 (May 19, 1980).

This definition suggests that a finding of a RCRA violation must depend upon reliable and accurate sampling. WCI urges that the Court interpret the regulations to require a particular sampling method before results may be viewed as a reliable and accurate indication of corrosivity. WCI says that the sampling method used makes a difference because the Pond substances were heterogeneous. [16] Therefore, unless an appropriate sampling method is used, WCI says the results will not reflect "the average properties of the universe or [*821] whole." WCI says that the sampling presented here by the Plaintiff United States does not meet the requirements adopted in the EPA's own regulations.

16 In an October 1985 study, the engineering firm Duncan, Lagnese & Associates sampled sludge from Ponds 5 and 6. It reported that the waste in the Ponds was heterogeneous, due to "considerable variation from point to point for all parameters measured." Exh. CJ.

Expert Charles Blumenscheim testified credibly on this issue:

> Q. Do you know whether the waste material in the ponds at WCI is homogeneous or heterogeneous?
>
> A. In my opinion it is not homogeneous its heterogeneous.
>
> Q. And what's the basis for that opinion?
>
> * * *
>
> A. These the water entering this pond 5, the way the pond is configured, this is a classic example of what we call plug-flow region. In the term of art. But what it means is that as the water enters the pond, it will move down the pond as a river would flow, if you can just visualize this as a river

> and any water entering here will move down this pond in segments. There is no mixers in this to make it homogeneous, and as the water enters this pond and then ultimately leaves the pond, enters the pipeline and enters this pond and again this water will move through this pond to these pumps and be pumped out and any water here again will enter this pond and be pumped to this pond so this is a classic example of a plug flow region.

[**28] In contrast, the United States first disputes that a sample needs to reflect the average properties of the whole. [17] Further, the United States argues that adoption of a sampling plan, and sampling in conformity with such a plan, is not a prerequisite to showing a violation of RCRA. The United States says that the failure to adopt a sampling plan and to comply with that plan goes to the weight of the evidence, rather than its admissibility.

> 17 Plaintiff United States proposed conclusion of law No. 24b.

Thus, the Court must first determine whether a sample needs to reflect the average properties of the whole. As to this issue, the United States' argument would turn the language of 40 CFR § 261.22 and 40 C.F.R. § 260.10 on its head. 40 CFR § 261.22 says corrosivity is determined based upon a "representative sample of the waste." 40 C.F.R. § 260.10 says the sample must reflect "the average properties of the universe or whole." In arguing that this Court disregard the ponds as a whole, the United States pushes [**29] aside its own regulations.

The Court therefore finds that the samples must be representative of the whole pond before a RCRA violation may be found. The key issue is what sampling method will produce a "representative sample" of the ponds and whether the methods used here produce a sufficiently reliable picture of the average properties of the ponds as a whole.

Defendant WCI argues that Plaintiff United States does not give evidence of representative samples because it failed to use the proper testing method found in Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA Publication SW-846 ("SW-846"). WCI says use of Method 9040, as specified in the Second Edition of SW-846, is required.

In contrast, the United States claims that samples not taken in conformity with Method 9040 can satisfy the requirement that samples exhibit the average properties of the universe or whole. First, the United States contests the applicability of Method 9040. The United States argues that before 1993, Method 5.2, as set forth in the First Edition of SW-846, was the method for deciding whether a waste was corrosive. Method 5.2's sampling requirements are less strict than the requirements [**30] suggested by Defendant WCI. Method 5.2 does not specify methods for determining the number of samples needed to obtain the average properties of the universe or whole. In contrast, Method 9040 does.

Alternatively, the United States says that SW-846 intends only to give guidance, not to mandate requirements. As a guidance document, the United States says SW-846 affords flexibility to use alternative test methods.

To decide this issue, the Court first considers the general applicability of Method 9040. During the relevant periods, RCRA regulations have always referenced certain test methods that are to be use to support a finding of "corrosivity," and, by extension, the presence of hazardous waste. 40 C.F.R. § 260.11 (citing test methods); 40 C.F.R. § 261.22(a)(1) (defining "corrosivity"). As the language of § 260.11 has altered over the years, the parties dispute which test method applied during the relevant period.

The United States argues that until August 31, 1993, 40 C.F.R. § 261.22(a)(1) required use of Method 5.2, as set forth in the First Edition of SW-846. [18] Specifically, until August 31, 1993, Section 261.22 provided, in pertinent part:

> (a) A solid waste exhibits [**31] the characteristic of corrosivity if a representative [*822] sample of the waste has either of the following properties:
>
> (1) It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5, as determined by a pH meter using either an EPA test method or an equivalent test method approved by the Administrator.... *The EPA test method for pH is specified as Method 5.2 in "Test Methods for Evaluation of Solid Waste, Physical/Chemical Methods"* (incorporated by reference, see 260.11).

40 C.F.R. § 261.22(a)(1) (1993 edition) (emphasis added).

> 18 40 C.F.R. §§ 260.11 and 261.22(a)(1) (1988-1993 Editions).

The Second Edition of SW-846 was formally adopted as part of Section 260.11 on September 21, 1982. [19] The Second Edition of SW-846 contains a "Conversion Table" which correlates the section and method numbers used in the First Edition of SW-846 with "the location of their replacements" in the Second Edition. SW-846 describes this conversion table as giving "the replacements" of the methods [**32] used in the First Edition of SW-846. In this Table, Method 5.2 is expressly replaced with Method 9040. However, the language of the regulation, 40 C.F.R. § 261.22(a)(1), retained its reference to Method 5.2 even as it referred parties to SW-846. The Second Edition of SW-846, and the conversion table within it, remained in effect until August 31, 1993, when the Third Edition of SW-846 was adopted. [20]

19 47 Fed. Reg. 41562 (1982).
20 58 Fed. Reg. 46040 (1993).

Defendant WCI points out that the Second Edition of SW-846's cross-index supports the conclusion that Method 5.2 was replaced by Method 9040. Also, soon after the formal adoption of the Second Edition of SW-846, the U.S. EPA issued a Technical Amendment which also noted the change from Method 5.2 to Method 9040. 48 Fed. Reg. 15256 (1983). Further, WCI also points to communication made in 1993 by the EPA at the time it adopted the Third Edition of SW-846. In August 1993, the Agency formally clarified that "the [**33] EPA method number for pH is incorrectly referenced in Section 261.22(a)(1) as Method 5.2. Therefore, the Agency is deleting the reference to Method 5.2 in that section and replacing it with the correct reference to Method 9040." 58 Fed. Reg. 46047 (1993). Thus, the EPA changed the regulations to reflect what had already been indicated in SW-846 for years: that Method 9040 replaced Method 5.2

In short, WCI argues that even though the *regulations* did not specifically mention Method 9040 until 1993, 40 C.F.R. § 261.22(a)(1) always defined corrosivity by reference to SW-846, in which Method 9040 replaced 5.2. Therefore, WCI argues that Method 9040 applied from at least 1984 to August 1993.

WCI makes a strong argument that Method 9040 was effective for the times relevant here. However, assuming the applicability of Method 9040, the Court finds that strict adherence to Method 9040 is not required to show that WCI violated RCRA. Reliability and accuracy of samples may be shown by methods other than Method 9040.

Arguing otherwise, WCI contends that corrosivity can only be established if the Plaintiff United States shows that Ponds 5, 6, and 6A had a pH of 2.0 or less using [**34] a pH meter in accordance with Method 9040. To comply with Method 9040, WCI says sampling must follow a statistically-valid sampling plan prepared in accordance with Section One of SW-846. Method 9040, § 6.1.

However, relevant language in SW-846 belies WCI's argument. SW-846 provides that a sampling plan is more statistically valid if it provides for "some form of random sampling" so that "every unit of the population (*e.g.* every location in a lagoon used to store a solid waste) has a theoretically equal chance of being sampled and measured," thus ensuring that "the sample [*823] is representative of the population." Section One, SW-846, Second Edition, § 1.1.2.

"Sampling precision is *most commonly achieved* by taking an appropriate number of samples from the population." Section One, SW-846, Second Edition (emphasis added). SW-846 provides a statistical equation to be used in determining the "appropriate number of samples." [21] Compliance with the statistical calculations in SW-846 establishes "a scientifically credible sampling plan" for characterizing waste." *Id.* at Section 1. Specifically, SW-846 says that "solid wastes contained in a landfill or lagoon are [usually] [**35] *best* sampled using the three-dimensional random sampling strategy." *Id.* (emphasis added).

21 Table 1, Equation 8, in Section One of SW-846.

SW-846 also says that "lagooned waste that is either liquid or semisolid is often best sampled using the methods recommended for large tanks." In describing the method used for sampling large tanks, SW-846 says "a representative set of samples is best obtained using the three-dimensional simple random sampling strategy described in Section 1.4.1."

In Section 1.4.1 of SW-846, the EPA says:

> The number of samples required for reliable sampling will vary depending on the distribution of the waste components in the container. As a minimum with unknown waste, a sufficient number and distribution of samples should be taken to address any possible versicle anomalies in the waste.

SW-846 at 1.4.1.

Under these provisions, sampling of Ponds 5, 6, and 6A *should* involve "a three-dimensional grid of sampling points and then using random number tables or generators [**36] to select points for sampling." *Id.* at 1.4.4.

As indicated, Method 9040 suggests that sampling *should* be done consistent with a sampling plan involving a sufficient number of samples. While such sampling is preferred, WCI does not show that the Plaintiff United States cannot proceed absent sampling in conformity with Method 9040.

Other courts have come to similar conclusions. In *United States v. Self*, 2 F.3d 1071 (10th Cir. 1993), the defendant, facing criminal charges, argued that the government failed to present evidence that certain hazardous wastes were sampled in accord with an EPA-approved test method. Rejecting this argument, the Tenth Circuit held that [HN11] "while an EPA-approved test of the material would have been persuasive evidence as to whether the material was hazardous waste, the government was not required to prove this element through test data." *Id.* at 1086.

To like effect, in *United States v. Baytank, Inc.*, 934 F.2d 599 (5th Cir. 1991), the government brought a criminal claim under RCRA. In that case, the government did not have sampling of the relevant drums, nor other sampling taken in conformity with EPA [**37] regulations. Instead, it relied upon company documents and testimony from persons in contact with the relevant drums. In finding the evidence sufficient to support a criminal conviction, the Fifth Circuit held:

> The government admits no drum samples were taken, but relies on Baytank records, and testimony as to its practices at the times charged, to show that the drums were used to store the 'slops' or residue of hazardous chemicals that had been extracted either for sampling or line cleaning purposes. We agree that these documents, including drum inventories, a hazardous waste log, and internal memoranda, as well as the testimony at trial, all amply demonstrate that many of these drums containing hazardous wastes were stored for longer than 90 days.

Id. at 614.

Other courts have held that the [HN12] failure to adhere to SW-846's precise framework [*824] does not stop a finding of hazardous substances. *See, e.g., United States v. Taylor*, 802 F. Supp. 116, 119 (W.D. Mich. 1992), *vacated on other grounds*, 8 F.3d 1074 (6th Cir. 1993) (sample analyzed under a test method not approved by EPA sufficient to establish threat of contamination [**38] under CERCLA). Further, failure to rigidly adhere to SW-846 does not render the sampling evidence inadmissible. *People v. Hale*, 29 Cal. App. 4th 730, 734 (1994) ("We discern no per se rule which automatically precludes the introduction of evidence of disposal of hazardous waste just because the gathering of the sample does not follow every jot and tittle of the EPA manual."). Any deviation from the guidance goes to the weight of the evidence and not its admissibility. *People v. Sangani*, 22 Cal. App. 4th 1120, 1136-1137 (1994) ("Failure to follow precise regulatory or statutory requirements for laboratory tests generally does not render the test results inadmissible, but instead goes to the weight accorded to the evidence."). [22]

> 22 Courts show deference to the interpretation of regulation given by administrative agencies charged with their enforcement. *United States of America v. Mobil Oil Corporation*, 1997 WL 1048911 (E.D.N.Y. 1997). In *Mobil Oil*, the company sought to offer evidence not in conformity with the regulations given by the U.S EPA. Rejecting Mobil's evidence, the court set forth a standard of review applicable to a claim that the sampling methods utilized are invalid. Under the court's test, it is not enough for WCI simply to "offer[] an alternative reading of the law." *Id.* at *9. Instead, WCI must establish that EPA's interpretation is "plainly erroneous" and that WCI's reading is "compelled by the regulation's plain language' or the Administrator's intent at the time the regulation was promulgated." *Id.* (quoting *Thomas Jefferson University Hospital v. Shalala*, 512 U.S. 504, 512, 129 L. Ed. 2d 405, 114 S. Ct. 2381 (1994)).

[**39] Consequently, although Method 9040 controlled sampling before 1993, the Court finds that strict adherence with Method 9040, including grid sampling pursuant to a plan, is not required to show that Ponds 5, 6, and 6A were corrosive. While sampling done in conformity with Method 9040 is preferable and more persuasive, evidence not conforming with the sampling provisions of SW-846 can support a finding that WCI generated hazardous substances subject to RCRA.

3. Required Showing

[HN13] To show that Ponds 5, 6, and 6A contained hazardous substances and were, as a result, subject to the cradle-to-grave restrictions of RCRA, the Plaintiff United States must show, via representative samples, only that the surface impoundment contained aqueous water with a pH of 2.0 s.u. or less, on at least one occasion. *United States v. Conservation Chemical Co.*, 733 F. Supp. 1215, 1224 (N.D. Ind. 1989) (finding that an aqueous solid waste exhibits the characteristic of corrosivity if it is properly tested and found to have a pH less than or equal to 2 "on at least one occasion"); *State v. PVS Chemicals, Inc.*, 50 F. Supp. 2d 171 (W.D.N.Y.

1998) (finding discharges of acidic water [**40] that fell below pH of 2 on 4 occasions out of 51 samples taken over course of 6 years was hazardous).

[HN14] In order to be valid, sampling must show that it is random, that is, that "every unit of the population (*e.g.*, every location in a lagoon used to store a solid waste) has a theoretically equal chance of being sampled and measured," thus ensuring that "the sample is representative of the population." Section One, SW-846, Second Edition, at 1.1.2.

With these principles in mind, the Court examines the samples presented by the government as evidence of RCRA violations.

C. Assessment of Samples

In claiming that Defendant WCI's Pond 5, 6, and 6A are subject to regulation under RCRA, the United States relies upon a limited number of testings done by U.S. EPA personnel and the large number of tests recorded by Defendant WCI's personnel [*825] at the intake to the central treatment plant.

WCI says the limited number of samples taken by the U.S. EPA are insufficiently representative of the ponds to serve as proof of a violation. WCI also says the 11,000 samples it recorded are insufficiently representative of wastewaters held in Ponds 5, 6, and 6A because the measuring probes were miscalibrated. [**41] Because none of the samples the government relies on were taken pursuant to Method 9040, WCI says there is insufficient evidence that it maintained hazardous waste at the Warren facility.

As discussed, the Court finds Method 9040 preferable for showing a RCRA violation, but it is not the exclusive means with which the government can support its case. The Court must now determine whether the available samples provide a reliable indicator that WCI maintained hazardous waste at the Warren facility.

Plaintiff United States shows sampling performed by WCI at the influent to Pond 6. The government produced WCI's internal "Turn Audit" forms reflecting pH measurements taken between 1988 and 1998. WCI tested over 300 samples a month at Pond 6 during these years. [23] The turn audit forms indicate that over 11,000 samples taken during these years had a pH of 2.0 or less. [24] WCI's operators made readings of 2.0 s.u. or less for Pond 6 wastewater entering the central treatment plant on 1,361 separate days, including 577 days during which readings of 1.7 s.u. were taken at the influent probe.

23 In July 1990, WCI took 240 samples. In every other month during the ten-year period, WCI took more than 300 samples.

[**42]

24 There were only 13 readings of 2.0 or less in 1995 and none in 1996 through 1998. Therefore, the bulk of the low pH readings date from 1988 to 1994.

During several months, virtually all the samples indicated low pH levels. In May 1991, 96.7% of the 369 samples taken that month indicated a pH level of 2.0 or below. In August 1991, 99.2% of the 372 samples taken that month registered at 2.0 or below, with 297 samples reflecting a pH of 1.7 or below. In May 1993, 90.9% of the 372 samples taken that month had a pH level of 2.0 or below, with 268 samples reading 1.7 or below.

At the rate WCI pumps water out of the pond, there is a complete turnover of pond water every three to four days. Thus, months during which low pH levels were the norm provide strong evidence that the samples were representative of the pond water as a whole during that time and that the water contained hazardous waste.

Though WCI levels valid criticism at the reliability of the influent pH probe, the measurements obtained from the probe are nevertheless probative of the wastewater's hazardous nature. An extremely large [**43] number of influent probe pH readings show corrosivity, including many readings with very acidic pH levels. Even if the pH calibration were not precise, any error was unlikely to account for the extremely low pH readings.

This is so because pH is measured on a logarithmic scale: as pH measurements move down the scale, the measure of acidity in a substance increases exponentially. A substance with a pH of 1.8 s.u. has twice the hydrogen ion (or acid) concentration of a substance with a pH of 2.0 s.u.. The difference between the measurement units is .2. But because of the logarithm, the .2 difference between 1.6 and 1.8 represents a greater increase in acidity level than does the .2 difference between 1.8 and 2.0. Therefore, even if WCI's probes were not calibrated precisely in relation to 2.0, the extremely low readings represent strong evidence of acidity because they represent such exponential change in acid levels.

Indeed, even SW-846 notes that when measurements fall far below the threshold allowed level, a method with lower accuracy and precision is tolerable:

[*826]

> It is now apparent that a judgment must be made as to the degree of sampling accuracy and precision that is required [**44] to reliably estimate the chemical characteristics of a solid waste for the purpose of comparing those char-

> acteristics to applicable regulatory thresholds. Generally, high accuracy and high precision are required if one or more chemical contaminants of a solid waste is present at a concentration that is close to the applicable regulatory threshold. *Alternatively, relatively low accuracy and low precision can be tolerated if the contaminants of concern occur at levels far below or far above their applicable thresholds.*

SW-826, § 1.1.1, P 3 (emphasis added). Although high accuracy and precision is preferred, the reading of 1.3, for example, reliably shows corrosivity even if taken through a less than ideal sampling method because it falls so far below the threshold of 2.0.

The United States does not rely solely on the measurements from the influent probe. The United States gives evidence from a WCI consultant engineer who took grab sample pH measurements on October 14 and 15, 1993, which showed pH of 2.0 or lower at the bosh box location. [25] Importantly, one of these samples had the extremely low pH value of 1.3 s.u. while another had the extremely low value of 1.7 s.u. [**45] Also, a large number of grab bag samples, tested on bench pH meters, indicate corrosivity. Finally, although limited, U.S. EPA sampling shows corrosivity.

> 25 Consultant Killam collected three grab samples from the bosh box that channels wastewater to the surface impoundments. The three samples had pH values of 1.3, 1.7 and 2.0 s.u., respectively.

In light of the substantial evidence presented by the United States, the Court finds that during periods of WCI's ownership, the wastewater treated, stored, and disposed of by WCI in Ponds 5, 6, and 6A exhibited the hazardous waste characteristic of corrosivity, within the meaning of 40 C.F.R. § 261.22. Thus, WCI Ponds 5, 6, and 6A were subject to RCRA.

However, the Government fails to show spent pickle liquor, subject to RCRA, was deposited into Ponds 5, 6, and 6A. The Court finds that WCI always neutralized any spent pickle liquor or acid spillage with excess lime. [HN15] Lime-neutralized spent pickle liquor is exempt from the RCRA's hazardous waste regulations under the [**46] iron and steel industry exemption in 40 C.F.R. § 261.3(c)(2)(ii)(A).

IV. Violations of RCRA

The Court has determined that there is sufficient evidence that WCI treated, stored, or disposed of hazardous waste at its Warren facility. Maintaining such hazardous waste triggers several requirements under RCRA. As detailed below, WCI's failure to comply with these requirements subjects it to penalties under RCRA.

A. First Claim for Relief

[HN16] 40 C.F.R. § 260.10 provides, in part:

> [A] "Hazardous waste management unit" is a contiguous area of land on or in which hazardous waste is placed, or the largest area in which there is significant likelihood of mixing hazardous waste constituents in the same area. Examples of hazardous waste management units include a surface impoundment, a waste pile, a land treatment area, a landfill cell, an incinerator, a tank and its associated piping and underlying containment system and a container storage area.

40 CFR § 260.10. Ponds 5, 6, and 6A at the WCI's Warren facility are hazardous waste management units. As hazardous waste management units, Ponds 5, 6, and 6A are subject to the provisions of RCRA and analogous state law.

[HN17] Under [**47] 42 U.S.C. § 6925(a) and (e) and Ohio Rev. Code §§ 3734.02(F) and 3734.04, the owner and operator of a hazardous waste management unit is prohibited from [*827] operating a hazardous waste management unit except in accordance with a permit issued pursuant to RCRA, unless the facility had interim status.

The wastewater treated, stored, and disposed of through the impoundments was a "solid waste," under 40 C.F.R. § 261.2(a)(2). During periods from 1988 to 1993, the wastewater stored and disposed of by WCI in Ponds 5, 6, and 6A, was also hazardous waste because it exhibited the characteristic of corrosivity, having a pH of 2 or less. Further, Defendant WCI has neither a permit issued pursuant to the provisions of 42 U.S.C. § 6925, nor does WCI have interim status.

Defendant WCI's operation of Ponds 5, 6, and 6A without a permit and without interim status violates RCRA and the federally approved hazardous waste management program for the State of Ohio. Each day that WCI operated Ponds 5, 6, and 6A without a permit or without interim status is a separate violation of RCRA.

B. Second Claim for Relief

Ponds 5, 6, and 6A were hazardous waste management [**48] units during periods from 1988 to 1993.

WCI operated these hazardous waste management units without including these hazardous waste management units in any RCRA Part A application, as required by 40 C.F.R. § 270.13 and O.A.C. § 3645-50-43, and without amending any RCRA Part A application.

Each day that Defendant operated Ponds 5, 6, and 6A without including these hazardous waste management units in any Part A application and without amending any Part A application is a separate violation of 42 U.S.C. § 6930 and O.A.C. § 3745-50-43.

C. Third Claim for Relief

WCI operated Ponds 5, 6, and 6A as hazardous waste management units without including these hazardous waste management units in any RCRA Part B application, and without amending any RCRA Part B application to include information pertaining to Ponds 5, 6, and 6A. 40 C.F.R. § 270.14 and O.A.C. § 3745-50-44.

Each day that WCI operated Ponds 5, 6, and 6A as hazardous waste management units without including these hazardous waste management units in any RCRA Part B application, and without amending any RCRA Part B application to include information pertaining to Ponds 5, 6 and 6A is a separate violation.

[**49] D. Fourth Claim for Relief

[HN18] Under 42 U.S.C. § 6928(a) and 40 C.F.R. § 270.1(b), a party also may not store hazardous waste in a surface impoundment without a permit or interim status. Ponds 5, 6, and 6A are "surface impoundments" within the meaning of 40 C.F.R. § 260.10.

[HN19] Under 42 U.S.C. § 6925(j), surface impoundments existing on November 8, 1984, were required to meet minimum technological requirements unless granted an exemption by the U.S. EPA or the State. [26] WCI did not receive interim status. As a facility that did not have a permit and did not have interim status, WCI was required to cease accepting hazardous waste and commence closure. 40 C.F.R. § 265.1(b). As explained earlier, the Court finds that WCI continued to receive hazardous waste after it was not eligible to do so. In continuing to receive hazardous substances, WCI violated RCRA.

26 42 U.S.C. § 6924(o).

WCI continued accepting hazardous wastes at Ponds 5, 6, and 6A, [**50] even though it failed to meet the technological requirements of 42 U.S.C. § 6924(o)(1)(A). WCI failed to close Ponds 5, 6, and 6A as required by 40 C.F.R. § 264.228 and O.A.C. § 3745-56-28.

Each day that WCI continued accepting hazardous wastes at Ponds 5, 6 and 6A, even though it failed to meet the technological requirements of 42 U.S.C. § 6924(o)(1)(A) is a separate violation.

[*828] E. Fifth Claim for Relief

[HN20] Under 40 C.F.R. § 264.112 and O.A.C. § 3745-55-12, WCI, as the owner or operator of a hazardous waste management unit, was required to have a written closure plan. The closure plan must identify the steps needed to perform a partial or final closure of the facility.

Defendant WCI failed to have a written closure plan that identified the steps necessary to perform partial or final closure of Ponds 5, 6, and 6A. WCI thus violated RCRA closure requirements described at 40 C.F.R. § 264.112 and O.A.C. § 3745-55-12.

Each day that WCI failed to have a written closure plan that identified the steps necessary to perform partial or final closure of Ponds 5, 6, and 6A is a separate violation.

F. Sixth Claim for Relief

[HN21] Under 40 C.F. [**51] R. §§ 264.140 - 264.151 and O.A.C. §§ 3745-55-40 - 3745-55-51, WCI, as the owner or operator of a hazardous waste management facility, was required to have a detailed written estimate in current dollars of the cost of closing hazardous waste management units. WCI was also required to comply with the financial assurance provisions of 40 C.F.R. § 264.143 and O.A.C. § 3745-55-43.

Defendant WCI has failed to comply with the closure costs and financial assurance requirements of 40 C.F.R. Part 264 and O.A.C. § 3745-55-40 - 3745-55-51. Each day that WCI failed to have and maintain a detailed written estimate, in current dollars, of the cost of closing hazardous waste management units to comply with the financial assurance requirements is a separate violation.

G. Seventh Claim for Relief

[HN22] The owner or operator of a surface impoundment is required to install, operate, and maintain a ground-water monitoring system which satisfies the criteria contained at 40 C.F.R. Part 264, Subpart F, and O.A.C. §§ 3745-54-90 - 3745-54-99 and 3745-55-01 - 3745-55-02. During periods after November 8, 1988, WCI failed to install, operate, and maintain a ground-water monitoring system that meets the requirements [**52] of 40 C.F.R. Part 264, Subpart F, and O.A.C. §§ 3745-54-90 - 3745-55-02.

The failure to operate such a ground-water monitoring system violates RCRA and the federally approved

hazardous waste management program for the State of Ohio.

H. Eighth Claim for Relief

At times from 1988 to 1993, Defendant WCI disposed of corrosive hazardous waste, having a pH of less than or equal to 2.0, from Ponds 5, 6 or 6A, which did not meet the treatment standards specified at O.A.C. § 3745-59-40 - 3745-59-43, in violation of 40 C.F.R. §§ 268.32 and 268.35(a) and O.A.C. §§ 3745-59-32 and 3745-59-35(A).

In disposing of such waste, WCI violated RCRA and the federally approved hazardous waste management program for the State of Ohio.

V. Penalty

[HN23] Under 42 U.S.C. § 6928(a) and (g), this Court has power to enjoin WCI and to impose civil penalties for each violation of RCRA and the hazardous waste management program for the State of Ohio. This Court can impose penalties up to $ 25,000 per day for each day of violation prior to January 30, 1997 and $ 27,500 for each day of violation thereafter.

In determining the appropriate civil penalties, the Court considers the seriousness of [**53] the violation, what efforts were made to comply with regulations, the harm caused by the violation, the economic benefit derived from noncompliance, the violator's ability to pay, the government's conduct, and the clarity of the obligation involved. *United States v. Ekco Housewares, Inc.*, 62 F.3d 806, 815 (6th Cir. 1995). In determining the penalty, this Court exercises its discretion. *Id.* (citing [*829] *United States v. Midwest Suspension and Brake*, 49 F.3d 1197, 1205 (6th Cir. 1995)).

A. WCI's Past Compliance and Seriousness of the Violation

From the time it assumed operation of the Warren facility in 1988, WCI has denied that it managed hazardous wastes in Ponds 5, 6 and 6A. Because it denied its management of hazardous wastes, WCI failed to provide notice to the U.S. EPA and the State that it managed hazardous wastes in Ponds 5, 6 and 6A and failed to obtain any permit or interim status under RCRA for management of the hazardous waste it maintained in Ponds 5, 6, and 6A.

42 U.S.C. § 6925(a) prohibits the treatment, storage or disposal of hazardous waste except in accordance with an authorized permit. *Ekco Housewares, Inc.*, 62 F.3d at 809. [**54] The receipt of a permit, and compliance with that permit are at the core of the federal hazardous waste management system. *United States v. Heuer*, 4 F.3d 723, 730 (9th Cir. 1993) ("It is fundamental that an entity which performs a hazardous waste activity for which a permit is required under RCRA may not legally perform that activity unless it has a permit for the relevant activity."). WCI's failure to obtain a permit and to comply with that permit disregards RCRA's "'cradle-to-grave' regulatory structure overseeing the safe treatment, storage and disposal of hazardous waste." *United Technologies Corp. v. EPA*, 261 U.S. App. D.C. 226, 821 F.2d 714, 716 (D.C. Cir. 1987).

Yet, WCI has made capital investments that have improved environmental quality. By 1992, WCI had invested $ 135 million in a continuous caster and ladle metallurgical facility that lowered costs and improved environmental performance. [27] In addition, WCI used a vigorous recycling program and eliminated about 80,000 tons of materials that formerly went to a landfill. In 1996, the Ohio EPA reported that: "WCI has achieved an 86 percent reduction in their toxic chemical releases from [**55] 1988 to 1994 . . . 1994 was WCI's most productive year in their eight-year history. The facility increased production by 5.8 percent over 1993 while reducing toxic release commission by 32.9 percent." In March 1999, the Environmental Defense Fund placed WCI in the top third of twenty integrated steel mills in the nation for its pollution control efforts.

27 The continuous caster and ladle facility eliminated approximately a hundred tons of air pollutants per year.

In summary, while Defendant WCI failed to comply with RCRA requirements as to Ponds 5, 6, and 6A, it otherwise made efforts to reduce pollution.

B. Discussion of Harm Caused by Noncompliance

The Court finds no credible evidence of harm caused by Defendant WCI's RCRA violations. First, though long-term effects of hazardous wastewater may be reflected in the sludge that collects in the beneath the wastewater, the Plaintiff United States does not allege that sludge in the Ponds ever had a pH of 2.0 or below. Second, monitoring wells placed downstream [**56] from Ponds 5, 6, and 6A show no impact on the environment resulting from the use of these ponds as wastewater treatment units. Finally, the United States does not allege that the Ponds currently contain wastewater with a pH of 2.0 or below.

[HN24] Where a proven violation of RCRA does not result in "the creation of a situation with the potential to seriously harm the environment," civil penalties have been substantially reduced. *United States v. Lacks Industries, Inc.*, 1990 U.S. Dist. LEXIS 7650, 1990 WL 261387, *4 (W.D. Mich. June 22, 1990). Thus, in deter-

mining an appropriate penalty, this Court takes into consideration the fact that WCI's use of Ponds 5, 6, and 6A has not resulted in any harm to human health or the environment.

[*830] C. Economic Benefit and Costs Saved

The Court also considers the economic benefit derived by WCI as the result of its failure to comply with RCRA. On this issue, the parties sharply disagree.

The Plaintiff United States says that WCI benefitted because it avoided expending monies to close Ponds 5, 6, and 6A, including dredging, disposal of dredged materials, and backfilling the ponds. The United States argues that WCI benefitted because it was otherwise required to install [**57] tanks to store wastewater with low pH; to set up a groundwater monitoring program; and to provide a closure and post closure plan together with necessary financial assurance. The United States says WCI delayed or avoided expending monies for these purposes and received an economic benefit.

In seeking to quantify this benefit, the United States says the benefit should be measured as the current value of the capital cost of the various expenditures needed to avoid RCRA violations, and the annual operating costs that would have attended earlier compliance, all expressed in today's dollars.

Plaintiff United States claims that Defendant WCI received a total economic benefit of approximately $ 9.1 million. According to the United States, the delayed capital expenditures gave WCI a $ 6,427,000 benefit and the avoidance of operating and maintenance costs gave WCI a $ 2,631,000 benefit.

In reaching its position that WCI obtained economic benefit of $ 9.1 million, the United States relies on several core assumptions. The United States relies upon the argument that remediation required moving the majority of the sludges from their current locations and depositing them in a toxic waste disposal [**58] site. If the sludge did not have to be removed, WCI did not receive the benefit of $ 2,615,102 for the dredging and backfilling of the impoundments and $ 3,696,690 for its disposal.

The Court finds credible WCI's testimony that Ponds 5, 6, and 6A are subject to a risk- based closure that gives consideration to human health and the environment. Under such a closure, the sludge would be left in place, it would be stabilized, and a cover would be placed upon it. Such a risk-based closure might involve moving the sludges from Ponds 6 and 6A to Pond 5, and then putting a cover on Pond 5. A risk-based closure would be significantly less expensive than the dredging and removal plan proposed by the United States. Dr. Kenneth Wise testified credibly that a risk-based resulted in a present value economic benefit of $ 732,065, including the cost of a storage tank.

D. Present Value Determination

As to the economic benefit derived by WCI from delayed compliance with RCRA, the parties also dispute what rate should be used to determine the present value of the benefit. The Plaintiff United States claims that this Court should use a weighted average cost of capital rate of 8.5 percent for both [**59] past amounts benefitted and for future benefits.

In contrast, the Defendant WCI suggests that the rate should be different for both past and future benefit. For past costs, WCI suggests the use of an after-tax, risk-free rate is correct. WCI argues that no uncertainty attends the amount and the risk-free return is the only economic benefit that a company earns from delaying an expenditure. WCI argues that any return above the risk-free rate does not reflect delay, but instead reflects risk.

As to future benefit, WCI says there is uncertainty. Future benefits are not risk free. As a result, WCI says a discount rate reflecting this risk should be used. Specifically, WCI argues that future benefits should be computed by using an after-tax corporate borrowing rate. WCI suggests a 9.6% rate should be used, based upon the current yield of WCI bonds.

[*831] The central issue is whether a rate reflecting risk should be used as to past benefits or obligations. Any return above the risk-free rate is earned not from delay but by assuming risk, and therefore is not properly considered economic benefit from noncompliance. Because this amount is known and the existence and solvency of the party is also [**60] known, it is inappropriate to increase the rate to reflect risk. As to this issue, the Court finds Defendant WCI's argument to be more persuasive. After observing the testimony of all the experts, the Court finds WCI's expert Kenneth Wise most credible.

In determining economic benefit, the Court therefore finds an after-tax, risk-free rate is correct.

E. Period for Determination of Economic Benefit.

For determining economic benefit, the Plaintiff United States says that computation should accrue from the initial dates of noncompliance until actual compliance is achieved. Thus, the United States argues that economic benefit should be calculated from November 1988, the first date of noncompliance.

[HN25] RCRA encompasses both current and continuing violations, even if the latter originated in activities occurring before the applicable date of the statute. *State v. PVS Chemicals, Inc.,* 50 F. Supp. 2d 171, 180

(W.D.N.Y. 1998). Thus, there is little doubt that the Court may consider WCI's conduct prior to May 11, 1993, to determine whether WCI is subject to, and violated, RCRA.

However, the assessment of a civil fine for such a violation is limited by the federal statute of [**61] limitations found in [HN26] 28 U.S.C. § 2462:

> Except as otherwise provided by Act of Congress, an action, suit or proceeding for the enforcement of any civil fine, . . . [or] penalty . . . shall not be entertained unless commenced within five years from the date when the claim first accrued.

28 U.S.C. § 2462. Thus, while the economic benefit WCI received from violating RCRA prior to May 11, 1993 may be relevant to an examination of the extent of the violations, the scope of injunctive relief, and WCI's good faith in remedying known violations, it is not determinative of this Court's assessment of a fine.

F. Ability to Pay

The Plaintiff United States and Defendant WCI dispute WCI's ability to pay a substantial penalty. The United States argued that WCI could and should pay a penalty of $ 34 million. In major part, the United States bases this position upon certain high dividends that WCI paid its corporate owner in recent years.

WCI challenges its ability to pay such a penalty with impunity. WCI says it needs to invest $ 40 million in capital annually and this investment would be impaired by such a penalty.

WCI has made [**62] profits in some recent years. However, it faces increased competition, especially during business downturns, from numerous competitors. First, cheap Asian steel has flooded the U.S. and world markets. As a result, U.S. steel imports increased 33% from 1997 to 1998, despite the fact that 1997 itself recorded high imports. As a result of these imports and the consequent competition, prices will remain low, with lower profit margins. [28]

> 28 Hot rolled steel prices declined from $ 25.32 per 100 pounds in 1995 to $ 22.46 in 1996, to $ 18.12 in 1997, and to about $ 14 in 1998.

Second, mini-mill capacity has also increased, resulting in lower prices and margins. This problem is likely to continue.

Third, this price competition with resulting pressure on margins has occurred during a time of economic expansion. When the inevitable downturn occurs, the pressure on producers will increase. As an unaffiliated operation, WCI will likely face [*832] even greater pressure during the next contraction.

Operating income, after taking [**63] away unrelated financial expenses, declined from $ 77 million ($ 58 per ton) in 1997 to $ 62 million ($ 44 per ton) in 1998. For the most recent quarter, ending January 31, 1999, WCI's operating income was a $ 613,000 loss compared to a $ 14,279,000 profit in the first quarter of the previous year. Capital expenditures declined from $ 39.9 million in 1997, to $ 35.4 million in 1996, to $ 15.6 million in 1998.

Taken as a whole, the Court finds that Defendant WCI does not have ability to pay any significant penalty and remain extant in the long term. Simply put, the Court credits testimony that WCI faces long odds for survival in an industry characterized by excess capacity, unrestrained dumping by foreign producers, and uncertain future demand in the next downturn.

G. The Government's Conduct

In fashioning a penalty, the Court considers the government's conduct. Since 1981, the Ohio EPA has conducted at least twelve hazardous waste compliance inspections of the WCI facility. After making these inspections, the Ohio EPA did not allege that Ponds 5, 6, and 6A were hazardous waste units subject to RCRA. In 1993, the Ohio EPA gave WCI a RCRA Part B permit for the storage of acid prior [**64] to recycling.

The U.S. EPA also inspected WCI's facility under the Clean Water Act and RCRA in 1990, 1991, and 1992. After conducting these inspections, the U.S. EPA inspectors did not allege that the Ponds were hazardous waste units.

Beginning in May 1993, the U.S. EPA made a "multimedia" inspection at WCI's Warren facility. This multimedia inspection was made under the Clean Water Act, the Clean Air Act, RCRA, and the Toxic Substances Control Act. Shortly after conducting this inspection, the U.S. EPA requested documents from WCI.

By early spring, 1994, Defendant WCI had produced documents requested by the U.S. EPA. With this production, WCI gave the U.S. EPA the "Turn Audits" forms recording the readings from the pH meters located at the aeration influent box, the aeration tank, the rapid mix tank, and the No. 3 clarifier. This data reflected readings every two hours from September 1, 1988. The Turn Audits also reflected the records of the grab sample pH measurements for Pond 6 influent wastewater.

Despite having this most important evidence in early 1994, the government delayed filing this action until

May 11, 1998. The government delayed filing even though it had filed a Clean [**65] Water Act action against WCI in June 1995. [29] The U.S. EPA delayed filing even though the EPA and WCI had reached a settlement of the Clean Water Act suit in April 1998 and even though that settlement made provision for the remediation of Pond 6 and to fill in Pond 6A.

29 *United States v. WCI Steel, Inc.,* Civil Action No. 4:95CV1442 (N.D. Ohio).

As described above, the government delayed resolution of this dispute. First, the government delayed investigation of WCI's wastewater handling methods despite knowledge that WCI used processes that are acidic. While RCRA requires self-reporting, the government's inattention delayed this action.

Second, even when it had suspicion and necessary information, the United States delayed this action more than four years. Moreover, it delayed this action despite expending large resources for discovery in the 1995 Clean Water Act case and despite settlement efforts in that case.

The government's delay and the government's splitting of causes of action are taken into account [**66] in setting the penalty imposed upon WCI. [HN27] *United States v. Bethlehem Steel Corp.*, 829 F. Supp. 1047, 1056-58 (N.D. Ind. 1993). "Courts should respond to EPA's undue agency delay by reducing penalties in an enforcement action [*833] in order to counteract any incentive the agency might have to place itself in a superior litigating position." *United States v. Marine Shale Processors,* 81 F.3d 1329, 1337 (5th Cir. 1996).

H. Penalty Finding

The United States requests a per diem penalty for each violation. This Court will not do so as it is within this Court's discretion to determine the total amount of penalty that WCI should pay. However, the Court considers the total days of violation in setting the penalty. *Bethlehem Steel Corp.,* 829 F. Supp. at 1056 (citing *United States (EPA) v. Environmental Waste Control, Inc.,* 710 F. Supp. 1172, 1242 (N.D. Ind. 1989)). The Court does not assume a $ 25,000 or $ 27,500 per day fine but rather views the evidence in total to determine a single penalty. In setting the penalty, the Court recognizes that deterrence is the major purpose of a civil penalty. *Id.*

After considering Defendant [**67] WCI's violations, the economic benefit it has obtained, the government's undue delay in bringing this action, the Court hereby assesses a civil penalty against WCI in the amount of $ 1 million.

I. Injunctive Relief

42 U.S.C. § 6928(a) gives the Plaintiff United States the power to file a civil action to obtain appropriate relief. The relief sought can include a temporary or permanent injunction.

[HN28] Normally, to obtain injunctive relief, a party must prove that there is no adequate remedy at law, that the plaintiff may suffer an irreparable injury if an injunction is not granted and that the balance of the equities justifies an injunction. However, when the government brings the action and shows that an activity endangers public health, injunctive relief is proper without undertaking a balancing of the equities. *Environmental Defense Fund, Inc. v. Lamphier,* 714 F.2d 331, 337-38 (4th Cir.1983); *United States v. Bethlehem Steel Corp.*, 38 F.3d 862, 868 (7th Cir. 1994). In cases of public health legislation, the emphasis shifts from consideration of irreparable injury to concern for the general public interest. *Id.*

The United [**68] States does not allege that Ponds 5, 6, and 6A currently contain wastewater with a pH of 2.0 or below. There have been no influent probe readings of 2.0 or below after 1995. The sludge lining Ponds 5, 6, and 6A does not have a pH of 2.0 or lower and there is no evidence that it ever did have such a low pH. Consequently, the United States' request for injunctive relief does not purport to correct ongoing conditions that pose any type of public health risk or risk to the environment.

[HN29] In deciding whether the strong remedy of injunctive relief should be given, the Court is most concerned with whether this relief is necessary to stop the danger that might result from violations of RCRA. Specifically, is injunctive relief necessary to stop WCI from receiving, handling, or disposing of corrosive wastes into Ponds 5, 6, and 6A? In circumstances where no evidence shows that corrosive wastes have been present in Ponds 5, 6, and 6A since at least 1995, the Court finds that injunctive relief is not necessary.

As described above, the Plaintiff United States filed an action in June 1995, alleging Clean Water Act violations with regard Ponds 5, 6, and 6A. With regard to that action, the United [**69] States used the same basic evidence that it uses in this case. The United States then settled this Clean Water Act case. As part of this settlement, the United States agreed to a Consent Decree. In that Consent Decree, the United States agreed that WCI should install a liner in Pond 6 and to fill in Pond 6A. Given the United States's agreement that WCI install a liner, it is inconsistent to now argue that Pond 6 must be closed to preserve public health.

Finding that the Plaintiff United States fails to show any imminent threat to health or the environment, the

Court denies the United States request for injunctive relief.

[*834] VI. CONCLUSION

For the reasons stated herein, the Court assesses a $ 1 million fine against Defendant WCI. The Court finds injunctive relief inappropriate in this case.

Accordingly, this action is terminated pursuant to Fed. R. Civ. P. 58.

IT IS SO ORDERED.

Date: October 22, 1999

Hon. James S. Gwin

U.S. District Court

ORDER

The Court has entered its findings of fact and conclusions of law in the above-captioned case. For the reasons set forth therein, the Court orders Defendant WCI Steel, Inc. to pay a civil fine of $ 1 million. Finding that WCI's RCRA [**70] violations pose no threat to the public health, the Court denies the United States' request for injunctive relief.

Accordingly, this action is terminated pursuant to Fed. R. Civ. P. 58.

IT IS SO ORDERED.

Date: October 22, 1999

Hon. James S. Gwin

U.S. District Court

Judicial Review of Discount Rates Used in Regulatory Cost-Benefit Analysis

Edward R. Morrison†

Executive orders, statutes, and precedent increasingly require cost-benefit analysis of regulations. Presidential executive orders have long required executive agencies to submit regulatory impact analyses[1] to the Office of Management and Budget ("OMB") before issuing regulations,[2] and recent federal legislation exhibits a trend toward mandatory cost-benefit analysis. For example, the Toxic Substances Control Act,[3] the Federal Insecticide, Fungicide and Rodenticide Act,[4] and the recent Safe Drinking Water Act Amendments[5] require the Environmental Protection Agency to balance costs and benefits in regulating chemicals and pesticides. In 1995, Congress passed the Unfunded Mandates Act,[6] requiring cost-benefit analysis of all significant federal regulations that require expenditures by state, local, or tribal governments.[7] Additionally, Congress has proposed several bills

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[1] A regulatory impact analysis assesses the potential costs and benefits (both monetary and nonmonetary) of a rule. EO 12291, 46 Fed Reg 13193, 13194 (1981). The report contains a "description of alternative approaches that could substantially achieve the same regulatory goal at lower cost, together with an analysis of this potential benefit and costs and a brief explanation of the legal reasons why such alternatives, if proposed, could not be adopted." Id.

[2] Although previous administrations issued executive orders encouraging agencies to consider the economic impact of proposed regulations, President Reagan's executive order, EO 12291, 46 Fed Reg 13193, was the first to require cost-benefit analysis. Section 2 of EO 12291 required agencies to ensure that the social benefits of a proposed regulation exceed its social costs. Id. In 1993, President Clinton issued EO 12866, 58 Fed Reg 51735 (1993), which generally affirms the approach of the Reagan order. Unlike Reagan's order, however, EO 12866 § 1(b) merely endorses cost-benefit analysis as a tool for evaluating regulatory options and does not require that benefits outweigh costs. 58 Fed Reg at 51735-36. See generally Richard H. Pildes and Cass R. Sunstein, *Reinventing the Regulatory State*, 62 U Chi L Rev 1, 3-7 (1995) (comparing the different approaches of the Reagan and Clinton executive orders); OMB, *Draft Report to Congress on the Costs and Benefits of Federal Regulations*, 62 Fed Reg 39352, 39355-57 (1997) (describing the development of regulatory analyses in successive administrations).

[3] 15 USC § 2605(c)(1) (1994).

[4] 7 USC § 136(bb) (1994).

[5] 42 USCA § 300g-1(b)(3) (1991 & Supp 1998).

[6] Pub L No 104-4, 109 Stat 48 (1995), codified at 2 USCA §§ 1501 et seq (1997).

[7] 2 USCA § 1532(a).

that would require federal agencies to apply cost-benefit analysis to all rules.[8]

This trend raises important questions about the methods agencies use to conduct cost-benefit analysis. To perform the analysis, an agency must first quantify the stream of costs and benefits that a regulation will generate in current and future periods.[9] Quantification, however, is not enough. Because of the time value of money (that is, a dollar today can be invested to yield more than a dollar tomorrow), costs and benefits in different periods are different "goods" and are not strictly comparable. Therefore, the agency must choose a discount rate that will convert future sums into present values. It can then use these present values to compute the net benefit (or "net present value") of the regulation.

Discount rates fundamentally influence judgments about the need for and the effectiveness of cost-benefit analysis. In 1986, OMB economist John Morrall documented extreme variation in the value that regulations implicitly place on human life.[10] On the low end, a National Highway Traffic Safety Administration ("NHTSA") regulation cost $100,000 per life saved;[11] on the high end, an Occupational Safety and Health Administration ("OSHA") rule cost $72 billion per life saved.[12] Although this study has greatly influenced recent congressional and academic proposals for regulatory reform,[13] emerging scholarship shows that Morrall's results depended critically on the discount rate he

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[8] See, for example, Risk Assessment and Cost-Benefit Act of 1995, HR 1022, 104th Cong, 1st Sess (Feb 23, 1995); Regulatory Improvement Act of 1997, S 981, 105th Cong, 2d Sess (June 27, 1997). See generally Cass R. Sunstein, *Congress, Constitutional Moments, and the Cost-Benefit State*, 48 Stan L Rev 247, 269-86 (1996) (describing regulatory reform efforts of the 104th Congress); Thomas O. McGarity, *The Expanded Debate over the Future of the Regulatory State*, 63 U Chi L Rev 1463, 1528-32 (1996) (same).

[9] This Comment ignores "incommensurability" issues—whether the value of life or other nonmonetary benefits can be measured "along a single metric without doing violence to our considered judgments about how these goods are best characterized." Cass R. Sunstein, *Incommensurability and Valuation in Law*, 92 Mich L Rev 779, 796 (1994).

[10] John F. Morrall III, *A Review of the Record*, Regulation 25, 30 table 4 (Nov/Dec 1986).

[11] *Initial Federal Motor Vehicle Safety Standards*, 32 Fed Reg 2408, 2414-15 (1967).

[12] *Occupational Exposure to Formaldehyde*, 50 Fed Reg 50412 (1985).

[13] See, for example, Lisa Heinzerling, *Regulatory Costs of Mythic Proportions*, 107 Yale L J 1981 (1998). Heinzerling notes, id at 1983 n 2, that Morrall's statistics underlie Stephen Breyer, *Breaking the Vicious Circle: Toward Effective Risk Regulation* 24-27 (Harvard 1993). For other commentary relying on Morrall's work, see Pildes and Sunstein, 62 U Chi L Rev at 105 & n 363 (cited in note 2); John D. Graham, *The Risk Not Reduced*, 3 NYU Envir L J 382, 398 n 79 (1994); W. Kip Viscusi, *Equivalent Frames of Reference for Judging Risk Regulation Policies*, 3 NYU Envir L J 431, 449-50 n 42 (1994).

chose, which differed markedly from the rates NHTSA and OSHA actually employed.[14]

The Morall study is just one example of how small variations in the discount rate can have very large effects on the results of cost-benefit analysis. Consider, for example, a proposed regulation that will generate $100 in benefits in fifty years. The present value[15] of this benefit is $61 at a 1 percent discount rate, $14 at 4 percent, $3 at 7 percent, and less than $1 at 10 percent. Unfortunately, despite the importance of the discount rate in cost-benefit analysis, few standards guide agency practice. Although OMB has issued discount rate guidelines since 1972,[16] discount rates vary significantly within and across agencies.

Few courts have reviewed agency discount rates, in part because relatively few statutes require agencies to conduct cost-benefit analysis, and in part because there are no meaningful standards of review for courts to apply. When courts have addressed the issue, they have either deferred to agency discretion or imposed their own judgments about discounting. The absence of standards for discounting is particularly troubling as cost-benefit analysis has played an ever greater role in new legislation. Although several legal scholars have discussed this problem, none has considered how economic theory can assist courts in reviewing agency discount rates.[17]

This Comment develops a framework for judicial review of an agency's choice of discount rate. Part I discusses the striking variation in the discount rates agencies use. Part II analyzes the economic theory of discounting and develops a simple conceptual framework for evaluating particular discount rates. Finally, Part III uses this conceptual framework to establish a standard of re-

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[14] See Heinzerling, 107 Yale L J at 1984-85 (cited in note 13).

[15] The general formula for computing the present value (in discrete time) of a sum X paid in n years, where the discount rate is r, is $X/(1 + r)^n$. Thus, when the discount rate is 5 percent, the present value of $100 paid in 50 years is $100/(1 + .05)^{50} = \$8.72$.

[16] See OMB, *Benefit-Cost Analysis of Federal Programs; Guidelines and Discounts*, 57 Fed Reg 53519, 53520 (1992), replacing and rescinding OMB Circular No A-94, *Discount Rate to be Used in Evaluating Time-Distributed Costs and Benefits* (Mar 27, 1972).

[17] One article has explored the appropriate discount rate policy for regulatory agencies. Daniel A. Farber and Paul A. Hemmersbaugh, *The Shadow of the Future: Discount Rates, Later Generations, and the Environment*, 46 Vand L Rev 267 (1993). The authors, however, do not address the appropriate standard of judicial review. Other commentators have discussed agency discount rates without reference to judicial review. See, for example, Heinzerling, 107 Yale L J at 2043-56 (cited in note 13); Bradford C. Mank, *Protecting the Environment for Future Generations: A Proposal for a "Republican" Superagency*, 5 NYU Envir L J 444, 460-62 (1996). See also Cass R. Sunstein, *Behavioral Analysis of Law*, 64 U Chi L Rev 1175, 1193-94 (1997).

view that courts may apply when reviewing an agency's choice of discount rate.

I. AGENCY PRACTICE: LARGE VARIATION WITHIN AND ACROSS AGENCIES

Agencies exhibit striking inconsistencies in their use of discount rates. Not only do different agencies use significantly different rates, but often a single agency employs very different rates for various regulations. Administrative records offer little explanation for this variation.

In an effort to standardize agency cost-benefit analysis, OMB has issued discount rate guidelines since 1972.[18] The most recent guidelines, published in 1992, recommend a 7 percent real[19] discount rate for analysis of all "public investments and regulatory programs that provide benefits and costs to the general public."[20] OMB asserts that this rate "approximates the marginal pretax rate of return on an average investment in the private sector in recent years."[21] However, OMB acknowledges that alternative rates may be appropriate in some cases.[22]

OMB's guidelines appear to have had little effect on the discount rates that agencies actually use.[23] This is evident in Tables 1 and 2 (following this Comment), which survey the discount rates agencies have employed during the past five years. Table 1 focuses on long-term regulations that provide costs or benefits over thirty or more years. Some agencies, such as the Department of Housing and Urban Development ("HUD") and the Food and Drug Administration ("FDA"), have used a relatively low rate of 3 percent; others, such as the Environmental Protection Agency ("EPA") and the Bureau of Reclamation, have employed rates in excess of 7 percent. Further, individual agencies have used different rates for different regulations. The EPA, for example, em-

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[18] See OMB, *Benefit-Cost Analysis of Federal Programs*, 57 Fed Reg at 53520 (cited in note 16).

[19] A real discount rate (as opposed to a nominal rate) excludes the premium for expected inflation.

[20] OMB, *Benefit-Cost Analysis of Federal Programs*, 57 Fed Reg at 53522-23 (cited in note 16). Prior to 1992, OMB recommended a 10 percent rate. OMB, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, 57 Fed Reg 35613, 35613-14 (1992).

[21] OMB, *Benefit-Cost Analysis of Federal Programs*, 57 Fed Reg at 53523 (cited in note 16).

[22] An agency, however, must gain OMB permission to use alternative discount rates, such as the "shadow price of capital," instead of the recommended 7 percent rate. Id.

[23] OMB has acknowledged as much. See OMB, *Draft Report to Congress*, 62 Fed Reg at 39379 (cited in note 2), where OMB notes that the EPA did not use the recommended discount rate in conducting its analysis of its lead-based paint rule.

ployed a 3 percent discount rate for regulations of lead-based paint but used 7 and 10 percent rates for regulations of drinking water and emissions from locomotives. This variation in discount rates has profound effects on the analysis of long-term regulations. Consider the HUD regulation of lead-based paint.[24] While that regulation had net benefits of $1,080.2 million at a 3 percent discount rate, it had net benefits of only $39 million at a 7 percent rate.[25] Although HUD acknowledged this, it favored the 3 percent rate merely because the regulation affected future generations.[26]

Slightly less inconsistency characterizes agency analyses of short-term regulations that yield benefits and costs within the next twenty years. Table 2 shows that most agencies use discount rates between 7 and 10 percent. However, there is still significant variation: several agencies, such as the EPA[27] and the FDA,[28] have used 3 percent rates.

The administrative record offers little explanation for the selection of discount rates. Many agencies employ discount rates without discussing the theoretical or political reasons for choosing a particular rate.[29] This seems particularly true for the EPA.[30]

II. THE THEORY OF DISCOUNT RATES

Scholars have long debated what discount rate is appropriate for regulations and other public projects. The debate has ethical, political, and economic dimensions. On one level, scholars debate the threshold issue of whether it is sound public policy for regula-

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[24] HUD, *Requirements for Notification, Evaluation and Reduction of Lead-Based Paint Hazards in Federally Owned Residential Property and Housing Receiving Federal Assistance*, 61 Fed Reg 29170 (1996).

[25] Id at 29189.

[26] Id. HUD noted that EPA also uses a 3 percent rate. Id.

[27] See EPA, *Comprehensive Guideline for Procurement of Products Containing Recovered Materials*, 62 Fed Reg 60962, 60970 (1997) (employing a 3 percent rate over a ten-year period).

[28] See Department of Health and Human Services, *Tobacco Regulation for Substance Abuse Prevention and Treatment Block Grants*, 61 Fed Reg 1492, 1504, 1506 (1996) (presenting benefit-cost analysis results using both 3 and 7 percent discount rates).

[29] Rare exceptions include the Department of Energy's regulation on energy conservation standards for consumer products, see Department of Energy, *Energy Conservation Program for Consumer Products*, 58 Fed Reg 47326, 47333-35 (1993), and the National Oceanic and Atmospheric Administration rules on natural resource damage assessments, see Department of Commerce, National Oceanic and Atmospheric Administration, *Natural Resource Damage Assessments*, 61 Fed Reg 440, 453-54 (1996), where the agencies justify their decisions to depart from OMB guidelines. See discussion in Part III.C.

[30] See, for example, EPA, *Protection of Stratospheric Ozone; Labeling*, 58 Fed Reg 8136, 8163 (1993) (offering alternative conclusions using a 2 percent and 7 percent rate without providing an explanation for using either discount rate).

tory agencies to discount future benefits, especially when those benefits accrue to future generations. On another level, given the choice to discount future costs and benefits, the debate becomes more economic. Here scholars disagree whether regulatory agencies should derive the appropriate discount rate from rates of return in financial markets or from a normative model of intergenerational social welfare.

This Part surveys both levels of the debate. Part A addresses the ethical, political, and economic debate over the threshold decision to discount future costs and benefits, demonstrating that sound public policy requires a regulatory agency to discount future sums. Part B surveys the economic and political debate over the appropriate discount rate. Finally, Part C synthesizes the discussion in this Part and develops a simple conceptual framework for choosing and evaluating discount rates.

A. The Philosophical Approach to Discount Rates

Philosophers,[31] legal scholars,[32] and several economists[33] have questioned the ethical and logical theory underlying the decision to discount future costs and benefits to future generations. A strong intuition suggests that individual lives today are no more or less valuable than lives in the future.[34] Just as a person's life should not be treated as less valuable because the person lives one hundred miles away, so too a life should not be treated as less valuable because it will exist one hundred years in the future.

Thus philosophers and some economists have argued that a zero discount rate should be used when evaluating projects with consequences that may benefit or harm future generations.[35] This

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[31] See, for example, Derek Parfit, *Rationality and Time*, 1983/84 Proceedings of the Aristotelian Society 47, 79-81; Derek Parfit, *Energy Policy and the Further Future: The Social Discount Rate*, in Douglas MacLean and Peter G. Brown, eds, *Energy and the Future* 31-37 (Rowman and Littlefield 1983); John Rawls, *A Theory of Justice* 284-303 (Belknap 1971).

[32] See, for example, Farber and Hemmersbaugh, 46 Vand L Rev at 289-300 (cited in note 17); Mank, 5 NYU Envir L J at 448-50, 460-62 (cited in note 17).

[33] See, for example, R.F. Harrod, *Towards a Dynamic Economics: Some Recent Developments of Economic Theory and their Application to Policy* 37-40 (Macmillan 1948); A.C. Pigou, *The Economics of Welfare* 24-26 (Macmillan 4th ed 1932); F.P. Ramsey, *A Mathematical Theory of Saving*, in J.M. Keynes and D.H. MacGregor, eds, *The Economic Journal: The Journal of the Royal Economic Society* 543 (Macmillan 1928); Robert M. Solow, *The Economics of Resources or the Resources of Economics*, 64 Am Econ Rev: Papers and Proceedings 1, 7-14 (1974).

[34] See Bruce A. Ackerman, *Social Justice in the Liberal State* 203 (Yale 1980).

[35] See id at 203; Harrod, *Towards a Dynamic Economics* at 45 (cited in note 33); Parfit, *Energy Policy* at 31, 36-37 (cited in note 31); Ramsey, *A Mathematical Theory of Saving* at 554 (cited in note 33); Solow, 64 Am Econ Rev: Papers and Proceedings at 9 (cited in note 33).

approach recognizes that harms to future generations deserve no less protection than harms to the current generation. As the renowned economist Frank Ramsey explained: "[I]t is assumed that we do not discount later enjoyments in comparison with earlier ones, a practice which is ethically indefensible and arises merely from the weakness of the imagination."[36]

Some commentators go further, arguing that the "present generation has a fiduciary responsibility to see that future generations enjoy a parity of social value and opportunity."[37] This fiduciary duty implies that the welfare of future generations, especially nearer ones, should be treated on par with (that is to say, not discounted relative to) the welfare of the current generation.[38]

This argument for zero discounting, however, does not deny the time value of money—that a dollar tomorrow is worth less than a dollar today (because a dollar can be invested today and yield more than a dollar tomorrow). Indeed, proponents of zero discount rates likely would agree that society *should* discount a monetary sum payable to future generations. Society can bequeath that benefit to future generations simply by investing a smaller sum in financial markets today. Rather, proponents of zero discounting argue that regulators should not discount *nonmonetary* benefits to future generations. Putting aside difficult commensurability problems, society cannot bequeath these benefits to future generations merely by investing in financial markets. This is especially true for environmental, health, and other less tangible benefits that future generations may be unable to "buy," because previous generations caused irreversible damage to the resources that provide these benefits. For example, if current society improperly stores nuclear waste and leakage causes the death of a child in some future generation, no sum will enable the parent to "buy" back the child's life.

While reasonable, the ethical intuition that the state should not discount benefits to future generations suffers from two weaknesses. First, this ethical standard can beget apparently unethical results. If the current generation is morally obligated to treat the welfare of future generations on par with its own welfare, then logic dictates that the current generation has a duty to undertake almost any sacrifice, short of starvation, to benefit the

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[36] Ramsey, *A Mathematical Theory of Saving* at 261 (cited in note 33).

[37] Mank, 5 NYU Envir L J at 448 (cited in note 17), referring to Ackerman, *Social Justice* at 203 (cited in note 34). See also Rawls, *A Theory of Justice* at 284-93 (cited in note 31); Mark Sagoff, *The Economy of the Earth: Philosophy, Law and the Environment* 63 (Cambridge 1988).

[38] See Farber and Hemmersbaugh, 46 Vand L Rev at 298-99 (cited in note 17).

future.[39] By foregoing consumption today and investing in projects that provide a stream of benefits for future generations, the current generation suffers a finite sacrifice but generates an infinite benefit (due to zero discounting) for the future.[40] Indeed, the moral intuition of zero discounting implies that it may be optimal for the current generation to save two-thirds or more of its annual income.[41] This is unacceptable, however, for "individuals are not morally required to subscribe fully to morality at any cost to themselves."[42] Further, while the argument against discounting seems compelling where future harms (such as the death of a child) are irreversible, this argument is too powerful. Most, if not all, regulations today seek to prevent some form of irreversible damage in the future, perhaps in future generations. Therefore, even the argument against discounting irreversible damage would generate excessive sacrifice today.

Second, the moral intuition of zero discounting rests on the questionable assumption that government policy should be based on moral introspection rather than individuals' actual behavior. Unless there is evidence that the current generation is not sufficiently altruistic toward future generations (evidence of a market failure), the observed behavior of individuals may be the most reliable indicator of the beliefs and values that should dictate policy choices in a democracy. Relative to the government, parents (the current generation) probably have superior information about optimal investments in the welfare of their children (future generations). Further, even if surveys indicate that a majority of the members of the current generation favors a zero discount rate, this finding is not persuasive if individuals in society behave *as if* they discount the future.[43] Discounting may be a good description

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[39] See Kenneth J. Arrow, *Discounting, Morality, and Gaming* 3-8, working paper (Dec 24, 1996), available online at <http://www-econ.stanford.edu/econ/wk-workp/swp970004.html> (visited July 6, 1998).

[40] See id at 5.

[41] See id at 6-7, developing a simple model of optimal investment and saving in a world that lasts forever. Empirical estimates of the model's parameters suggest that the optimal savings rate is two-thirds or greater.

[42] Id at 2. Philosophers and legal scholars reject this criticism, claiming that it confuses intergenerational efficiency and intergenerational equity. See Tyler Cowen and Derek Parfit, *Against the Social Discount Rate*, in Peter Laslett and James S. Fishkin, eds, *Justice between Age Groups and Generations* 148-49 (Yale 1992); Farber and Hemmersbaugh, 46 Vand L Rev at 291-92 (cited in note 17). In reality, society maximizes two objectives: total welfare and intergenerational equity. See Cowen and Parfit, *Against the Social Discount Rate* at 149 ("[W]e should not simply aim for the greatest net sum of benefits. We should have a second moral aim: that these benefits be fairly shared between different generations."), citing Rawls, *A Theory of Justice* at 297-98 (cited in 31).

[43] For a well-known statement of this principle of economic modeling, see Milton Friedman, *The Methodology of Positive Economics*, in Kurt R. Leube, ed, *The Essence of*

of individual behavior, and a good guide for public policy, regardless of whether individuals believe they discount the future or not.[44]

B. The Economic Approach to Discount Rates

Economic theory offers two principal theories for discounting costs and benefits to future generations: the opportunity cost of capital ("OCC") and the social rate of time preference ("SRTP"). Both theories provide strong political and ethical support for positive discount rates. However, economists disagree whether the OCC or SRTP should guide regulators.[45] Although the two theories are logically consistent,[46] they generate very different discount rates in practice. The SRTP yields relatively low rates, around 1 to 3 percent.[47] In contrast, the OCC generally produces rates in excess of 5 percent.[48] This Part introduces the two theories and reviews the major issues underlying the debate.

1. Opportunity cost of capital.

a) The economic theory. The cost of a public investment is not merely the value of the resources consumed. It also includes the opportunity cost of those resources. The opportunity cost reflects the value of the next best use of the resources, such as investment in the private sector. Consider, for example, a proposed regulation that costs $1 million today and promises to reduce

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Friedman 161-66 (Hoover Institution 1987).

[44] Kenneth J. Arrow has demonstrated that this is actually the case in *Intergenerational Equity and the Rate of Discount in Long-Term Social Investment* 19-20, working paper (Dec 1995), available online at <http://www-econ.stanford.edu/econ/workp/swp97005.html> (visited July 5, 1998). Even in a world where each generation wants to treat all future generations equally, every generation will behave as if it discounts the future. This occurs because, as the philosophical critique recognizes, no generation will make excessive sacrifices for the future. Every generation is slightly selfish. Consequently, each generation strategically decides how many resources to transfer to the next generation, given that the next generations may decide not to transfer these resources to the further future. The result of this strategic interaction is a savings rate that corresponds to a positive rate of discount on the welfare of future generations.

[45] See id at 3-10.

[46] See Robert C. Lind, *A Primer on the Major Issues Relating to the Discount Rate for Evaluating National Energy Options*, in Robert C. Lind, ed, *Discounting for Time and Risk in Energy Policy* 27 (Resources for the Future 1982).

[47] See Kenneth J. Arrow, et al, *Intertemporal Equity, Discounting and Economic Efficiency*, in James P. Bruce, Hoesung Lee, and Erik F. Haites, eds, *Climate Change 1995* 131-33 (Cambridge 1996); Richard D. Morgenstern, *Conducting an Economic Analysis: Rationale, Issues, and Requirements*, in Richard D. Morgenstern, ed, *Economic Analyses at EPA: Assessing Regulatory Impact* 36 (Resources for the Future 1997).

[48] See Arrow, et al, *Intertemporal Equity* at 132-33 (cited in note 47); Morgenstern, *Conducting an Economic Analysis* at 36 (cited in note 47).

pollutants that will cause damaging climate change in fifty years. If nothing is done to control the pollutants today, fifty years from now future society will suffer damage requiring $10 million in abatement costs. At first blush, the regulation appears attractive: a $1 million investment avoids a $10 million expenditure in the future. No conclusion about the desirability of the regulation can be drawn, however, without considering the next best use of the $1 million investment today. If the resources could be invested in an asset, such as a long-term bond with a 5 percent return, society would be better served if the government avoided the regulation: the bond would yield over $10 million in fifty years,[49] leaving future generations with more than enough resources to combat the environmental damage. In other words, at a 5 percent discount rate, the proposed regulation does not pass the cost-benefit test because it has a negative net present value.

A standard measure of the opportunity cost of a public investment is the interest rate on assets with similar risk and duration in private financial markets. Public investment generally displaces private investment because it takes resources out of the private sector, either directly (through taxes) or indirectly (through the private costs of complying with regulations).[50] Private assets, therefore, represent the next best investment opportunities for the resources used for public investments.[51]

The fundamental intuition underlying the OCC approach is that the government should choose projects that maximize the resources available to future generations, not those that maximize particular aspects of future welfare, such as environmental well-being. Because the current generation cannot know the economic constraints facing future generations, it is better for the current generation to invest in their general well-being by choosing the projects with the highest rates of return. As proponents of this approach argue:

> Insofar as we today should consider the welfare of future generations, our duty lies not in leaving them exactly the social and environmental life we think they ought to have, but rather in making it possible for them to inherit a climate of open choices—that is, in leaving behind a larger level of general fluid resources to be redirected as they, not we, see fit.[52]

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[49] The actual payoff of the bond would be ($1,000,000)x$(1.05)^{50}$=$11,467,340.

[50] See, for example, Arrow, *Intergenerational Equity* at 7 (cited in note 44); William J. Baumol, *On the Social Rate of Discount*, 58 Am Econ Rev 788, 789-93 (1968).

[51] See generally *Discounting an Uncertain Future*, FEEM Newsletter 24 (Dec 1997).

[52] Arrow, et al, *Intertemporal Equity* at 133 (cited in note 47), quoting Aaron Wildav-

b) Applying the economic theory. The OCC is a *descriptive* approach to the choice of a social discount rate.[53] The approach assumes that the price system—in particular, the rate of return available in financial markets—accurately reflects the scarcity of resources, expectations about the future, and societal preferences regarding future consumption vis-à-vis current consumption. The OCC approach makes no assumption about what the social discount rate *should* be.

The OCC approach, however, is complicated and may not be appropriate for evaluating all public projects. Critics have identified several limitations to the OCC approach. To begin, the OCC is not directly observable. Rates of return in financial markets include premia for risk,[54] the expected rate of inflation, and taxes that should not affect the social discount rate. Scholars have shown that once these factors are subtracted, the discount rate (in real terms) will generally exceed 5 percent, but it may be as low as 1 percent.[55] The particular rate will vary over time and will change with expectations regarding the welfare of future generations. Critics, however, note that it is very difficult to adjust observed rates of return for taxation, risk, and other factors.[56]

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sky, *Searching for Safety* 216 (Transaction Books 1988).

[53] See Arrow, et al, *Intertemporal Equity* at 132-33 (cited in note 47). .

[54] Although risk-averse investors demand a premium to compensate for the risk of an asset, most scholars agree that no such premium is necessary for government investments because (1) the government's investment portfolio (its collection of regulations and investments) is sufficiently broad to eliminate most diversifiable risk, see Baumol, 58 Am Econ Rev at 794 (cited in note 50), and (2) even if a government investment is risky, the cost of risk-bearing is trivial when it is spread among taxpayers, see Kenneth J. Arrow and Robert C. Lind, *Uncertainty and the Evaluation of Public Investment Decisions*, 60 Am Econ Rev 364, 370-74 (1970).

[55] See Arrow, et al, *Intertemporal Equity* at 133 (cited in note 47); Raymond J. Kopp and Paul R. Portney, *Mock Referenda for Intergenerational Decisionmaking*, 5 Discussion Paper 97-48 (Resources for the Future 1997), available online at <http://www.rff.org/disc_papers/PDF_ files/9748.pdf> (visited July 5, 1998).

[56] See Richard H. Thaler and George Loewenstein, *Intertemporal Choice*, in Richard H. Thaler, ed, *The Winner's Curse: Paradoxes and Anomalies of Economic Life* 105-06 (Princeton 1996). Additionally, some scholars object to the use of the OCC when an agency evaluates benefits to future generations because financial markets generally do not offer assets that pay out in future generations. See Farber and Hemmersbaugh, 46 Vand L Rev at 296-97 (cited in note 17); FEEM Newsletter, *Discounting* at 24-25 (cited in note 51). The OCC makes most sense where financial markets offer assets with term structures that are similar to regulations that agencies are considering. In such situations, the agency can directly compare the payoff of the regulation to the payoff of the asset. Where the regulation involves intergenerational welfare, financial markets are unhelpful and therefore the OCC approach is inappropriate. This objection, however, merely points out a complication of the OCC; it does not undermine the approach. Financial markets will exist in future generations, so there are trading strategies whereby individuals could invest sequentially in private assets that collectively have a duration comparable to the long-term public project. The expected rate of return on this strategy would be one logical discount rate for the public investment.

Additionally, critics note that the OCC approach assumes that public projects and regulations divert resources (via taxation) from capital markets. To the contrary, evidence suggests that, in the absence of taxation, members of society would invest only a fraction of their resources in credit markets[57] and would consume the rest. Therefore, to the extent that regulations are financed by resources that would otherwise be consumed, the OCC may overstate the appropriate rate of discount. Instead, the SRTP, which measures the rate at which society is willing to trade current and future *consumption*, may be closer to the relevant rate.[58]

These considerations have led some economists to conclude that the appropriate discount rate may vary with the type of regulation or public project and how it is financed. When the government relies on debt to finance the regulation, the OCC provides more accurate results.[59] When government relies on taxes, however, a combination of the OCC approach and the SRTP approach may be more appropriate.[60] At least one economist, however, has questioned this notion that the discount rate should vary with the government's source of funds.[61] Whether the state uses debt or taxes to finance regulations, it is essentially imposing a tax on production by diverting inputs from productive processes (firms). Therefore, the appropriate discount rate will always be the OCC.

2. Social rate of time preference.

a) The economic theory. While the OCC relies on observable behavior to derive the social discount rate, the SRTP relies on theory to derive that rate. Standard economic theory hypothesizes,[62] and empirical evidence confirms,[63] that individuals value

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[57] See Arrow, *Intergenerational Equity* at 9 (cited in note 44).

[58] See id; see also Lind, *A Primer on the Major Issues* at 29-32 (cited in note 46); Joel D. Scheraga, *Perspectives on Government Discounting Policies*, 18 J Envir Econ & Mgmt S-65, S-67 (1990). The SRTP is discussed in the following Part.

[59] See, for example, Scheraga, 18 J Envir Econ & Mgmt at S-65 (cited in note 58).

[60] The appropriate discount rate would be a weighted average of the rates derived from the OCC and SRTP approaches, where the weights are approximately equal to the proportion of funds that displaces investment (for the OCC-based rate) and the proportion that displaces consumption (for the SRTP-based rate). See Larry A. Sjaastad and Daniel L. Wisecarver, *The Social Cost of Public Finance*, 85 J Pol Econ 513, 514-16 (1977).

[61] See Baumol, 58 Am Econ Rev at 791-92 (cited in note 50).

[62] See generally Maureen L. Cropper and Frances G. Sussman, *Valuing Future Risks to Life*, 19 J Envir Econ & Mgmt 160, 173-74 (1990) (applying standard theory to the problem of valuing future risks to life); Andreu Mas-Colell, Michael D. Whinston, and Jerry R. Green, *Microeconomic Theory* 732-36 (Oxford 1995) (describing standard theory of intertemporal choice and the theory underlying discounting).

current consumption more than future consumption. The rate at which a person will trade (via a hypothetical asset) current for future consumption is known as the individual rate of time preference. Analogously, the *social* rate of time preference represents the rate at which members of society, on average, are willing to trade current benefits for future benefits. The appropriate measure of the SRTP, however, depends on the government's theory of intergenerational welfare: different models of welfare imply different measures of the SRTP.

Most welfare models, in which the current government chooses projects to maximize the joint welfare of all generations, show that the SRTP can be written as the sum of two components: pure time preference and the growth rate of per capita income.[64] Pure time preference is a measure of preferences, reflecting each generation's desire (or impatience) to receive benefits sooner rather than later.[65] The more impatient the present generation, the higher the discount rate on benefits to future generations. The growth rate of per capita income is a measure of scarcity, reflecting the relative incomes of different generations.[66] The higher the income of future generations relative to the current generation (that is, the higher the growth rate of per capita income), the higher the discount on benefits to future generations.

The pure time preference component is controversial because it might reflect myopia, a special affinity for nearer generations, or some other defect in "our telescopic faculty" that should not guide government decisions about intergenerational welfare.[67] This criticism is valid insofar as the observed "myopia" of the current generation imposes some negative externality on future gen-

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[63] See, for example, Michael J. Moore and W. Kip Viscusi, *Discounting Environmental Health Risks: New Evidence and Policy Implications*, 18 J Envir Econ & Mgmt S-51, S-61 (1990) (providing evidence that workers discount future job-related health and safety hazards at a 2 percent rate); Thaler and Loewenstein, *Intertemporal Choice* at 92 (cited in note 56) (discussing evidence that discount rates vary with age, irrespective of whether the future outcome is a gain or loss, or whether the size of the gain or loss is large or small).

[64] See Arrow, et al, *Intertemporal Equity* at 134-35 (cited in note 47). There the authors illustrate a popular welfare model: a continuous-time welfare function, where the welfare of each generation is additively separable. In this model, the optimality conditions for public investment yield the expression: $\Delta+\mu g=SRTP$. Here, Δ is a measure of pure time preference ("impatience"), g is the growth rate of per capita income, and μ is a scale factor equal to the elasticity of marginal utility with respect to consumption (for simplicity, this scale factor can be treated as constant and ignored). While Δ is constant over time, μg will vary with per capita income. The higher the rate of income growth, g, the higher is the social rate of discount r.

[65] See id at 131, 136.

[66] See id.

[67] Pigou, *The Economics of Welfare* at 25 (cited in note 33).

erations, who would pay the current generation to be less myopic if such payments were possible. Thus, the government should override societal preferences in favor of intergenerational welfare.[68] However, given that individuals are altruistic toward future generations (for example, children and grandchildren), it is unclear when the preferences of the current generation will exert a negative externality on future generations.[69]

In contrast, the SRTP's dependence on economic growth has strong economic and ethical justifications. If future generations will be better off than the current generation, optimal resource allocation suggests that the current generation should favor public investments with immediate payoffs over those that benefit future generations.[70] Similarly, the ethical notion that one generation should not sacrifice excessively for another implies that regulatory agencies should discount benefits to future generations—who will be better off than current citizens anyway—when evaluating potential projects.[71]

b) Applying the economic theory. The SRTP is a *prescriptive* approach to the social discount rate. It assumes that society should maximize an arbitrarily chosen intergenerational welfare function,[72] and then derives the social discount rate from the optimality conditions of that function. This approach, however, raises at least three controversial ethical, political, and economic issues.

First, while the OCC approach relies on observable economic behavior, the SRTP rejects such evidence in favor of normative models of intergenerational welfare. Thus the SRTP implicitly assumes a market failure: financial markets provide a poor indicator of society's willingness to invest in particular projects (such as climate control) that benefit future generations.[73] The source of this market failure is unclear. The failure may result from information problems, such as the current generation's inability to as-

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[68] Many economists do not believe that myopic societal preferences justify government intervention. See, for example, Kopp and Portney, *Mock Referenda* at 5 (cited in note 55). See also Arrow, et al, *Intertemporal Equity* at 136 (cited in note 47), where the authors note that a nonzero pure rate of time preference may be defensible because "as a matter of *description*, the current generation gives less value to consumption of future generations."

[69] Once we account for altruism, the societal discount rate will be a function of the rate of intergenerational altruism. See Gary S. Becker, *A Treatise on the Family* 162-69 (Harvard Enlarged ed 1991).

[70] See Arrow, et al, *Intertemporal Equity* at 131, 136-37 (cited in note 47).

[71] See id at 136.

[72] See, for example, the welfare function discussed in note 64.

[73] See Sjaastad and Wisecarver, 85 J Pol Econ at 515-16 (cited in note 60).

sess the costs to future generations (for example, pollution mitigation, medical costs, and risks of mortality) if a particular regulation is not imposed.[74] Alternatively, the market failure may reflect myopia: members of the current generation may not care sufficiently about (or may not be sufficiently altruistic toward) future generations, who would be willing to pay members of the current generation to invest in particular projects.[75] In either case, however, the government likely cannot test whether the market failure is sufficiently serious to warrant the normative approach of the SRTP, which effectively overrides observed societal preferences in favor of a particular welfare model.

Second, even assuming market failures warrant the SRTP approach, it is unclear whether an agency can identify an appropriate intergenerational welfare function and whether that function will generate discount rates that yield better outcomes than rates derived by the OCC approach.[76] Critics claim that even the most simple (and popular) welfare functions yield unreasonable discount rates that are "glaringly inconsistent" with the observed behavior of governments.[77] Further, if the SRTP yields a social discount rate that differs from the rate based on the OCC—thereby forcing society to invest at a rate that differs from market rates—government regulation may not have its intended effect on future generations. Society today can only control the welfare of the immediately succeeding generation.[78] If government today attempts to influence further generations by investing in irreversible projects (such as climate control technology), intermediate generations will merely reduce their investments in the future if they believe that the original investment was excessive. Such a reduction in investments is particularly likely to occur if technological changes have made the original investments worthless.[79]

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[74] See, for example, Amartya K. Sen, *Approaches to the Choice of Discount Rates for Social Benefit-Cost Analysis*, in Lind, ed, *Discounting for Time and Risk* at 349-50 (cited in note 46).

[75] Id at 349.

[76] See Arrow, et al, *Intertemporal Equity* at 131-33 (cited in note 47).

[77] Id at 132. The authors further note that a "discount rate of 2% implies far more investment than actually occurs in any country now, and thus would require a big jump in savings rates to finance." Id at 133.

[78] See Richard A. Epstein, *Justice Across the Generations*, 67 Tex L Rev 1465, 1482 (1989); Arrow, *Discounting, Morality, and Gaming* at 12 (cited in note 39).

[79] This is a variant of the theory of Ricardian Equivalence, which states that government generally cannot force one generation to save for the next by imposing a tax or investing in long-term assets. This forced saving will be "undone" as members of the first generation reduce their private bequests to future generations. For the basic theory of Ricardian Equivalence, see Robert J. Barro, *Are Government Bonds Net Wealth?*, 82 J Pol Econ 1095 (1974).

Contrary to the beliefs of some commentators,[80] economic theory provides strong support for the principle that current society best serves future generations by choosing investments that maximize general welfare in the future, not by choosing investments that protect future societies against particular problems.[81]

Finally, even if a regulator can identify a proper intergenerational welfare function, the regulator faces complex methodological problems. Consider the simple welfare function that describes the SRTP as a function of pure time preference and the growth rate of per capita income. Scholars debate how to measure these components of the SRTP. Although the typical approach is to derive the components from studies of individual behavior, studies in behavioral economics show that individual time preference may vary with age, income, the type of future payoff (that is to say, whether the payoff is a gain or loss, or whether it involves risk to future lives), and the amount of time until the payoff.[82] Indeed, some studies indicate that the SRTP may be much higher than scholars have generally believed and may even exceed the OCC.[83] The SRTP theory offers no guidance here.

Additionally, once an agency computes the SRTP, it faces significant difficulties in applying the rate.[84] Unlike the OCC, the SRTP is an appropriate discount rate for future *consumption*. Thus, an administrative agency must convert all costs and benefits of a proposed regulation into consumption equivalents; as in the OCC approach, the costs of a proposed regulation include the private investment that it displaces.[85]

3. A conceptual framework.

As a threshold matter, it seems unreasonable for agencies not to discount benefits to future generations in their cost-benefit analyses of proposed rules. To begin, without a discount rate, the analysis fails to account for the opportunity cost of resources that are diverted from private investment toward investment in the

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[80] See Farber and Hemmersbaugh, 46 Vand L Rev at 298-99 (cited in note 17).

[81] See Arrow, *Discounting, Morality, and Gaming* at 12 (cited in note 39).

[82] See generally Thaler and Loewenstein, *Intertemporal Choice* at 92-106 (cited in note 56).

[83] See id. See also Robert C. Lind, *Reassessing the Government's Discount Rate Policy in Light of New Theory and Data in a World Economy with a High Degree of Capital Mobility*, 18 J Envir Econ & Mgmt S-8, S-19 (1990), in which the author points to evidence that credit card debtors pay interest rates in excess of 16 percent.

[84] See Morgenstern, *Conducting an Economic Analysis* at 36 (cited in note 47); Scheraga, 18 J Envir Econ & Mgmt at S-66 (cited in note 58).

[85] See Lind, *A Primer on the Major Issues* at 39-55 (cited in note 46); Lind, 18 J Envir Econ & Mgmt at S-11 (cited in note 83).

proposed rule. Having no discount rate may lead the agency to adopt rules that *reduce* the welfare of future generations, because the resources could have been invested in assets with higher rates of return. Additionally, a zero discount rate biases cost-benefit analysis in favor of rules that impose excessive sacrifices on the current generation. Finally, a zero discount rate is inconsistent with the observable behavior of individuals, which is arguably the best guide for policy in a democratic state.

The choice of discount rate is primarily a matter of policy and secondarily a matter of methodology.[86] Policy judgments largely dictate the choice between the two competing approaches to discounting. The OCC approach assumes that succeeding generations will be in the best position—because of superior information—to deal with environmental, health, or other problems. Therefore, the optimal regulatory policy is to maximize the wealth of succeeding generations. In contrast, the SRTP approach assumes that current society may be in a better position to deal with particular problems, such as global warming and nuclear waste storage. Thus, the SRTP overrides market prices and chooses seemingly suboptimal investments (relative to prevailing market rates of return) to ensure that future generations do not suffer these risks. Thus, agency choice between the OCC and SRTP approaches should be based, in part, on a determination whether current society is in a better position to deal with long-term problems.

Methodological issues determine the relative costs of applying the OCC or SRTP approaches. While the OCC approach requires detailed information about alternative financial assets and adjustments for taxes, risk, and inflationary expectations, the SRTP requires complex estimates of parameters such as the pure rate of time preference and the growth rate of per capita income.[87] Additionally, the SRTP approach requires an agency to determine the precise effects of the regulation on future *consumption*. Although the regulation may raise future consumption by improving air quality or other public goods, the project may also lower future consumption by diverting funds from private investment. The agency must subtract this "opportunity cost" of the regulation, which raises precisely the same issues as in the OCC approach (specifically, the agency must adjust market rates of return for risk, taxes, inflation, and other distortions).

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[86] This is also described in Arrow, et al, *Intertemporal Equity* at 134 (cited in note 47).

[87] Additionally, as shown in note 64, the SRTP also requires an estimate of a scale factor representing the elasticity of marginal utility with respect to per capita income.

On balance, policy and methodology issues favor the OCC over the SRTP. Because the current generation cannot know the resource constraints or preferences of future generations, regulators take large gambles with scarce resources when they follow the SRTP approach and invest in particular environmental, energy, or other projects that have lower returns than assets in financial markets. Like the Malthusian predictions of overpopulation,[88] these gambles may prove mistaken because they are based on incomplete information about market failures in financial markets and the capabilities of future generations to contend with environmental and other harms. Future generations would be better served (and better able to contend with future harms) if the government invests in rules that maximize their general welfare and enable them to make their own choices regarding the environment, energy, and other public goods.

Additionally, methodological issues favor the OCC approach because it is much simpler to calculate and apply.[89] While the OCC relies on observable financial market data, the SRTP requires that the regulator select a particular welfare function, derive an expression for the social discount rate, and identify empirical analogues for the parameters of the discount rate. Additionally, the regulator must convert all benefits and costs (including opportunity costs) into consumption equivalents.

III. JUDICIAL REVIEW OF AGENCY DISCOUNT RATES

Very few courts have reviewed agency discount rates. When courts have reached the issue, they have either deferred to agency discretion[90] or imposed their own judgment about discounting.[91] No court has developed a meaningful standard of review for agency choice of discount rates. This is troubling because legislation increasingly requires cost-benefit analysis. As such legislation is enacted, courts will encounter challenges to the methods—including discount rates—agencies use to conduct the

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[88] See generally Gary S. Becker, *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education* 323-25 (Chicago 3d ed 1993).

[89] See Raymond J. Kopp, Alan J. Krupnick, and Michael Toman, *Cost-Benefit Analysis and Regulatory Reform: An Assessment of the Science and the Art* 41, available online at <http://www.rff.org/disc_papers/PDF_files/9719.pdf> (visited July 5, 1998); Morgenstern, *Conducting an Economic Analysis* at 36-37 (cited in note 47).

[90] See, for example, *Ohio v Department of Interior*, 880 F2d 432, 465 (DC Cir 1989) (deferring to Department's choice of discount rate, which is "first and foremost a policy choice").

[91] See, for example, *Corrosion Proof Fittings v EPA*, 947 F2d 1201, 1218 (5th Cir 1991), citing popular press—*What Price Posterity?*, The Economist 73 (Mar 23, 1991)—for the principle that if EPA discounts future costs, it must also discount future benefits.

analysis. Judicial review will prevent arbitrary agency decisions and ensure that statutory cost-benefit requirements have force. Without standards to cabin agency discretion, cost-benefit analysis may become mere window dressing, providing a veneer of scientific backing for agencies' arbitrary choices.[92]

This Part proposes a standard for judicial review. First, Part A briefly indicates when a court should review agency discount rates. Part B then shows that significant uncertainty surrounds the standard of review that courts should apply to discount rates. In an effort to resolve the uncertainty, this Part proposes a standard of review based on the conceptual framework developed in Part II. Finally, Part C illustrates the proposed standard of review by applying it to discount rates that agencies have employed in recent cost-benefit analyses.

A. When Judicial Review Is Appropriate

A court will review agency discount rates when either the underlying statute requires cost-benefit analysis or the agency relies on such analysis to justify a rule, adjudication, or exercise of discretion.

Statutes increasingly contain direct or indirect requirements for traditional cost-benefit analysis or a less rigorous comparison of the costs and benefits of a regulation. Direct requirements appear in such statutes as the Toxic Substances Control Act ("TSCA"), which requires the agency to consider "reasonably ascertainable economic consequences of the rule,"[93] and the Federal Insecticide, Fungicide and Rodenticide Act ("FIFRA"), which requires the agency to promulgate regulations of toxins after considering the environmental, economic, and social impact of the regulations.[94] Similarly, the Energy Policy and Conservation Act ("EPCA") requires the Department of Energy to assess whether an energy conservation regulation is economically justified,[95] and

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[92] See, for example, Scheraga, 18 J Envir Econ & Mgmt at S-66 (cited in note 58) (The author, an EPA official, noted that "many discounting procedures are subject to manipulation. . . . This can lead to manipulation of the outcomes by some clever (or perhaps ignorant) analyst.").

[93] 15 USC § 2605(c)(1) ("In promulgating any rule under . . . this section with respect to a chemical substance or mixture, the Administrator shall consider and publish a statement with respect to . . . the reasonably ascertainable economic consequences of the rule, after consideration of the effect on the national economy, small business, technological innovation, the environment, and public health.").

[94] 7 USC § 136(bb) defines an "unreasonable adverse effect on the environment" as "any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide."

[95] 42 USC § 6295(o)(2)(B)(i)(I) (1994) (providing that the Department of Energy must

the 1996 Amendments to the Safe Drinking Water Act ("SDWA") explicitly require cost-benefit[96] and risk-risk[97] analysis of all major drinking water regulations. Additionally, under the Unfunded Mandates Act,[98] *all* federal agencies must conduct cost-benefit analysis of any rule requiring significant (over $100 million) expenditures by state, local, or tribal governments.[99]

Indirect requirements for cost-benefit analysis appear in statutes mandating reasonable regulations, such as regulations that are "reasonably necessary" or that reduce an "unreasonable risk." In *American Textile Manufacturers' Institute, Inc v Donovan* (the *Cotton Dust* case),[100] the Supreme Court noted that Congress likely intends cost-benefit analysis where a statute uses the phrase "unreasonable risk."[101] Similarly, many lower courts have found requirements for cost-benefit analysis in statutory language calling for "reasonably necessary" regulations.[102]

Where statutes contain such direct or indirect language requiring cost-benefit analysis, courts can and should review the methods that agencies use, especially their choice of discount rate. In *Corrosion Proof Fittings v EPA*,[103] the Fifth Circuit reviewed the EPA's choice of discount rate under the TSCA,[104] and in *Natural Resources Defense Council, Inc v Herrington*,[105] the D.C. Circuit reviewed the agency's discount rate in a rulemaking

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consider, among other things, "the economic impact of the standard on manufacturers and on the consumers of products subject to such standard").

[96] 42 USCA §300g-1(b)(3)(C)(i) provides that "[w]hen proposing any national primary drinking water regulation that includes a maximum contaminant level, the Administrator shall" analyze the costs of complying with the regulation and "[t]he incremental costs and benefits associated with each alternative maximum contaminant level considered."

[97] Id § 300g-1(b)(3)(C)(i)(VI) (requiring the Administrator to consider "[a]ny increased health risk that may occur as the result of compliance, including risks associated with co-occurring contaminants").

[98] 2 USCA §§ 1501 et seq.

[99] 2 USCA § 1532(a).

[100] 452 US 490 (1981).

[101] Id at 510 n 30. However, in the same decision, the Court noted that statutory language calling for regulation "to the extent feasible" creates no obligation to conduct such analysis. Id at 509. For further discussion of statutory language that may or may not require cost-benefit analysis, see Cass R. Sunstein, *Interpreting Statutes in the Regulatory State*, 103 Harv L Rev 405, 419, 435 (1989).

[102] See, for example, *National Grain and Feed Association v OSHA*, 866 F2d 717, 728 (5th Cir 1988); *United Automobile Workers v OSHA*, 938 F2d 1310, 1319 (DC Cir 1991) ("Cost-benefit analysis is certainly consistent with the language" of the statute.); *Alabama Power Co v OSHA*, 89 F2d 740, 746 (11th Cir 1996) ("Although the agency does not have to conduct an elaborate cost-benefit analysis, it does have to determine whether the benefits expected from the standard bear a reasonable relationship to the costs imposed by the standard."), citing *American Petroleum Institute v OSHA*, 581 F2d 493, 503 (5th Cir 1978).

[103] 947 F2d 1201 (5th Cir 1991).

[104] Id at 1218.

[105] 768 F2d 1355 (DC Cir 1985).

pursuant to the EPCA.[106] Similarly, in *Ohio v Department of Interior*,[107] the D.C. Circuit reviewed the agency's choice of discount rate in a rulemaking pursuant to the Superfund Act ("CERCLA").[108] These cases—as well as the Administrative Procedure Act ("APA")[109]—make clear that it is appropriate for a court to review the reasonableness of agency cost-benefit analysis.

Similarly, judicial review is appropriate when an agency relies on cost-benefit analysis in a rulemaking, adjudication, or exercise of discretion, even when the underlying statute does not require such analysis. Case law[110] and the APA[111] require the court to review such agency action for reasonableness under the "arbitrary and capricious" test. This implies that the court can and should review the methods—especially the choice of discount rate—that the agency used to perform the cost-benefit analysis.[112] This Comment, however, focuses on cases where the underlying statute contains a requirement for cost-benefit analysis.

B. The Standard of Review

Judicial review of discount rates involves two levels of analysis. First, a court will consider whether the agency action—the

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[106] Id at 1412-14.

[107] 880 F2d 432 (DC Cir 1989).

[108] Id at 465.

[109] 5 USC § 706(2)(A) (1994) (specifying the arbitrary and capricious test for judicial review of agency actions).

[110] See, for example, *Motor Vehicle Manufacturers Association v State Farm Mutual Automobile Insurance Co*, 463 US 29, 33-34 (1983) (finding that NHTSA abused its discretion to issue motor vehicle safety standards that "shall be practicable, shall meet the need for motor vehicle safety, and shall be stated in objective terms"); *Citizens to Preserve Overton Park, Inc v Volpe*, 401 US 402, 416 (1971) (applying arbitrary and capricious test to agency discretion where the statute required the agency to consider "feasible and prudent" alternatives); *National Coalition Against Misuse of Pesticides v Thomas*, 809 F2d 875, 882-83 (DC Cir 1987) (finding that EPA abused its discretion to promulgate pesticide tolerance levels "to the extent necessary").

[111] 5 USC § 706(2)(A).

[112] Arguably the APA implies that the choice of discount rate is insulated from judicial review because it is "committed to agency discretion by law." 5 USC § 701(a)(2) (1994). In this case there is "no law to apply," *Overton Park*, 401 US at 410 (citation omitted); that is, there is no statutory standard against which a court may judge the agency's use of its discretion. See generally, Richard J. Pierce, Jr., Sidney A. Shapiro, and Paul R. Verkuil, *Administrative Law and Process* § 5.3 at 124-29 (Foundation 2d ed 1992). However, this approach is controversial among scholars. Compare Raoul Berger, *Administrative Arbitrariness and Judicial Review*, 65 Colum L Rev 55, 77-83 (1965) (arguing that the "no law to apply" rationale does not preclude judicial review for abuse of discretion), with Kenneth C. Davis, 4 *Administrative Law Treatise* § 28.16 at 80-81 (West 1958) (arguing that where there is "no law to apply," even abuse of discretion is not reviewable). Additionally, courts regularly review the reasonableness of agency discretion under the "arbitrary and capricious" test even when the underlying statute conveys broad discretionary power. See, for example, *State Farm*, 463 US at 42-43, 51-57; *Overton Park*, 401 US at 411-413, 417.

decision to discount and the choice of a particular discount rate—represents an interpretation of the underlying statute that the agency administers.[113] This raises a question of law, subject to the two-step standard of review in *Chevron USA, Inc v Natural Resources Defense Council, Inc.*[114] If the agency action raises no question of law, the court will review the agency decision for abuse of discretion under the arbitrary and capricious test.[115] As this Part demonstrates, the threshold decision to discount arguably is a question of law. In contrast, the choice of a particular discount rate is largely a matter of agency discretion.

This Part first considers the question of law and argues that courts generally have reached the right conclusion when they have found that an agency acts unreasonably if it fails to discount future costs and benefits. Next, the Part considers the question of agency discretion, showing that courts have been unable to articulate a meaningful test to determine whether the agency's choice of discount rate is arbitrary and capricious. The Part concludes, therefore, by offering a meaningful test and demonstrating how a court would employ the framework in Part II to take a "hard look" at an agency's choice of discount rate.

1. Review of agency statutory interpretation: The decision to discount future costs and benefits.

Chevron established the well-known standard of review for questions of law.[116] A court will defer to an agency's interpretation of a statute if the interpretation is not contrary to the intent of the statute (*Chevron* Step One) and if it is reasonable (*Chevron* Step Two).[117] The court will apply "traditional tools of statutory construction" to infer Congress's intent.[118] It will test the reasonableness of the agency interpretation by determining whether the agency considered all statutorily relevant factors and ignored statutorily irrelevant factors.[119] This test of reasonableness, how-

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[113] A statutory interpretation (a question of law) is reviewable under 5 USC § 706(2)(C).

[114] 467 US 837, 842-45 (1984).

[115] Courts may review agency discretion under 5 USC § 706(2)(A), (D).

[116] 467 US at 837.

[117] Id at 842-45. See also *Ohio*, 880 F2d at 464 ("As petitioners point to no CERCLA provision addressing the precise question in issue [the choice of discount rate], their burden is to show that the imposition of the discount rate was unreasonable or contrary to the statutory purpose.").

[118] *Chevron*, 467 US at 843 n 9. See also *INS v Cardozo Fonseca*, 480 US 421, 446-50 (1987) (employing tools of statutory construction); *Babbitt v Sweet Home Chapter of Communities for a Great Oregon*, 515 US 687, 703-05 (1995) (same).

[119] See *Chevron*, 467 US at 845; *State Farm*, 463 US at 42-44.

ever, tends to be quite similar to the arbitrary and capricious standard of review that courts apply to agency discretion.[120]

Thus, when courts encounter challenges to agency discount rates, *Chevron* Step One implies that they must first interpret the statute in question to determine Congress's intent. However, most statutes—such as TSCA and FIFRA—offer no particular standards for conducting cost-benefit analysis, evidencing no congressional intent as to the appropriate methods for choosing a discount rate. This forces courts to proceed to the next level of analysis—*Chevron* Step Two—and examine the reasonableness of the agency decision.

Thus, in the few cases where courts have reviewed an agency's decision to discount future costs and benefits, they have focused on the reasonableness of the decision, not on whether the decision is consistent with the purpose of the statute. In *Corrosion Proof Fittings*, for example, the court found that the EPA would act unreasonably if it failed to discount future benefits: "Because the EPA must discount costs to perform its evaluations properly, the EPA also should discount benefits to preserve an apples-to-apples comparison, even if this entails discounting benefits of a non-monetary nature."[121] Similarly, in *Ohio*, the court found that the Department of the Interior did not act unreasonably when it followed OMB guidance and discounted future benefits.[122] In neither case, however, did the court articulate a standard of reasonableness. In *Corrosion Proof Fittings*, the court held simply that an agency cannot discount costs without discounting benefits;[123] in *Ohio*, the court deferred to the agency's decision because it was "first and foremost a policy choice."[124]

Although they lack coherent explanations, *Corrosion Proof Fittings* and *Ohio* reach the correct conclusion: discounting is reasonable; not discounting is arbitrary.[125] However, the courts in these cases could have reached the same conclusion more simply by relying on the language of the underlying statutes (*Chevron* Step One). A plain reading of statutory language requiring an agency to consider "the reasonably ascertainable economic consequences of the rule, after consideration for the effect on the na-

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[120] See Ronald M. Levin *The Anatomy of* Chevron*: Step Two Reconsidered*, 72 Chi-Kent L Rev 1253, 1266-77 (1997) (demonstrating that analysis of a question of law under *Chevron* Step Two is very similar to—indeed, may be identical to—arbitrary and capricious review).

[121] 947 F2d at 1218.

[122] 880 F2d at 465.

[123] 947 F2d at 1218.

[124] 880 F2d at 465.

[125] See the discussion in Part II.

tional economy"[126] suggests that the agency should use reasonable methods for evaluating the costs and benefits of a regulation. This is precisely the conclusion in *Gas Appliance Manufacturers Association, Inc v Department of Energy*,[127] where the D.C. Circuit considered a statute requiring that regulations be "adequately analyzed in terms of . . . economic cost and benefit, and impact upon affected groups."[128] The court found that this language required the agency to use reasonable methods in its cost-benefit analysis.[129] As demonstrated in Part II, reasonable cost-benefit analysis includes positive discount rates for future costs and benefits.

2. Review of agency discretion: The choice of a particular discount rate.

Most courts treat the choice of discount rate as a matter of agency discretion.[130] Unless the underlying statute calls for stringent review,[131] courts will apply the APA's "arbitrary and capricious" standard of review to the agency's choice.[132] The Supreme Court has interpreted this standard as requiring that courts take a "hard look" at the agency's decision, inquiring whether the agency provided a detailed explanation, investigated reasonable alternatives, and considered statutorily relevant factors and ignored statutorily irrelevant factors.[133]

Although the standard of review calls for a "hard look," most courts have taken a "soft look"[134] at agency discount rates. In *Cor-*

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[126] TSCA, 15 USC § 2605(c)(1)(D).

[127] 998 F2d 1041 (DC Cir 1993).

[128] Id at 1044, quoting the Energy Conservation Standards for New Buildings Act of 1976, 42 USC § 6839 (1988), repealed by the Energy Policy Act of 1992, Pub L No 102-486, Title I § 101(a)(2), 106 Stat 2776, 2783.

[129] 998 F2d at 1045-46.

[130] See, for example, *Corrosion Proof Fittings*, 947 F2d at 1218 n 19 (concluding that the EPA's choice of a 3 percent real discount rate was not unreasonable); *Ohio*, 880 F2d at 465 n 46 (deferring to agency choice of 10 percent rate); *Northern California Power v FERC*, 37 F3d 1517, 1522-23 (DC Cir 1994) ("It was . . . entirely proper for the Commission to calculate the present value . . . using a discount rate that focused on the consumers' value of money.").

[131] TSCA, for example, provides for substantial evidence review. 15 USC § 2618(c)(1)(B)(i).

[132] See 5 USC § 706(2)(A); *Overton Park*, 401 US at 413-16.

[133] See, for example, *State Farm*, 463 US at 43-44; *Vermont Yankee Nuclear Power Corp v Natural Resources Defense Council, Inc*, 435 US 519, 549-55 (1978); *Overton Park*, 401 US at 415-17. See also *Scenic Hudson Preservation Conference v FPC*, 354 F2d 608, 617-18, 620-22 (2d Cir 1965).

[134] The term "soft look" is borrowed from Richard J. Pierce, *Judicial Review of Agency Actions in a Period of Diminishing Agency Resources*, 49 Admin L Rev 61, 90 (1997) (characterizing Judge Easterbrook's dissent in *Salameda v INS*, 70 F3d 447 (7th Cir 1995), as the "soft look" position).

rosion Proof Fittings, for example, the Fifth Circuit deferred to the EPA's choice of a 3 percent discount rate because "historically the real rate of interest has tended to vary between 2% and 4%."[135] The court did not consider alternative measures of the discount rate, nor did it inquire whether the EPA applied this rate appropriately. Similarly, in *Ohio*, the D.C. Circuit deferred to the Department of Interior's choice of a 10 percent discount rate because the choice was "first and foremost a policy choice."[136] Despite this conclusion, the court noted that the agency would need to provide a "reasonable justification" if it revised its discount rate in the future, although it gave no indication what such a justification would be.[137]

The D.C. Circuit has attempted to harden the prevailing "soft look" by inquiring into the theory underlying agency discount rates. In *Northern California Power Agency v FERC*,[138] the parties disputed whether the appropriate discount rate should reflect the average discount rate of members of society (which FERC advocated) or the cost of borrowing for city governments (which the plaintiff municipalities advocated).[139] After reviewing the basic theory of discounting and citing a popular textbook,[140] the court concluded that the appropriate rate should reflect the discount rate of members of society.[141] The court, however, did not inquire whether FERC's particular rate (15 percent) was a good measure of the appropriate social discount rate.

Similarly, in *Herrington*, the D.C. Circuit invalidated the discount rate that the Department of Energy ("DOE") had used in cost-benefit analysis of energy efficiency standards.[142] Applying hard look review, the court found that the DOE failed to explain how it derived this rate. In stark contrast to its approach in *Ohio*, the D.C. Circuit held that the agency could not rely on OMB guidelines to justify its choice: "The disputed OMB circular is essentially a general instruction to government agencies and does not explain the reasoning behind the discount rate it recom-

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[135] 947 F2d at 1218 n 19.

[136] 880 F2d at 465.

[137] Id at 465 n 46.

[138] 37 F3d 1517 (DC Cir 1994).

[139] Id at 1522-23.

[140] Id at 1523, citing E.J. Mishan, *Cost Benefit Analysis* 176 (Praeger 1976).

[141] Id ("Additionally, when determining the net present benefit of a project, a discount rate that reflects society's, as opposed to an individual's, preferences is commonly used. It was therefore entirely proper for the Commission to calculate the present value of the net benefits of the projects using a discount rate that focused on the consumers' value of money.") (citations omitted).

[142] 768 F2d at 1410-14.

mends."[143] The court stressed that the "major consequences of the discount rate made it particularly important that DOE fix the rate carefully and explain its decision intelligibly."[144] Although *Herrington* critically examined the DOE's decision, the case is similar to other "soft look" cases because the court offers no standard of review for agency discount rates.

These cases show that, even where courts attempt to take a hard look at agency discount rates, their inquiry generally ends after testing whether the agency has provided at least a "tolerably terse"[145] explanation for its choice. Courts do not address the other, "harder" elements of this review: whether the agency addressed reasonable alternatives and whether it considered statutorily relevant factors and ignored statutorily irrelevant factors. Courts' "soft look" review of discount rates seems perverse when they will apply a strict hard look review to other elements of agency cost-benefit analysis.[146] The problem appears to be that courts lack a coherent framework for reviewing the agency choice of discount rate.

In evaluating the choice of a discount rate, courts should undertake a three-step analysis. First, as *Herrington* requires, a court must find at least a "tolerably terse" explanation of the agency's choice of discount rate. Second, the court should inquire whether the agency considered reasonable alternatives. As explained in Part II, the choice between the OCC and the SRTP approaches is primarily a matter of policy and secondarily a matter of methodology.[147] The court should find that an agency abused its discretion if it failed to acknowledge these alternative approaches and explain why, in its view, policy and methodology favor one approach over another. Requiring such an explanation ensures not only that the agency's decision has a rational basis, but that the agency recognizes and responds to the social (and administrative) costs and benefits of a particular approach.[148]

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[143] Id at 1413.

[144] Id at 1414.

[145] Id at 1413, quoting *Greater Boston Television Corp v FCC*, 444 F2d 841, 852 (DC Cir 1970).

[146] See, for example, *Competitive Enterprise Institute v NHTSA*, 956 F2d 321, 323-27 (DC Cir 1992), where the court found that NHTSA acted arbitrarily by not considering the risk-risk tradeoffs of new fuel economy standards. For analysis of this case, see Cass R. Sunstein, *Health-Health Tradeoffs*, 63 U Chi L Rev 1533, 1565-67 (1996).

[147] See note 86 and accompanying text.

[148] This is precisely the goal of hard look review, as explained by the Supreme Court in *State Farm*, where the Court stated that "the agency must examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choices made.' . . . In reviewing that explanation, we must 'consider whether the decision was based on a consideration of relevant factors and whether

Finally, given the agency's choice between the OCC and SRTP, courts should examine whether the agency properly applied the chosen method. The OCC and SRTP involve very different methodologies. If an agency applies the OCC, it must consider whether the financial markets offer assets or trading strategies with term structures similar to the proposed regulation. Additionally, the agency must adjust the market rates of return for taxes, risk, inflation, and distortions due to credit constraints. Finally, the agency should consider whether the regulation diverts resources from investment or consumption. In contrast, if an agency applies the SRTP, a court should ask whether the agency converted the future benefits of the regulation into consumption equivalents. Additionally, the agency should reduce future benefits to account for the fact that the regulation may divert resources from private investment and thereby lower future consumption.[149]

Hard look review of agency discount rates would not take the choice of a discount rate out of the hands of administrative agencies, which possess greater competence than courts in this area. Nor would hard look review tax judicial resources or require judges to develop special expertise. Rather, hard look review of agency choice of discount rates asks a series of simple questions that courts generally ask when reviewing agency discretion: Is there a record?[150] Did the agency explain its choice between the relevant alternatives, the SRTP and OCC?[151] Did the agency consider the relevant factors in applying either method?[152]

Admittedly, hard look review of agency discount rates will raise both the cost of judicial review and the cost of conducting cost-benefit analysis. However, the costs of judicial review will

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there has been a clear error of judgment.'" 463 US at 43 (citations omitted).

[149] Hard look review should be particularly strict when an agency applies the SRTP. This method raises more difficult policy issues and creates more complex methodological problems than the OCC. Most academic studies indicate that agencies have very little experience applying this method. See Kopp, Krupnick, and Toman, *Cost-Benefit Analysis and Regulatory Reform* at 41 (cited in note 89).

[150] See, for example, *State Farm*, 463 US at 43 ("We will . . . uphold a decision of less than ideal clarity if the agency's path may reasonably be discerned.") (citations omitted); *SEC v Chenery*, 318 US 80, 94 (1943) ("[T]he orderly functioning of the process of review requires that the grounds upon which the administrative agency acted be clearly disclosed and adequately sustained.").

[151] See, for example, *State Farm*, 463 US at 43 ("Normally, an [agency decision] would be arbitrary and capricious if the agency . . . entirely failed to consider an important aspect of the problem."); *Scenic Hudson*, 354 F2d at 624-25 ("The record as it comes to us fails markedly to make out a case for the [agency decision] on, among other matters, costs, public convenience and necessity, and absence of reasonable alternatives.").

[152] See, for example, *Overton Park*, 401 US at 416 ("[T]he court must consider whether the [agency] decision was based on a consideration of the relevant factors.").

rise only because courts to date have not given serious consideration to agency discount rates. This increased cost is not problematic, because both the APA[153] and case law[154] require the level of serious consideration implied by hard look review.

Additionally, although hard look review will impose costs on agencies by requiring them to prepare detailed explanations of their discount rate choices, these added costs are outweighed by the benefits to society from more careful, reasoned consideration of the methods used in cost-benefit analysis. A primary goal of cost-benefit analysis is to help agencies identify the advantages and disadvantages of various regulatory strategies and thereby allocate their scarce budgetary resources toward regulations that best promote social welfare.[155] By rationalizing and disciplining agency decision making, cost-benefit analysis promotes the regulatory efficiency as well as the political accountability of agencies.[156] Yet, when agencies lack meaningful standards for conducting the analysis, cost-benefit analysis is subject to manipulation, may be ridden with error, and has the appearance of mere window dressing.[157] Hard look review, therefore, strengthens cost-benefit analysis by giving agencies strong incentives to develop consistent and theoretically sound methods of analysis.

C. Applying the Standard of Review to Agency Discount Rates

Hard look review would significantly alter the way agencies select discount rates. As this Part illustrates, many recent discount rate choices by agencies would not survive judicial review under this standard.

Perhaps the most interesting application of hard look review would involve OMB's guidelines for discount rates. Applying this standard, a court would find that an agency *cannot* rely on OMB guidelines to justify its choice of discount rate. Although OMB adopts the OCC approach and provides an adequate explanation for this choice, thereby surviving the first two levels of analysis under hard look review, OMB fails the third level of analysis, be-

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[153] 5 USC § 706(2)(A) (requiring courts to set aside agency action that is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with the law").

[154] See text accompanying notes 138-44.

[155] For analysis of the pathologies of administrative decisionmaking in the absence of effective cost-benefit analysis, see Breyer, *Breaking the Vicious Circle* at 10-29 (cited in note 13) and Cass R. Sunstein, *Free Markets and Social Justice* 289-94 (Oxford 1997). See also Thomas O. McGarity and Sidney A. Shapiro, *OSHA's Critics and Regulatory Reform*, 31 Wake Forest L Rev 587, 622-32 (1996) (discussing the costs and benefits of cost-benefit analysis).

[156] See Sunstein, 48 Stan L Rev at 252-53 (cited in note 8).

[157] See, for example, Scherega, 18 J Envir Econ & Mgmt at S-66 (cited in note 58).

cause it does not sufficiently explain its application of the OCC approach. In particular, OMB advocates a 7 percent discount rate, *unadjusted* for taxes or risk.[158]

Likewise, EPA discount rates generally would not survive hard look review. The agency chooses radically different discount rates for different regulations, generally providing no explanation for this variation.[159] Indeed, EPA practice appears arbitrary because it often chooses relatively high discount rates (between 7 and 10 percent) for regulations imposing future costs[160] and low rates (around 3 percent) for regulations creating future benefits.[161] Because the agency offers no coherent explanation for these choices, its discount rates would fail the second level of analysis under hard look review.

In contrast, a recent DOE regulation likely would survive hard look review. The agency provided detailed justification of its discount rate in a rule setting energy conservation standards for certain major household appliances.[162] After reviewing the theoretical and practical aspects of both the SRTP and the OCC, the Department tentatively advocated the OCC approach, noting that "consideration must be given to the opportunity costs of devoting more economic resources to the production and purchase of more energy-efficient appliances and fewer national resources to other alternative types of investment."[163]

Not all agency choices are as simple to evaluate under hard look review. A harder case appears in a recent regulation by the National Oceanic and Atmospheric Administration ("NOAA"), where the agency established standards for valuing damages to natural resources and the costs of mitigating those damages.[164] There NOAA considered both the SRTP and OCC, explaining the

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[158] See notes 18-20 and accompanying text.

[159] The EPA generally offered no explanations for the regulations in Tables 1 and 2. Consider, for example, EPA, *Protection of Stratospheric Ozone*, 58 Fed Reg at 8163 (cited in note 30).

[160] See, for example, EPA, *Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines: Voluntary Standards for Light-Duty Vehicles*, 62 Fed Reg 31192, 31215 (1997) (applying a 10 percent discount rate to pollution credits that the agency will give to manufacturers of automobiles); EPA, *Amended Proposed Test Rule for Hazardous Air Pollutants*, 62 Fed Reg 67466, 67477 (1997) (using a 7 percent discount rate to annualize initial regulatory costs).

[161] See, for example, EPA, *LEAD; Requirements for Lead-Based Paint Activities in Target Housing and Child-Occupied Facilities*, 61 Fed Reg 45778, 45808 (1996) (using a 3 percent discount rate for "core" analysis of future benefits).

[162] DOE, *Energy Conservation Program*, 58 Fed Reg at 47333-35 (cited in note 29).

[163] Id at 47335.

[164] Department of Commerce, NOAA, *Natural Resource Damage Assessments*, 61 Fed Reg at 450-57 (cited in note 29).

theory and methodological issues underlying each alternative.[165] The agency ultimately advocated a 3 percent discount rate for valuing damages to natural resources because the rate is reasonable in light of existing estimates of the SRTP, the rate is close to the real after-tax rate of return on riskless Treasury bills, and a relatively low discount rate may be appropriate for goods (natural resources) that are not traded in a market.[166] Unfortunately, however, NOAA also concluded—without a coherent explanation—that different discount rates should apply to the benefits (the value of damages to natural resources) and costs (mitigation of damages) of restoring natural resources. While the agency advocated the SRTP for benefits,[167] it supported the relatively high OCC rate for costs.[168] This illogical decision should fail hard look review.

CONCLUSION

The discount rate is a critical element of cost-benefit analysis. The value of cost-benefit analysis in improving regulatory decisions depends, in large part, on the reasonableness of the discount rate. Small variations in the discount rate can significantly bias the analysis. Despite the importance of the discount rate, courts have failed to develop a standard of review for agency discount rate choices. This is particularly troubling in light of evidence that agency practice exhibits wide-ranging, and generally unexplained, variation in discount rates. Not only do different agencies employ different rates, but the same agency will sometimes apply different rates to different regulations without explanation.

This Comment seeks to strengthen cost-benefit analysis by providing a framework for judicial review of agency discount rates. As a threshold matter, courts should find, as a matter of law, that an agency acts unreasonably if it fails to discount future costs and benefits, even if they accrue to future generations. Additionally, courts should take a "hard look" at agency discount rates and ask three basic questions: Is there a record for the agency's choice? Did the agency explain its choice between the alternative approaches to discounting, the SRTP and OCC? Did the agency consider the relevant factors in applying the chosen method? While these questions are standard fare in hard look re-

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[165] Id at 453-54.
[166] Id.
[167] Id at 454.
[168] Id at 456.

view, they would represent a significant advance in judicial review of discount rates. More importantly, hard look review would provide strong incentives for agencies to adopt morally and economically sensible discount rates.

NOTES

THE USE OF THE DISCOUNT RATE IN EPA ENFORCEMENT ACTIONS

The U.S. Environmental Protection Agency ("EPA") is responsible for protecting the public health and environment. Beginning in the late 1960s and early 1970s, Congress delegated this responsibility and authority to the EPA through several environmental protection statutes. Under these statutes, the EPA promulgates and enforces a number of regulations designed to reduce emissions of pollutants in order to protect public health and the environment including, air, water and land.[1] As a result, a national system of environmental regulations has replaced nuisance suits and the common law as the primary means of ensuring environmental quality.[2]

According to those who support the development of a national regulatory system for environmental protection, common law liability and nuisance litigation are incapable of controlling pollution in a complex modern industrial society. On the other hand, there are individuals who advocate a decentralization of environmental management and policy, if not a complete return to nuisance litigation, because they believe the current national system fails to achieve environmental protection in an efficient, cost-effective manner.[3] Notwithstanding this important debate, this Note presumes that the national

[1] *See* Federal Water Pollution Control Act ("CWA") of 1972, 33 U.S.C. §§ 1251-1387 (1994); Resource Conservation and Recovery Act ("RCRA") of 1976, 42 U.S.C. §§ 6901-6992k (1994); Clean Air Act ("CAA") of 1970, 42 U.S.C. §§ 7401-7671q (1994).

[2] *See* STEPHEN G. BREYER ET AL., ADMINISTRATIVE LAW AND REGULATORY POLICY 351 (4th ed. 1999) (asserting that a dramatic trend beginning in the 1960s was the development of several national environmental protection statutes). *See also* JESSE DUKEMINIER & JAMES E. KRIER, PROPERTY 776-77 (4th ed. 1998) (describing the dominant role of the federal government in environmental regulation since 1970); Allison Rittenhouse Hayward, *Common Law Remedies and the UST Regulations*, 21 B.C. ENVTL. AFF. L. REV. 619, 630 (1994) (explaining that with the enactment of statutes such as the CAA, the CWA, and RCRA, pollution became regulated by comprehensive federal laws and regulations).

[3] Perhaps no case has been cited more than *Boomer v. Atlantic Cement Co.*, 257 N.E.2d 870 (N.Y. 1970), for the proposition that common law nuisance actions can be used to efficiently address environmental pollution problems. In *Boomer*, the court awarded permanent damages, instead of an injunction, to plaintiffs in a private nuisance suit after balancing the harm to the plaintiffs' property against the beneficial effects of the defendants' cement plant. *Id.*

regulatory system will not be phased out or discontinued. However, many firms delay or do not comply with EPA regulations. Throughout the remainder of this Note, the terms "delayed compliance" and "noncompliance" are used interchangeably.

The environmental protection statutes grant the EPA the authority to seek civil penalties for delayed or noncompliance. A critical component of civil penalties is the economic benefits of delayed compliance.[4] Often there is a significant time lag between the occurrence of a violation and enforcement followed by a penalty payment. During this interval a firm may use the avoided costs of noncompliance toward its next best alternative investment(s). A discount rate is used to estimate the present value of economic benefits as of the penalty payment date.

The EPA advocates using the weighted average cost of capital ("WACC") based on the principle that the economic benefits of delayed compliance include potential risk-related profits from alternative investment(s). Risk-related profits are potential profits that compensate a firm for risk associated with its alternative investment. Previously, most courts accepted the EPA position.[5] However, in a recent case, *United States v. WCI Steel, Inc.*,[6] the U.S. District Court for the Northern District of Ohio accepted the alternative argument that the risk-free rate was the appropriate discount rate.[7] Use of the risk-free rate does not capture potential risk-related profits.[8]

The resolution to this potentially emerging split among the courts is important for several reasons. First, the two discount rates result in substantially different estimates of the present value of economic

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[4] *See* CWA, 33 U.S.C. § 1319(d); RCRA, 42 U.S.C. § 6928(a)(3); CAA, 42 U.S.C. § 7413(e)(1).

[5] *See* United States v. Smithfield Foods, Inc., 972 F. Supp. 338, 349 (E.D. Va. 1997), *aff'd*, 191 F.3d 516, 531 (4th Cir. 1999), *cert. denied*, 531 U.S. 813 (2000) (affirming the district court's use of the WACC to estimate the present value of economic benefit from avoiding the cost of compliance). *See also* United States v. Roll Coater, Inc., [1991] 21 Envtl. L. Rep. (Envtl. L. Inst.) 21,073, 21,075 (S.D. Ind. 1991) (finding use of WACC discount factor more appropriate than alternative methods).

[6] 72 F. Supp. 2d 810 (N.D. Ohio 1999).

[7] *Id.* at 830-31 (holding that the risk-free discount rate rather than the WACC is the correct rate to use in estimating the present value of the economic benefits of noncompliance and that any profits earned in excess of the risk-free rate are earned not from noncompliance, but by assuming risk).

[8] Whether the WACC or risk-free rate is used, adjustments for related tax effects must be made. *See* Environmental Protection Agency, Calculation of the Economic Benefit of Noncompliance in EPA's Civil Penalty Enforcement Cases, 64 Fed. Reg. 32,948, 32,950 (proposed June 18, 1999) (explaining that EPA accounts for tax effects by using after-tax cash flows to estimate economic benefits of delayed compliance); Kenneth T. Wise et al., *EPA's New BEN Model: A Change for the Better?*, 1993 TOXICS L. REP. 1125, 1127 (explaining that the after-tax risk-free rate is used in actual calculations to account for interest earned on avoided costs that were taxable).

benefits of noncompliance. If the risk-free rate is employed, the estimate can be lower by an order of magnitude, which may, as a result, encourage forum shopping in order to ensure that a "friendly" court hears the case.[9] Second, the same group of expert economists has appeared before different courts in support of these two approaches, resulting in divergent judicial determinations as to which rate is appropriate. Third, the literature in support of both the risk-free rate and the WACC as applied to environmental regulatory noncompliance tends to be dominated by those who are either interested parties or expert witnesses in litigation. Finally, unlike previous assessments, this Note investigates which discount rate is correct in light of the legal doctrine of temporary takings and the underlying structure and purpose of damages in tort actions. Interestingly, this emerging split appears to be part of a larger debate among the courts about the appropriate rate for pre-judgment interest to be applied to damage awards.[10]

The remaining sections of this Note are as follows: Part I explains the important role of civil penalties and the discount rate in enforcing environmental regulations, given the purpose of imposing regulations; Part II explains the general role of the discount rate in estimating present value; Part III outlines the mechanics of estimating present value using the WACC and risk-free rate; Part IV shows that economic and financial theory support using the risk-free discount rate; Part V demonstrates that temporary takings and tort law are congruent with economic and financial theory supporting the risk-free discount rate; and Part VI recommends an approach for the appropriate accounting of economic benefits and potential risk-related profits from noncompliance in the context of civil penalties.

I. CIVIL PENALTIES, REGULATION, AND THE ECONOMIC BENEFIT OF DELAYED OR NONCOMPLIANCE

The critical question this Note addresses is which discount rate, the risk-free rate or the WACC, should be used to determine the present value of *ex post* economic benefits, or those benefits a firm enjoys from the time of delayed or noncompliance through the penalty

[9] Of course jurisdictional requirements may restrict a firm's ability to forum shop.

[10] *Compare* Blanton v. Anzalone, 760 F.2d 989, 992-93 (9th Cir. 1985) (holding that the interest rate on 52-week U.S. Treasury Bills to be applied to post-judgment interest civil money judgments in federal courts, as required under 28 U.S.C. § 1961, should also be applied to pre-judgment interest in an ERISA suit unless the trial court finds that a different rate is appropriate), *with* Smith v. Am. Int'l Life Assurance Co., 50 F.3d 956, 958 (11th Cir. 1995) (holding that because the language of 28 U.S.C. § 1961 only addresses post-judgment interest, determination of the pre-judgment interest rate in an ERISA suit is left to the discretion of the district court subject only to a review for abuse of discretion).

payment date. For the reasons developed throughout this Note, the conclusion is that the appropriate discount rate to use is the risk-free discount rate (or a firm's cost of debt if it faced more than a mere probability of bankruptcy during the period of noncompliance). The risk-free rate separates economic benefits due to the illicit act of violating a regulation from potential risk-related returns.

Noncompliance with EPA regulations defeats the very purpose of the regulation, which is the protection of human health and the environment. Society is therefore unable to capture the increase in social well-being. It is then necessary to ensure compliance through the imposition of civil penalties. Penalizing firms through the imposition of a civil penalty that includes economic benefits of delayed compliance deters the target firm (i.e., specific deterrence) and other firms (i.e., general deterrence) from similar violations in the future.[11]

In order to understand the important role that civil penalties play in environmental protection, a brief explanation for imposing regulations is needed. Regulations are imposed to correct for market failures such as negative externalities.[12] In the context of pollution, negative externalities exist as firms fail to internalize the external cost of pollution as a result of their production process. Consequently, the quantity of goods and services consumed exceeds the optimal level. The optimal level is where the marginal social benefits equal marginal social costs. This is displayed in Figure 1. Q* represents the socially optimal level of output of good or service Q when a firm internalizes all costs of production, including pollution damages imposed on others. The associated market price is P*. Qo represents output when a firm fails to internalize the external cost. The associated market price is Po. The distance between points B and C represents the marginal externality cost.

The failure to internalize the cost of pollution is shown in Figure 1. D is the marginal willingness to pay, which represents the value of Q to consumers. MCp, the marginal private cost, which is less than MCs, the marginal social cost, characterizes the firm's cost of produc-

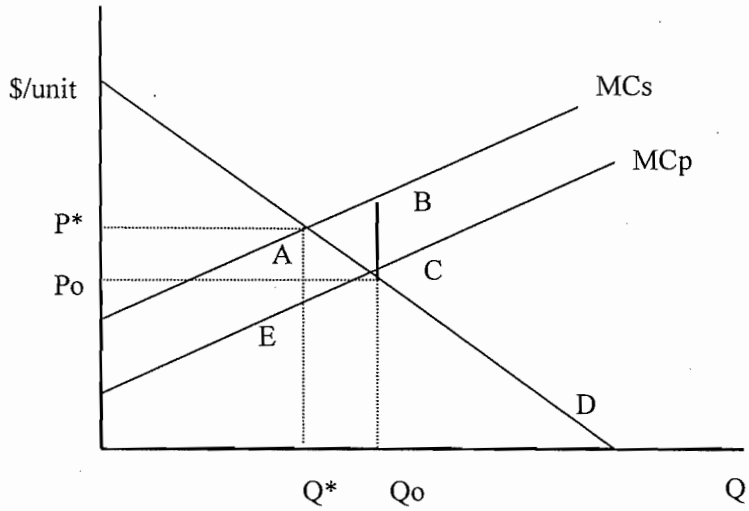
[11] *See* United States v. Smithfield Foods, Inc., 191 F.3d 516, 529 (4th Cir. 1999), *cert. denied*, 531 U.S. 813 (2000) (stating that the economic benefit component of a civil penalty is to prevent violators from obtaining a competitive advantage through noncompliance); United States v. Bethlehem Steel Corp., 829 F. Supp. 1047, 1057 (N.D. Ind. 1993) (discussing in the context of a RCRA violation "that the major purpose of a civil penalty is deterrence").

[12] *See* TOM TIETENBERG, ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS 53-54 (3d ed. 1992) (describing the problem of externalities as causing a market failure because prices do not adjust to account for pollution). *See also* SCOTT J. CALLAN & JANET M. THOMAS, ENVIRONMENTAL ECONOMICS AND MANAGEMENT: THEORY, POLICY, AND APPLICATIONS 81-84 (1996) (defining a negative externality as a spillover effect from either production or consumption that extends outside the market and affects third parties who are neither the consumer nor the producer).

tion. The marginal social cost of production represents the cost of producing goods and services after a firm internalizes the cost of pollution.[13] In Figure 1, the area ABCE represents the benefits of improved public health and environmental quality as a result of a firm internalizing the cost of pollution.

The EPA promulgates and enforces environmental protection regulations in order to force firms to internalize pollution costs.[14] The cost of production changes from MCp to MCs. Triangle ACE is lost profits as the quantity of Q produced and sold falls from Qo to Q* due to this increase in cost. The difference between these two areas, triangle ABC, is the net gain in social well-being.

Figure 1
Social Cost of Pollution



[13] See TIETENBERG, supra note 12, at 52 (defining MCp as the cost of production excludng the cost of pollution and MCs as the social cost of production that includes the cost of pollution).

[14] *See* R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960) (arguing that in the absence of transaction costs, polluters and non-polluters will internalize the cost associated with negative externalities through bargaining and negotiation rather than government intervention). However, due to the large number of affected parties, the Coase Theorem's assumption of zero-transactions costs does not hold true for most, if not all, environmental issues EPA regulates. *See* ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES 280 (1991) (describing Coase's assumption of zero transactions costs as unrealistic). Relatedly, the Coase Theorem does not address another situation where environmental regulation is required, where there are potential "free-riders" who may seek the benefits of pollution reductions without incurring any of the associated transactions costs.

II. ECONOMIC BENEFIT OF DELAYED OR NONCOMPLIANCE AND THE ROLE OF THE DISCOUNT RATE

For simplicity, assume here and throughout the rest of this Note that the economic benefits of delayed or noncompliance are *ex post* relative to the penalty payment date.[15] A firm derives economic benefits from noncompliance with environmental regulations by avoiding the commitment of financial resources for pollution control. Economic benefits are derived from two sources: (1) avoided capital investments required for the purchase and installation of pollution control equipment (e.g., scrubbers to remove sulfur emissions from fossil fuel combustion), and (2) avoided operation and maintenance expenses as a result of the initial choice not to install pollution control equipment. A firm may apply these funds toward other investments until a civil penalty is paid and compliance is required.

The role of the discount rate is to determine the present value of economic benefits from noncompliance because there is a lag between a violation, enforcement, and payment of a penalty. The present value is estimated by applying the compounded discount rate to the avoided cost from the initial date of delayed compliance through the penalty payment date. A court may choose the WACC or the risk-free discount rate. With the decision in *United States v. WCI Steel, Inc.*, courts have taken divergent positions on which rate is correct.[16]

III. ESTIMATING PRESENT VALUE OF ECONOMIC BENEFIT: RISK-FREE RATE VS. WACC

The mechanics of estimating the present value of economic benefits using the risk-free rate and applying its retrospective *ex post* analysis are:

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[15] In reality, we may have to account for economic benefits that would be expected to accrue *ex ante*, or after the penalty payment date. For these benefits those who advocate use of the risk-free rate for *ex post* benefits relative to the penalty payment date agree with the EPA that the WACC should be used to discount *ex ante* benefits relative to the penalty payment to their present value as of the penalty payment date. *See* Stewart C. Myers et al., The BEN Model and the Calculation of Economic Benefit 5 (Mar. 1997) (prepared for the BEN Coalition and the Synthetic Organic Chemical Manufacturers Association) (explaining that *ex post* analyses may have to account for future cash flows whose value is not known with certainty, such as the cost of equipment replacement based on necessary replacement cycles) (on file with author).

[16] In rare instances, courts have applied discount rates solely based on the cost of equity capital. *See* Atlantic States Legal Found. Inc. v. Universal Tool & Stamping Co., 786 F. Supp. 743, 751 (N.D Ind. 1992). However, this Note does not consider this discount rate, as even the EPA believes it should not be used to determine the present value of the economic benefits of delayed compliance in enforcement cases. *See* Environmental Protection Agency, Calculation of the Economic Benefit of Noncompliance in EPA's Civil Penalty Enforcement Cases, 64 Fed. Reg. 32,948, 32,959 (proposed June 18, 1999).

$$PVPCE_1 = \sum_{i=1}^{ppd} C_{i,on\ time} * (1+k)^{ppd-i} \quad [1]$$

Equation 1, where $PVPCE_1$ is the present value of pollution control expenditures, represents the present value of pollution control expenditures for on time compliance with an EPA regulation as of the penalty payment date ("ppd"). $C_{i,on\ time}$ is the cost of compliance that would have been incurred for each period *i*. Additionally, *k* is the risk-free discount rate and is used to determine the present value of $\sum C_{i,on\ time}$ as of ppd.

$$PVPCE_2 = \sum_{j=1}^{ppd} C_{j,delay} * (1+k)^{ppd-j} \quad [2]$$

Equation 2 represents the present value of pollution control expenditures in the case of delayed or noncompliance after the EPA has required a firm to comply, also as of the penalty payment date. $C_{j,delay}$ is the cost of compliance incurred in each period from *j* through the date on which the penalty is paid. *k* is the risk-free discount rate and is used to determine the present value of $\sum C_{j,delay}$ as of ppd. The present value of the economic benefit is then calculated by subtracting the value of equation 2 from equation 1.

The mechanics the EPA employs to estimate the present value of economic benefits using the WACC and applying its prospective *ex ante* analysis to *ex post* benefits through the penalty payment date are:

$$PVPCE_3 = \sum_{i=1}^{ppd} C_{i,on\text{-}time}/(1+k)^{i-1} \quad [3]$$

Equation 3 represents the present value of pollution control expenditures for on time compliance with an EPA regulation as of the original noncompliance date. Similar to the risk-free analysis, $C_{i,on\ time}$ is the cost of compliance that would have been incurred for each period *i* through ppd. However, the discount rate, *k*, which is used to determine the present value of $\sum C_{i,on\ time}$ as of the original noncompliance date is the WACC rather than the risk-free rate.

$$PVPCE_4 = \sum_{j=1}^{ppd} C_{j,delay}/(1+k)^{((j+s)-1)} \quad [4]$$

Equation 4 represents the present value of pollution control expenditures in the case of delayed or noncompliance after the EPA has compelled a firm to comply, also as of the original noncompliance date. $C_{j,delay}$ is the cost of compliance that is incurred for each period and s is the number of periods from the initial date of noncompliance until compliance begins. After subtracting the value of equation 4 from equation 3, the last step in the EPA's analysis is to apply the WACC and bring this value forward to determine the present value of economics benefit as of the penalty payment date.

The choice of analytical framework and thus k is critical, given the power of compounding, because a small change in the magnitude of k can result in a significant difference in the estimate of the present value of economic benefits from delayed compliance. The WACC is significantly higher than the risk-free rate. A court's decision to use the WACC or risk-free rate results in estimates of the present value of economic benefits that are orders of magnitude apart.[17] However, this choice must be based not on whether one favors higher or lower estimates, but on economic, financial, and legal theory, and how such theory comports with the purpose of deterrence underlying the imposition of civil penalties. A review of relevant decisions shows that except for the court in *WCI Steel*, courts provide no explanations based on economic or financial theory regarding their choice of discount rate.[18]

IV. ECONOMIC AND FINANCIAL THEORY JUSTIFIES THE RISK-FREE DISCOUNT RATE

Having described the options for estimating the present value of economic benefits of noncompliance, it is now necessary to assess which choice is correct based on economic and financial theory. The WACC is a firm's weighted average cost of capital. Typically, a firm's cost of capital is divided into the cost of debt (e.g., interest on corporate bonds) and the cost of equity (i.e., rate of return on firm's

[17] *See* United States v. WCI Steel, Inc., 72 F. Supp. 2d 810, 830-31 (N.D. Ohio 1999) (showing that controlling for the type of remediation required for RCRA sludge management violations, the estimated present value of the economic benefit using the WACC was $2.8 million, while the estimate was only $732,000 using the risk-free rate). *See also* Robert H. Furhman, *A Discussion of Technical Problems with EPA's BEN Model*, 1 ENVTL. LAW. 561, 576-79 (1995) (outlining several articles that assert that the risk-free discount rate is correct and using a hypothetical example demonstrating that the WACC results in an estimated present value of economic benefits of noncompliance of approximately $1.1 million, while the risk-free rate results in an estimate of $485,000).

[18] *See* United States v. Smithfield Foods, Inc., 972 F. Supp. 338, 349 n.17 (E.D. Va. 1997), *aff'd* 191 F.3d 516 (4th Cir. 1999), *cert. denied*, 531 U.S. 813 (2000) (stating that the court was simply more persuaded by the testimony of the economic expert supporting use of the WACC).

stock) based upon a firm's capital structure. The cost of capital represents the cost of financing pollution control equipment purchases to comply with environmental protection regulations or the opportunity cost of foregone investments because of such purchases.[19] A rational profit-maximizing company might choose not to comply with a regulation if it could earn a rate of return equal to the WACC, especially because pollution control equipment yields no actual monetary income to a firm.[20] Consequently, proponents of the WACC assert that only by using this discount rate can all earnings be disgorged and the violator made indifferent when deciding between compliance and noncompliance.[21]

The WACC includes a risk premium that captures and compensates those who provide capital resources to a firm.[22] The EPA recognizes the presence of a risk premium in a firm's cost of capital in the EPA's own internal guidance documents.[23] The risk is due to the uncertainty of *future* cash flows or profits that an investment may generate. The economic benefits of noncompliance are estimated from the perspective of a firm making the initial decision not to comply and use the avoided costs for an alternative investment expected to earn a rate of return at least as large as the WACC.

However, if the amount of cash flow is known, there is no risk and thus no need to include a risk premium in the discount rate. In fact, this is the very point of those who support using the risk-free rate because, by definition, enforcement actions are taken after the avoided costs of delayed compliance are known. The EPA implicitly

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[19] *See* Environmental Protection Agency, Calculation of the Economic Benefit of Noncompliance in EPA's Civil Penalty Enforcement Cases, 64 Fed. Reg. at 32,958.

[20] *Id.* at 32,949.

[21] *Id.* at 32,963-64 (explaining that capturing all of the economic benefits and returning the violator to the financial position prior to noncompliance requires accounting for the rate of return a company earns on the alternative investments made in lieu of purchasing and maintaining pollution control equipment).

[22] *See* Myers et al., *supra* note 15, at 9 (describing the cost of capital as reflecting the risk and uncertainty of future cash flows of an investment). *See also* WALTER NICHOLSON, MICROECONOMIC THEORY: BASIC PRINCIPLES AND EXTENSIONS 250 (5th ed. 1992) (explaining that the variance in potential outcomes for an activity proxies the economic concept of risk); Wise et al., *supra* note 8, at 1127 (explaining that the cost of capital incorporates the risk of an investment); Kenneth T. Wise et al., *EPA's "BEN" Model: Challenging Excessive Penalty Calculations*, 1992 TOXICS L. REP. 1492, 1495 n.14 (discussing that the WACC is a risk-adjusted discount rate in order to account for uncertainty in the amount of future cash flows). As applied to the firm in the case of delayed compliance, the activity of investing avoided costs has more than one potential outcome. The outcome may yield a high rate of return, providing the firm with a significant payoff. On the other hand, the investment may fail, leaving the firm with a loss. The risk premium in the WACC is the compensation the firm, and thus its investors, receive for the willingness to take the risk.

[23] *See* U.S. EPA, GUIDELINES FOR PREPARING ECONOMIC ANALYSES ch. 9 (2000) (explaining that analyses of the economic impact of future regulatory compliance costs on firms must use the firms' private costs of capital that reflect risk).

acknowledges the accuracy of this statement.[24] Consequently, there is no uncertainty in the amount of avoided costs, and to compound forward using the WACC would effectively compensate the EPA for risk when no such risk exists.[25] The economic benefits of noncompliance are estimated from an *ex post* perspective based on a firm's actual avoided costs. The use of the WACC to estimate the present value of economic benefits would compensate the government for risk that it did not bear.[26]

The financial theory of applying the risk-free discount rate to noncompliance finds its roots in the literature on tort law advocating use of the risk-free rate to estimate the present value of damages for wrongs committed in the past.[27] Like an award for past damages in tort, the avoided cost has occurred in the past and is thus known and certain. The amount of the avoided cost need only be compounded by the risk-free rate up to the penalty payment date to account for the pure time value of money. The risk-free rate paradigm does not deny that a firm might earn risk-related profits, or what some might refer to as profits from arbitrage. However, it distinguishes such profits from the present value of economic benefits of noncompliance.

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[24] *See* Environmental Protection Agency, Calculation of the Economic Benefit of Noncompliance in EPA's Civil Penalty Enforcement Cases, 64 Fed. Reg. at 32,958 (showing that the amount of the estimated financial gain from initial delay is the same, and is known and certain under either approach).

[25] *See* Myers et al., *supra* note 15, at 10 ("Assume the benefits of delayed compliance have been identified. These benefits are now fixed past cash flows—there is no risk in hindsight. The only remaining step is to bring those cash flows to the present. . . . [T]he risk-free rate should be used. Using any higher rate would compensate the government for risks it has not incurred."). *See also* Wise et al., *supra* note 8, at 1127 (explaining that the amount of past cash flows are known and thus risk-free, requiring the use of a risk-free discount rate to determine present value); Wise et al., *supra* note 22, at 1495 n.14 (asserting that there is no uncertainty associated with past cash flows, and thus a risk-free discount rate must be used to estimate the present value).

[26] *See* United States v. WCI Steel, Inc., 72 F. Supp. 2d. 810, 831 (N.D. Ohio 1999) ("The central issue is whether a rate reflecting risk should be used as to past benefits or obligations. Any return above the risk-free rate is earned not from delay but by assuming risk, and therefore is not properly considered economic benefit from noncompliance. Because this amount is known and the existence and solvency of the party is also known, it is inappropriate to increase the rate to reflect risk."). *See also* Myers et al., *supra* note 15, at 10 (explaining that a company could place funds that would otherwise be used for environmental regulatory compliance in a risky investment, but that any return over the risk-free rate is compensation for bearing the risk, not a benefit from noncompliance).

[27] *See* R.F. Lanzillotti & A.K. Esquibel, *Measuring Damages in Commercial Litigation*, 5 J. ACCOUNTING, AUDITING & FINANCE 125, 134 (1990) ("In the case of past lost profits . . . since the materialized cash flows are certain, the risk-free rate should be used to bring the past lost profits to present value."). *See also* Franklin M. Fisher & R. Craig Romaine, *Janis Joplin's Yearbook and the Theory of Damages*, 5 J. ACCOUNTING, AUDITING & FINANCE 145, 153-56 (1990) (arguing that making a plaintiff whole for a lost profit or destroyed asset, where compensation is paid at a future point, requires a damage award equal to the value of the lost profit or destroyed asset as of the time of injury compounded forward to the award payment date using a risk-free discount rate to account only for the time value of money).

Indeed, the EPA's advocacy of the WACC disregards the essential point of the retrospective *ex post* view. The risk-free discount rate is correct because of certainty in the amount of the avoided costs. Judge Posner's decision in *Douglass v. Hustler Magazine, Inc.*[28] addressed an economic expert's estimate of the present value of the plaintiff's lost future earnings due to invasion of her privacy as a result of an illegal publication of photos of her in *Hustler Magazine*. Regarding this estimate, Posner wrote:

> One [problem] is that in discounting to present value the economist failed to correct for the extreme riskiness of the earnings stream for which he was trying to find a present value. An award of damages is a sum certain. If it is intended to replace a stream of earnings that is highly uncertain—surely an understatement in discussing [future] earnings in the field of entertainment—then risk aversion should be taken into account in computing the discount (interest) rate. The riskless rate . . . would be the proper rate if the earnings stream that the damages award was intended to replace was one that would have been obtained with certainty.[29]

Unlike the plaintiff's future earnings in *Douglass*, the economic benefit of delayed compliance is known and certain. Clearly, the risk-free rate should be used to estimate its present value. Any return over the risk-free rate is compensation for bearing risk, not an economic benefit of noncompliance.

In addition, consider the position of a firm that has decided not to comply with an environmental regulation. Other than putting avoided costs under the mattress, the only way for a firm to ensure that the funds derived from delayed compliance will be available to pay the civil penalty is to place them in a risk-free investment such as a treasury bond.[30] If a firm places the funds in a risk-bearing investment, any return over the risk-free rate is the reward for willingness to accept the risk. If the risky venture fails and all of the funds are lost, the EPA will not waive the company's compliance requirement, and will likely impose some form of fine anyway. In short, the risk-free rate is appropriate since the EPA bears no risk from delayed compliance.

A related criticism of employing the risk-free rate is that it may result in a negative estimate of the present value of economic benefits

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[28] 769 F.2d 1128 (7th Cir. 1985).

[29] *Id.* at 1143 (citation omitted).

[30] *See* Myers et al., *supra* note 15, at 10 ("[F]rom the violator's point of view: what can the violator do with the money during the period of noncompliance without taking on the risk of losing all or a portion of it? The only answer is to invest in a risk free security.").

from delayed compliance. The EPA provides an example in which the use of the WACC results in a positive economic benefit, whereas the use of the risk-free rate results in a negative estimate of economic benefits.[31] An unstated assumption is that a firm must obtain positive benefits from delayed or noncompliance. However, there is no rationale in economic or financial theory to substantiate this assumption. There is no reason that delaying expenditures *must* result in a positive financial gain.

A priori, given the number of financial variables that can affect expenditures, including potential changes in their value over time, the difference between on time and delayed expenditures for pollution control is intuitively indeterminate. For example, consider the choice as to when to purchase a home. One might choose to purchase a home today at current prices and interest rates, or delay the purchase hoping that interest rates or purchase prices, or both, will decrease. Unfortunately, it is possible that a "negative" benefit may result, as only one or perhaps neither factor will decrease or even possibly increase. When the present value of the two total purchase costs is compared, there may be a negative benefit. Consider the position of those who did not purchase a home in the early 1990s, prior to the substantial increase in housing prices that occurred in the late 1990s. Instinctively, under such a scenario, even after accounting for possible tax benefits of owning a home, it would not be shocking that a buyer might experience a negative financial gain due to his delayed purchase. Thus, it should not be surprising that a firm might experience a similar "negative" benefit from delaying expenditures on pollution control equipment.

Notwithstanding the conceptual power of using the risk-free rate for *ex post* benefits, one critical assumption underlies the use of this discount rate. This assumption is that a firm does not face any risk of bankruptcy.[32] As discussed below, if a firm has faced more than a negligible risk of bankruptcy during the period of delayed compliance, use of the risk-free rate would be inappropriate. A firm's cost of debt, or the interest rate charged for borrowing funds from a bank or through a bond issue, becomes the appropriate discount rate.[33] The avoided costs due to delay are fixed and known and thus equivalent to

[31] Environmental Protection Agency, Calculation of the Economic Benefit of Noncompliance in EPA's Civil Penalty Enforcement Cases, 64 Fed. Reg. 32,948, 32,959 (proposed June 18, 1999).

[32] *See* Myers et al., *supra* note 15, at 10.

[33] *See* GABRIEL HAWAWINI & CLAUDE VIALLET, FINANCE FOR EXECUTIVES: MANAGING VALUE FOR CREATION 303-04 (1999) (defining the cost of debt as either the interest rate a bank charges a firm in exchange for a loan or the market yield to maturity for bonds the firm has issued).

a debt obligation. The only uncertainty is the risk of default, which banks and bondholders include in either the interest charged or required yield. Synonymous with a typical borrower and a bank, a firm is in effect the borrower and the government is the lender.[34] Moreover, due to the tax deductibility of interest payments, firms tend to prefer debt financing to equity financing through the sale of stock.[35] If a firm has multiple debt obligations, a weighted average of the interest rates or yield to maturities should be used to determine a firm's average cost of debt.

There is no clear line that dictates when courts or the EPA should employ the cost of debt as compared to the risk-free rate to determine the present value of economic benefits. There is some probability greater than zero that any firm, even the most financially secure, may have faced bankruptcy during the period of noncompliance. However, it is inequitable to assert that the cost of debt, instead of the risk-free rate, should be used in all cases. Courts must make this determination on a case-by-case basis using all of the relevant evidence presented. Such evidence may include information concerning a firm's liquidity,[36] the market yield of a firm's bonds,[37] and the yield spread between the market yield of a firm's bonds over a government bond with the same maturity.[38] Courts may also consider the overall economic state of the industry to which a firm belongs. The *ex post* retrospective analysis remains the same, regardless of whether the risk-free rate or cost of debt is used. This Note will presume that a court should apply the risk-free discount rate unless there is more than a negligible probability of a firm having faced bankruptcy during the period of noncompliance.[39]

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[34] *See* Myers et al., *supra* note 15, at 10. If the firm has multiple debt obligations, including either bank loans and/or multiple bond issues, a weighted average of the interest rates or yield to maturities should be used to determine the firm's average cost of debt.

[35] *See* HAWAWINI & VIALLET, *supra* note 33, at 372.

[36] *See id.* at 67 (describing a firm's liquidity as its ability to meet its "*recurrent* cash obligations towards various creditors" and noting that a firm that is illiquid is technically bankrupt).

[37] *See id.* at 281 (explaining that the market yield is a measure of a firm's credit risk and is used by bond rating agencies such as Standard & Poor's or Moody's to rate a firm's overall credit risk).

[38] *See id.* at 282 (discussing that large or growing yield spreads indicate that the firm is a credit risk).

[39] J. Huston McCulloch, an economist at Ohio State University, and Menahem Spiegel, an economist at Rutgers University, agreed that either the risk-free rate or cost of debt was the appropriate discount rate to use to determine the present value of economic benefits of delayed or noncompliance prior to the penalty payment date. However, in their opinion, the cost of debt should be used unless a firm had escrowed the initial avoided costs in a secure investment in a risk-free treasury such as U.S. government T-Bills, because all firms have some probability of entering bankruptcy.

V. LEGAL FRAMEWORKS JUSTIFYING THE RISK-FREE RATE OVER THE WACC

This section demonstrates that two legal frameworks, temporary takings and tort jurisprudence, are congruent with the economic and financial theory for using the risk-free rate to estimate the present value of economic benefits in enforcement cases.

A. Delayed Compliance Is Synonymous with a Temporary Taking

Temporary regulatory takings occur when a government regulation has temporarily denied the owner of an interest the ability to make use of that interest. Analogously, when a firm delays complying with an environmental regulation, it temporarily "takes" the public interest in a safe and clean environment, an interest described in Part II, until appropriate enforcement actions are taken. Significantly, temporary takings litigation demonstrates that for a temporary invasion of another's interest, damages are awarded for *actual* damages incurred and not those that are uncertain or based on speculation. Moreover, just as the government's liability is limited to actual damages, a firm's liability for economic benefits measured from the noncompliance date through the penalty payment date should be limited to *actual* economic benefits. The risk-free discount rate is consistent with this approach, while the WACC is not.

In *First English Evangelical Church v. County of Los Angeles*,[40] the Supreme Court recognized the existence of compensable temporary regulatory takings and defined takings as temporary because the regulation is eventually "invalidated by the courts."[41] Typically, the situation is the government's denial of potential future development to a landowner.[42] Though the Supreme Court in *First English Evangelical Church* held that landowners must be compensated, it did not prescribe a fixed method of estimating compensation.[43]

Subsequently, courts have ruled that those subject to temporary takings are entitled to *actual* damages only. In *Corrigan v. City of Scottsdale*,[44] while addressing the damages to which the plaintiff property owner was entitled due to an invalid zoning ordinance, the

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[40] 482 U.S. 304 (1987).

[41] *See id.* at 310.

[42] *See* J. Margaret Tretbar, *Calculating Compensation for Temporary Regulatory Takings*, 42 U. KAN. L. REV 201, 207 (1993) ("[T]he effect of an ultimately invalid regulation prohibiting development of property held for future use is often simply a delay in development or an impairment of the landowner's ability to plan for future development.").

[43] *See First English Evangelical Church*, 482 U.S. at 321-22 (remanding the case for further consideration without defining how to estimate the amount of compensation to which the landowner was entitled).

[44] 720 P.2d 513 (Ariz. 1986).

court emphasized that the plaintiff was entitled only to provable actual damages.[45] Similarly, in both *Yuba Natural Resources, Inc. v. United States*[46] and *Poirier v. Grand Blanc Township*,[47] the courts denied lost profits as part of the plaintiff's damage award because such profits were speculative.[48] In *Yuba* and *Poirier*, the courts stated that the compensation the plaintiff was entitled to for actual damages was best measured by the fair value of what was taken, which did not include lost profits.[49]

Like the government regulations in *Corrigan*, *Yuba*, and *Poirier*, firms that delay compliance with EPA regulations and pollute the environment temporarily "take" the public interest in environmental quality. This "taking" occurs until the EPA takes enforcement actions to force compliance. As the plaintiffs in the temporary takings cases are entitled to damages from the government, the EPA is entitled to economic benefits of noncompliance. However, just as the plaintiffs in the temporary takings cases are entitled only to *actual* damages and were foreclosed from receiving compensation for speculative profits, the EPA should be entitled only to *actual* economic benefits, which is consistent with the language and intent of the environmental protection statues.[50] Applying the concepts of actual economic benefits requires the use of the risk-free discount rate to estimate the present value of avoided costs from delayed compliance whose value is known and certain:

> [T]he language in environmental statutes and court opinions indicates an intent to remove the *actual* economic benefit associated with noncompliance. The approach most consistent with the statutes and opinions would take advantage of all available information to determine the actual economic benefit, not the expected economic benefit at the noncompliance date. The calculations would use actual data from the past (*ex post*) and expected data from the future (*ex ante*) to value the on-time and delay cases as of the present.[51]

Based on the economic and financial theory described in Part IV, the analysis in the quotation requires that the risk-free discount rate be applied to the known and certain *ex post* avoided costs to estimate the

[45] *Id.* at 519 (stating that such actual damages must be provable to a reasonable certainty).
[46] 904 F.2d 1577 (Fed. Cir. 1990).
[47] 481 N.W.2d 762 (Mich. Ct. App. 1992).
[48] *See Yuba*, 904 F.2d at 1581-82; *Poirier*, 481 N.W.2d at 766.
[49] *See Yuba*, 904 F.2d at 1581-82; *Poirier*, 481 N.W.2d at 766. *But see* Wheeler v. City of Pleasant Grove, 833 F.2d 267, 270-71 (11th Cir. 1987) (holding that plaintiffs in temporary takings cases are entitled to a market rate of return or foregone expected profits).
[50] *See* Myers et al., *supra* note 15, at 7.
[51] *Id.* at 7.

present value of economic benefits of delayed compliance through the penalty payment. In so doing, the EPA is proscribed from collecting speculative economic benefits that may have never materialized.

Though not a temporary takings case, *Independent Bulk Transport, Inc. v. Vessel MORANIA ABACO*[52] demonstrates why the risk-free discount rate is appropriate for estimating the present value of economic benefits in EPA enforcement cases. In *Independent Bulk*, prior to obtaining an award for damages, the plaintiff was required to expend funds to repair his ship, which the defendant's ship had damaged in a collision.[53] The plaintiff had requested prejudgment interest equal to its cost of borrowing funds.[54] In response, the court stated:

> Plaintiff's position that prejudgment interest should be determined through proof of what the particular plaintiff actually paid to borrow money during the relevant period is in error. Consideration of the precise credit circumstances of the victim would inject a needless variable into these cases. Plaintiff is entitled to the income which the monetary damages would have earned, and that should be measured by interest or short-term, risk-free obligations.[55]

Clearly, the *Independent Bulk* court established that plaintiffs are entitled to be compensated for the cost of money based on risk-free investments for known *ex post* damages. The EPA's position that the present value of *ex post* economic benefits should be calculated using the WACC is inconsistent with the court's position.

B. Similar Goal and Comparable Structure of Civil Penalties and Damage Awards in Tort Cases

The minimum goal of EPA enforcement actions, in order to deter future regulatory violations, is to make a firm completely indifferent toward compliance and noncompliance. However, this does not justify the artificial estimation of the present value of economic benefits using the WACC. In torts, punitive damages are designed to ensure that defendants are not better off after the legal process has concluded.[56] As discussed below, the assessment of an appropriate "pu-

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[52] 676 F.2d 23 (2d Cir. 1982).

[53] *Id.* at 24-25.

[54] *Id.* at 27.

[55] *Id. See also* W. Pac. Fisheries, Inc. v. Cent. Nat'l Ins. Group of Omaha, 730 F.2d 1280, 1288-89 (9th Cir. 1982) (approving of the rationale in *Independent Bulk* while deciding an analogous case, which according to the court had been captured in application of the risk-free rate for post judgment interest under 28 U.S.C § 1961 and thus such rate was also appropriately applied as prejudgment interest unless substantial evidence required use of a different rate).

[56] *See* David D. Haddock et al., *An Ordinary Economic Rationale for Extraordinary Legal Sanctions*, 78 CAL. L. REV. 1, 27 (1990) (asserting that the amount of punitive damages depends

nitive" component of civil penalties is the correct approach from a legal as well as an economic and financial perspective.

In tort cases, compensatory damages are directed at deterrence.[57] This is the prevailing view among the courts.[58] Further, the purpose of punitive damages is punishment and deterrence.[59] In *Kalavity v. United States*,[60] the court stated: "Damages are 'punitive' when awarded separately for the sole purpose of punishing a tortfeasor who inflicted injuries 'maliciously or wantonly, and with circumstances of contumely and indignity.'"[61] Further, the court in *O'Gilvie v. International Playtex, Inc.*[62] explained that punitive damages are imposed for willful or wanton conduct in order to restrain and deter others from similar actions.[63] Thus, it is inaccurate for the EPA to assert that

on the particular circumstances of a case with respect to the defendant, not the plaintiff). *See also* Robert D. Cooter, *Economic Analysis of Punitive Damages*, 56 S. CAL. L REV. 79, 89-90 (1982) (explaining that punitive damages are justified by the need to deter and punish those who intentionally commit egregious harms); Jason Johnston, *Punitive Liability: A New Paradigm of Efficiency in Tort Law*, 87 COLUM. L. REV. 1385, 1388-89 (1987) (arguing that courts have a propensity to underestimate damages and that properly-set punitive damages can overcome these errors and provide defendants with appropriate incentives and help achieve optimal levels of deterrence).

[57] *See* Kalavity v. United States, 584 F.2d 809, 811 (6th Cir. 1978) (explaining that ordinary tort damages serve both a compensatory and deterrent function).

[58] *See* MARSHALL S. SHAPO, BASIC PRINCIPLES OF TORT LAW 342-43 (1999) (explaining that the prevailing view among courts is that the purpose of compensatory damages is both to compensate the plaintiff and deter the defendant). The minority view is that the purpose of compensatory damages is to compensate victims and that punishment and deterrence emanate solely from punitive damages. *See* Vanskike v. ACF Indus., Inc., 665 F.2d 188 (8th Cir. 1981) (asserting that there is a distinction between compensatory and punitive damages, and that if punishment and deterrence are to be achieved it must be done through a separate award of punitive damages).

[59] *See* Pac. Mut. Life Ins. Co. v. Haslip, 499 U.S. 1, 21 (1991) (describing the purpose of punitive damages as deterrence); O'Gilvie v. Int'l Playtex, Inc., 821 F.2d 1438, 1446 (10th Cir. 1987) (same); Kalavity v. United States, 584 F.2d 809, 811 (6th Cir. 1978) (describing the singular purpose of punitive damages is punishment and deterrence); *In re* Exxon Valdez, No. A89-0095-CV, 1995 U.S. Dist. LEXIS 12952, at *3 (D. Alaska Jan. 27, 1995) (explaining that punitive damages are to deter conduct); Green Oil Co. v. Hornsby, 539 So.2d 218, 222 (Ala. 1989) (holding that the purpose of punitive damages is not compensate but to deter behavior); Wangen v. Ford Motor Co., 294 N.W.2d 437, 450 (Wis. 1980) (same). *See also* SHAPO, *supra* note 58, at 358-59 (describing the role of punitive damages as serving to punish the defendant and provide specific and general deterrence that have a "heightened behavior controlling effect").

[60] 584 F.2d 809 (6th Cir. 1978).

[61] *Id.* at 811 n.1 (citing Milwaukee R.R. v. Arms, 91 U.S. 489, 493 (1875)). *See also* Roginsky v. Richardson-Merrel, Inc., 378 F.2d 832, 842-43 (2d Cir. 1967) (describing the conduct that New York courts have found to support punitive damages as wanton, malicious, or gross and outrageous); Leichtamer v. Am. Motors Corp., 424 N.E.2d 568, 580 (Ohio 1981) (asserting that in Ohio punitive damages may be awarded for actual malice or malice that may be inferred from intentional, reckless, willful, or gross conduct).

[62] 821 F.2d 1438 (10th Cir. 1987).

[63] *Id.* at 1446.

the only "appropriate" focus in a tort action is compensating the victim.[64]

Importantly, the Supreme Court has recognized the significant deterrent effect of civil penalties on noncompliance. In *Friends of the Earth, Inc. v. Laidlaw Environmental Services*,[65] the Court explained that the purpose of a civil penalty for violation of the Clean Water Act is deterrence.[66] Deterrence provides incentives not only for current violators to come into compliance, but also for the current violator and others to avoid future violations.[67] Given that courts apply these factors for violations of many of the environmental protection statutes, it is clear that a purpose of civil penalties is deterrence.

Civil penalties have two components: economic benefits of delayed compliance and a dollar penalty to account for the severity of the violation, including the violator's willfulness in delaying or not complying with a regulation.[68] According to the EPA, the economic benefit portion of a civil penalty constitutes "a critically important element of deterrence."[69] The additional dollar penalty is imposed over and above economic benefits in EPA enforcement actions to account for the severity of the violation and deter future violations.[70] While using the risk-free rate may leave the violating firm with some net gain due to potential risk-related profits, such profits are derived from accepting risk and should not be included in the estimate of present value of economic benefits. The fact that a violating firm may derive some financial gain after accounting for the economic benefits

[64] *See* Environmental Protection Agency, Calculation of the Economic Benefit of Noncompliance in EPA's Civil Penalty Enforcement Cases, 64 Fed. Reg. 32,948, 32,958 (proposed June 18, 1999).

[65] 528 U.S. 167 (2000).

[66] *Id.* at 706.

[67] *Id.* at 707. Though beyond the scope of this Note, another potential explanation for imposing civil penalties is retribution. *See id.* at 706.

[68] *See* ENVIRONMENTAL PROTECTION AGENCY, PUB. NO. 300-F-00-002, LEVELING THE PLAYING FIELD 1 (2000), *available at* http://www.epa.gov/oeca/ore/med/. *See also* Hayward, *supra* note 2, at 648-49 (explaining that the EPA seeks civil penalties to deter polluters from violating regulations and resolves environmental problems by removing the economic benefit as well as imposing further penalties over and above the economic benefit).

[69] Environmental Protection Agency, Calculation of the Economic Benefit of Noncompliance in EPA's Civil Penalty Enforcement Cases, 64 Fed. Reg. at 32,958. *See also* EPA, LEVELING THE PLAYING FIELD, *supra* note 68, at 3 (asserting that federal courts have almost unanimously recognized the importance of economic benefit in setting civil penalties that will deter firms from violating environmental protection regulations in the future).

[70] Environmental Protection Agency, Calculation of the Economic Benefit of Noncompliance in EPA's Civil Penalty Enforcement Cases, 64 Fed. Reg. at 32,958 n.21. *See also* EPA, LEVELING THE PLAYING FIELD, *supra* note 68, at 3 (explaining that federal courts impose a punitive component of civil penalties over and above economic benefits to achieve the goal of deterrence).

is analogous to the remedial outcome associated with compensatory damages as applied to the environment.[71]

More important, the dollar penalty plays a directly analogous role to punitive damages in traditional tort cases, which are used to make the defendant indifferent toward committing or not committing an illicit act. In *United States v. Municipal Authority of Union Township*,[72] the court held that the goal of a civil penalty is to deter violators through the imposition of an economic benefit component and punitive component designed to account for the willfulness or maliciousness of the violator's activities.[73] The court's language in *Union Township* is directly comparable to language used to describe the underlying rationale for punitive damages in tort cases.

Further, the factors courts and the EPA use to assess the amount of the "gravity," a dollar penalty portion of the civil penalty are analogous to those that courts employ in determining the reasonability of the level of punitive damages. Specifically, the factors are:

(1) seriousness of violations;

(2) the economic benefit from the violation;

(3) any history of violations;

(4) good faith efforts to comply with the applicable requirements;

(5) the economic impact of the penalty on the violator; and

(6) such other matters as justice may require.[74]

Factor (2) accounts for the economic benefit portion of the civil penalty, while factors (1), (3), and (4) represent the gravity factors. Factor (5) assesses the ability of violators to pay a penalty that may be imposed. The EPA's internal policies for establishing the level of

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[71] *See* Haddock et al., *supra* note 56, at 17-18 (explaining that in thin markets such as environmental quality, where transactions do not occur on a continuous basis through a regular market, the awarding of compensatory damages leaves a defendant with a net gain).

[72] 929 F. Supp. 800 (M.D. Pa. 1996), *aff'd*, 150 F.3d 259 (3d Cir. 1998).

[73] *Id.* at 803-05. *See also* United States v. Bethlehem Steel Corp., 829 F. Supp. 1047, 1057 (N.D. Ind. 1993) (explaining that the "major purpose of a civil penalty [under RCRA] is deterrence").

[74] *See* CWA, 33 U.S.C. § 309(d) (1994). *See also* United States v. WCI Steel, Inc., 72 F. Supp. 2d 810, 828 (N.D. Ohio 1999) (showing that the factors to be considered under CWA are the same under RCRA).

civil penalties are consistent with those the courts follow.[75] For example, the factors the EPA considers in determining the amount of civil penalties to pursue under section 311(b)(3) of the Clean Water Act are:

(1) the nature, extent, and degree of success of any efforts of the violator to minimize or mitigate the effects of the discharge;

(2) any history of prior violations;

(3) any other penalty for the same incident;

(4) any other matters as justice may require;

(5) the economic impact of the penalty on the violator;

(6) the seriousness of the violation or violations;

(7) the degree of culpability involved;

(8) the economic benefit to the violator, if any, resulting from the violation.[76]

EPA guidance documents contain a disclaimer that they are for internal purposes only and thus do not create enforceable rights by parties in litigation with the EPA.[77] Nevertheless, courts may consider them in determining the final penalty amount.[78] This is consistent with the doctrine that the final amount of a civil penalty is subject

[75] The EPA's generic civil penalty policy for determining the amount of a penalty the agency intends to seek essentially parallels the factors that courts consider. *See* EPA, LEVELING THE PLAYING FIELD, *supra* note 68, at 1 (describing recovery of the economic benefit, plus a gravity penalty, as the foundation of EPA civil penalty policy).

[76] *See* ENVIRONMENTAL PROTECTION AGENCY, CIVIL PENALTY POLICY FOR SECTION 311(b)(3) AND SECTION 311(j) OF THE CLEAN WATER ACT (1998) (providing an example, pursuant to § 311(b)(8) of the Clean Water Act, as amended by 33 U.S.C. § 1321(b)(8)), *at* http://www.epa.gov/oeca/ore/water/311pen.html (last visited Mar. 30, 2002).

[77] *See* Barnett M. Lawrence, *EPA's Civil Penalty Policies: Making the Penalty Fit the Violation*, 22 ENVTL. L. REP. 10,529, 10,531 (1992) (discussing that the EPA's internal guidance documents cannot be cited to create rights in legal actions involving the EPA and may be changed at any time without public notice).

[78] *See* Friends of the Earth, Inc. v. Laidlaw Envtl. Serv., Inc., 956 F. Supp. 588, 610-11 (D.S.C. 1997) (taking into account the defendant's own legal costs, along with the plaintiff's legal costs that the defendant is responsible for, in setting the ultimate penalty to be paid).

to the discretion of trial courts.[79] Further, plaintiffs in citizens' suits may use EPA guidelines to decide upon a negotiated penalty with a firm that has violated environmental quality statutes and EPA regulations.[80]

In *Pacific Mutual Life Insurance Co. v. Haslip*,[81] the Supreme Court held that a set of factors established by the Alabama Supreme Court (the *Hammond* factors) provides a sufficient and meaningful review of the reasonability of punitive damage awards.[82] These factors are:

(1) whether there is a reasonable relationship between the punitive damages award and the harm likely to result from the defendant's conduct as well as the harm that actually occurred;

(2) the degree of reprehensibility of the defendant's conduct, the duration of that conduct, the defendant's awareness, any concealment, and the existence and frequency of similar past conduct;

(3) the profitability to the defendant of the wrongful conduct and the desirability of removing that profit and of having the defendant also sustain a loss;

(4) the "financial position" of the defendant;

(5) all the costs of litigation;

(6) the imposition of criminal sanctions on the defendant for its conduct, these to be taken in mitigation; and

(7) the existence of other civil awards against the defendant for the same conduct, these to be taken in mitigation.[83]

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[79] *See* Tull v. United States 481 U.S. 412, 426-27 (1987) (holding that the setting of final civil penalty amounts under CWA is left to the discretion of trial judges). *See also* United States v. Smithfield Foods, Inc., 191 F.3d 516, 529 (4th Cir. 1999) (asserting that the trial court's valuation of the civil penalty is reviewed only for abuse of discretion); United States v. Bethlehem Steel Corp., 829 F. Supp. 1047, 1055 (N.D. Ind. 1993) (explaining that assessment of the amount of a civil penalty is determined based on the court's "informed" discretion).

[80] *See* Lawrence, *supra* note 77, at 10,531.

[81] 499 U.S. 1 (1991).

[82] *Id.* at 21-22.

[83] *Id.* at 21.

The *Hammond* factors are analogous to guidance that other courts have offered in assessing the reasonability of the level of punitive damages. In *O'Gilvie v. International Playtex., Inc.*,[84] the court stated that under Kansas law:

> In assessing punitive damages the nature, extent, and enormity of the wrong, the intent of the party committing it, and all circumstances attending the transaction involved should be considered. Any mitigating circumstances which may bear upon any of the above factors may be considered to reduce such damages. In fixing an award of punitive damages a jury may consider the amount of actual damages recovered, defendant's financial condition and the probable litigation expenses.[85]

Although there are some differences, the factors set forth in the civil penalty sections of the environmental protection statutes and internal EPA guidance documents demonstrate a remarkable similarity. Clearly, the purpose and method for assessing damage awards in tort law and civil penalties in enforcement cases, especially the punitive component, are very much the same. Thus, if the EPA believes that a civil penalty should include a firm's potential risk-related profits, the agency should present the requisite proof and seek the imposition of an appropriate dollar penalty.

VI. INCORPORATING ECONOMIC BENEFITS AND POTENTIAL RISK-RELATED OR SECOND ORDER PROFITS INTO CIVIL PENALTIES DUE TO DELAYED OR NONCOMPLIANCE WITH ENVIRONMENTAL REGULATIONS

Both the courts and the EPA should universally adopt use of the risk-free rate, a new approach to incorporating the present value of economic benefit and second order returns from noncompliance with environmental regulations. Both financial and legal theory demonstrate that the present value of economic benefits from the noncompliance date through the penalty payment date should, as the court in *United States v. WCI Steel* ruled, be calculated using the risk-free interest rate from the initial date of noncompliance through the penalty payment date.

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[84] 821 F.2d 1438 (10th Cir. 1987).

[85] *Id.* at 1446-47 (citations omitted). *See also* Wangen v. Ford Motor Co., 294 N.W.2d 437, 461 (Wis. 1980) (explaining that either a trial or appellate court has the power to reduce punitive damages to a fair and reasonable amount, and that a plaintiff whose award of punitive damage is reduced may accept the lower amount or a new trial).

Nevertheless, health and environmental quality policy concerns suggest that courts and the EPA may consider a firm's potential risk-related profits in setting the level of the gravity component of a civil penalty. Indeed, some reasonable amount of punitive or gravity penalty may need to be added to the economic benefits of delayed or noncompliance in order to attain the appropriate level of deterrence.[86] The courts can consider potential risk-related profits through the "such other matters as justice may require" factor contained in environmental statutes. The EPA may adopt such a feature by amending its current civil penalty guidelines.

However, this recommended approach would require both the courts and the EPA to justify the inclusion of potential risk-related profits as part of a civil penalty on a case-by-case basis. This recommendation is consistent with the underlying premise of Judge Posner's opinion in assessing the plaintiff's claim for punitive damages in *Douglass*: "The plaintiff should be required to establish, at least within rough limits, the profits attributable to [the defendant's] violation of her rights."[87]

CONCLUSION

This Note has examined whether the risk-free discount rate or the WACC should be used to estimate the present value of the economic benefits of noncompliance with environmental regulations that are *ex post* relative to the penalty payment date. Financial and economic theory, along with the legal jurisprudence in temporary takings and the structure and purpose of civil penalties, dictates the use of the risk-free rate. Use of the risk-free rate separates economic benefits due to the illicit act of violating a regulation from the ability to invest wisely. As part of a civil penalty, a court and the EPA may find that deterrence requires penalizing firms beyond the present value of economic benefits, through the imposition of a punitive component including potential profits earned from bearing the risk of alternative investments rather than complying with environmental regulations. Thus, it is recommended that the courts consider the need to include

[86] *See* Lynn M. Dodge, *Economic Benefit in Environmental Civil Penalties: Is BEN too Gentle?*, 77 U. DET. MERCY L. REV. 543, 552-54 (2000) (arguing that civil penalties should include wrongful profits earned as a result of noncompliance with environmental regulations).

[87] Douglass v. Hustler Magazine, Inc., 769 F.2d 1128, 1145 (7th Cir. 1985). *See also* Dan C. Dobbs, *Deterrence-Measured Remedies*, 40 ALA. L. REV. 831, 866 n.91 (1989) ("But while extracompensatory liability might be *triggered* on the basis of such a common sense estimate [that misconduct is profitable], the *measure* of that liability is another matter and requires proof.").

potential risk-related profits through the "such other matters as justice may require" factor.

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[†] I would very much like to thank Professor Jonathan L. Entin, Professor Marc R. Poirier, and Professor Menahem Spiegel for their suggestions and comments. All remaining errors are the responsibility of the author.

BEN USER'S MANUAL

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Office of Enforcement and Compliance Assurance
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THIS MANUAL IS RELEASABLE IN ITS ENTIRETY

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MAILING LIST ADDITION

If you would like to receive updated materials, and you work for a federal, state or local government environmental agency, please e-mail your name, government mailing address, and government phone number to benabel@indecon.com. If you have any questions about updates, contact the EPA enforcement economics toll-free helpline at 888-ECON-SPT (326-6778).

If you are a member of the public and would like to obtain these materials, download them from the U.S. EPA's web site at http://es.epa.gov/oeca. (This address may have changed by the time you read this manual. To obtain the current address, you can call the helpline at 888-ECON-SPT.)

September 1999

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

A. OVERVIEW

The U.S. Environmental Protection Agency developed the BEN computer model to calculate the economic benefit a violator derives from delaying and/or avoiding compliance with environmental statutes. EPA uses the model to assist its staff in developing settlement penalty figures. BEN can also develop testimony for trial or hearings, but an expert is necessary to explain its methodology and calculations. While the primary purpose of the BEN model is to calculate the economic benefit of noncompliance, the model can also calculate the after-tax net present value of supplemental environmental projects (SEP's) that involve early compliance.[1] For all other SEP's, you should use the PROJECT model.

Calculating economic benefit using the BEN model is generally the first step in developing a civil penalty figure under EPA's February 16, 1984, generic penalty policy. This two part document was codified in the General Enforcement Policy Compendium as P.T. 1-1 and P.T. 1-2. Related medium-specific policies have been developed since then to implement the 1984 policy. The BEN model assists in fulfilling one of the main goals of the generic policy. That goal is that civil penalties should at least recover the economic benefit from noncompliance to ensure that members of the regulated community have a strong economic incentive to comply with environmental laws on time. You can use BEN in all cases to measure benefit from delayed and/or avoided compliance, except for Clean Air Act Section 120 actions, which require the application of a Section 120 specific computer model.

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[1] As a form of SEP, a defendant may offer to comply with an environmental regulation significantly earlier than is required. Such a SEP has associated with it an after-tax net present value that is the maximum amount by which you can reduce the proposed civil penalty. For the "compliance date" in the BEN model, enter the date when the regulation requires compliance of the defendant (i.e., the date by which you would normally expect the defendant to achieve compliance). For BEN's "noncompliance date," enter the date that the defendant is proposing for its early compliance (i.e., a date earlier than the compliance date you previously entered). Enter all other inputs normally. BEN's "economic benefit" result is the maximum amount by which you should mitigate the proposed civil penalty.

BEN is easy to use, and designed for people with no background in economics or financial analysis. Because the program contains standard values for many of the variables needed to calculate economic benefit, BEN requires only a small number of user inputs. BEN also allows the user to modify all of its standard values. Data requirements, standard values and modifications are described in detail in Chapter 3.

B. CONTEXT AND THEORY OF ECONOMIC BENEFIT

Compliance with environmental regulations usually requires a commitment of financial resources; both initially (in the form of a capital investment or one-time nondepreciable expenditure) and over time (in the form of annually recurring costs). These expenditures might result in better protection of public health or environmental quality, but are unlikely to yield any direct financial return.

Economic benefit represents the financial gains that a violator accrues by delaying and/or avoiding such pollution control expenditures. Funds not spent on environmental compliance are available for other profit-making activities or, alternatively, a defendant avoids the costs associated with obtaining additional funds for environmental compliance. (This concept is known in economics as opportunity cost.) Economic benefit calculates the amount by which a defendant is financially better off from not having complied with environmental requirements in a timely manner. Economic benefit is "no fault" in nature. A defendant need not have deliberately chosen to delay compliance (for financial or any other reasons), or in fact even have been aware of its noncompliance, for it to have accrued the economic benefit of noncompliance.

The appropriate economic benefit calculation should represent the amount of money that would make the violator indifferent between compliance and noncompliance. If the enforcement agency fails to recover through a civil penalty at least this economic benefit, then the violator will retain a gain. Because of the precedent of this retained gain, other regulated companies may see an economic advantage in similar noncompliance, and the penalty will fail to deter potential violators. Economic benefit does not represent compensation to the enforcement agency as in a typical "damages" calculation for a tort case, but instead is the minimum amount by which the violator must be penalized so as to return it to the position it would have been in had it complied on time.

C. SUMMARY OF BEN METHODOLOGY

BEN calculates the economic benefits gained from delaying and avoiding required environmental expenditures. Such expenditures can include: (1) Capital investments (e.g., pollution control equipment), (2) One-time nondepreciable expenditures (e.g., setting up a reporting system, or acquiring land), (3) Annually recurring costs (e.g., operating and maintenance costs). Each of these expenditures can be either delayed or avoided. BEN's baseline assumption is that capital investments and one-time nondepreciable expenditures are merely delayed over the period of

noncompliance, whereas annual costs are avoided entirely over this period. BEN does allow you, however, to analyze any combination of delayed and avoided expenditures.

The economic benefit calculation must incorporate the economic concept of the "time value of money." Stated simply, a dollar today is worth more than a dollar tomorrow, because you can invest today's dollar to start earning a return immediately. Thus, the further in the future the dollar is, the less it is worth in "present-value" terms. Similarly, the greater the time value of money (i.e., the greater the "discount" or "compound" rate used to derive the present value), the lower the present value of future costs.

To calculate a violator's economic benefit, BEN uses standard financial cash flow and net present value analysis techniques, based on modern and generally accepted financial principles. First, BEN calculates the costs of complying on-time and of complying late, adjusted for inflation and tax deductibility. To compare the on-time and delayed compliance costs in a common measure, BEN calculates the present value of both streams of costs, or "cash flows," as of the date of initial noncompliance. BEN derives these values by discounting the annual cash flows at an average of the cost of capital throughout this time period.

BEN can then subtract the delayed-case present value from the on-time-case present value to determine the initial economic benefit as of the noncompliance date. Finally, BEN compounds this initial economic benefit forward to the penalty payment date at the same cost of capital to determine the final economic benefit of noncompliance.

A violator may gain illegal competitive advantages in addition to the usual benefits of noncompliance. These may be substantial benefits, but they are beyond the capability of BEN or any computer program to assess. Instead BEN asks you a series of questions about possible illegal competitive advantages so that you may identify cases where they are relevant. EPA is in the process of developing guidance protocols for such situations. You can obtain a copy of these protocols from EPA's enforcement economics toll-free helpline at 888-ECON-SPT. Meanwhile, if illegal competitive advantage is an issue you should consult an expert or the helpline.

D. HOW TO USE THIS MANUAL

This manual provides instructions for accessing, operating and interpreting results from the BEN program. It also takes you step by step through a BEN case.

Chapter 2 outlines the procedures for installing and managing the model. Chapter 3 describes BEN's data requirements, default values and opportunities for customization. Chapter 4 addresses common issues that arise when using BEN. Appendix A contains a detailed discussion of the economic rationale and computational methods used in BEN. You do not have to be familiar with Appendix A to use BEN or this manual.

All of the information from this manual except Appendix A is available through BEN's on-line help system. The help system is context sensitive and may be accessed at anytime during the program by pressing F1. It may also be accessed using the Help pull-down menu on the main screen.

If you are a government employee (of any federal, state or local agency) and need further assistance in operating the program or understanding the results, please contact the EPA enforcement economics toll-free helpline at 888-ECON-SPT (326-6778) or benabel@indecon.com. If you need legal or policy guidance, please contact Jonathan Libber, the BEN/ABEL coordinator at 202-564-6102, or e-mail him at libber.jonathan@epamail.epa.gov.

BEN is an interactive computer program that runs in the Windows™ operating environment. You can obtain a copy of BEN from EPA's web site (http://es.epa.gov/oeca). [2] If you lack internet access and are a government employee (federal, state, or local), you can contact EPA's enforcement economics toll-free helpline (888-ECON-SPT, or 888-326-6778).

Chapter 2 contains five sections describing procedures for using BEN. Section A describes the structure of the computer program. Section B explains the procedures for installing the program on your computer. Section C provides data format requirements and additional helpful hints for entering data at your computer, as well an overview of error messages. Section D tells you how to calculate and print results. Section E explains how to exit the program and save files. For an in-depth description of each variable and recommended sources of information, see Chapter 3.

A. STRUCTURE OF THE COMPUTER PROGRAM

BEN consists of five different screens: main/case screen, run screen, options screen, specific cost estimates screen, and results screen. In general, you start with the case screen, enter data on separate screens, return to the case screen, then view (and print) your output on the results screen. BEN operates like any standard Windows™ application. Use the mouse or the Tab and Return keys to move between cells and within a screen. Hold down the Shift key while pressing Tab to return to previous entries.

When you first open BEN the case screen appears. BEN starts up with a blank case screen. You can obtain a new screen at any time by selecting "New" from the File menu, or using the Ctrl+N shortcut. To toggle between cases, select the appropriate file name under the "Window" menu.

[2] This address may have changed by the time you read this manual. To obtain the current address, you can call the helpline at 888-ECONSPT.

The first inputs on the case screen are case name, analyst name and office/agency. These values are for reference only and do not affect the results. Then BEN asks for the violator's tax status and state. With this information BEN references an internal database and automatically calculates the relevant marginal tax rates. Here you have the opportunity to modify taxes by pressing the **[Customize Taxes]** button. Under taxes is the **[Competitive Advantage]** button. Pressing this button presents you with questions to alert you to the presence of illegal competitive advantage. At the bottom of the screen, BEN requires you to enter the penalty payment date.

The right side of the case screen is for run management. Here you can create a new run, enter or edit run data, copy a run, remove a run, and calculate a run. You can create multiple runs for each case.

The run screen is where you enter the costs of compliance. You must enter all the cost data and cost estimate dates for a run before you can calculate economic benefit.

From the run screen you may go to the options screen. The option screen allows you to change BEN's standard values for the discount/compound rate and inflation. Here you can also alter the number of replacement cycles, useful life for capital equipment, whether a cost is delayed or avoided, and tax deductibility of one-time nondepreciable expenditures. This screen contains BEN's default settings, so you will never need to use it unless you customize the standard values.

From the options screen you may go to the specific cost estimates screen. This screen is needed only under certain rare circumstances. Here you can adjust BEN's assessment of on-time and delay compliance costs.

The result screen is reached from the main screen, and displays the results of BEN's calculation. Here you have three options: you can print out a summary of the BEN calculation, you can print out a detailed version of the calculation, and/or you can return to the run screen.

Once you are finished with a calculation, you can create, edit or calculate other runs. You can even create other case files, and toggle between them. Before you exit BEN it gives you the option of saving the current case, plus you can save your case file at anytime during your session. The case is saved with a ".ben" extension in the folder you specify, and all runs are automatically saved with the case.

At any time during your use of the model you can access the context-sensitive help system by pressing the F1 key, just as in any Windows application.

B. INSTALLING BEN

BEN requires a personal computer running the Windows operating system (version 3.1 or higher). In addition, for optimal formatting of various data entry screens, set your display in the

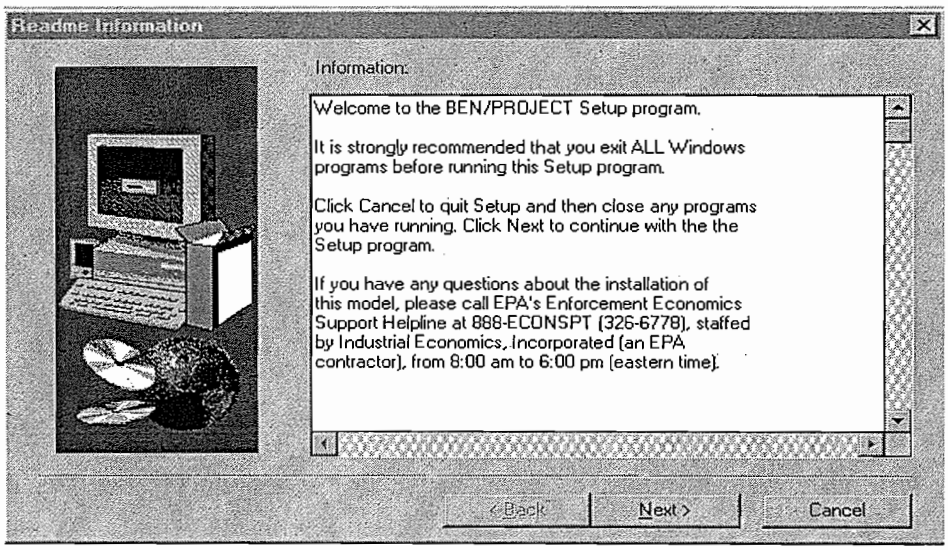
control panel to "small fonts" option. ("Small fonts" is the Windows default, so unless your display settings have been altered, your computer should be set appropriately.)

The remainder of this section describes how to install BEN from EPA's website or from floppy disks onto a local network or stand-alone PC. Installing BEN will automatically install the PROJECT model, since the models share some installation files. If you have trouble downloading or installing the model, consult your local computer technician.

BEN is located on the EPA website at http://es.epa.gov/oeca.[3] To install BEN, first download the installation file to your computer or network, then run the file and follow the steps listed below for installing it from a set of disks. The installation screens will appear as they do for installation from a disk, although you will not be prompted for a second disk.

If you have access to the installation disks, insert Disk 1 and run "a:\setup.exe" (or "b:\setup.exe" if the floppy is in the b:\ drive). Then click **[OK].** If you receive a warning message that you cannot copy a file because it is in use, simply click **[OK]**. It is merely notifying you that the file the installation system is trying to copy already exists on your computer and is currently open.

The first BEN setup screen will appear:



You should close all other programs before installing the model. To do so, click on **[Cancel]**, close the programs and repeat the appropriate steps above. Otherwise click **[Next]** and proceed to the second screen as shown below:

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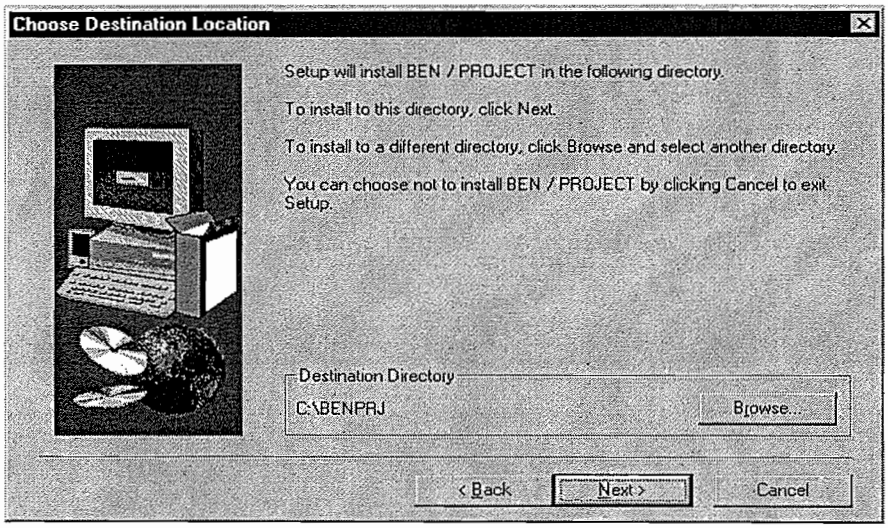
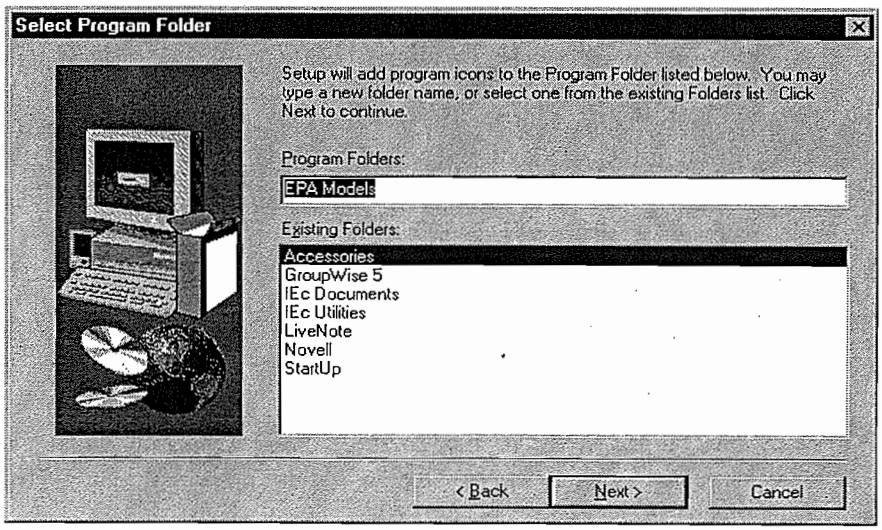
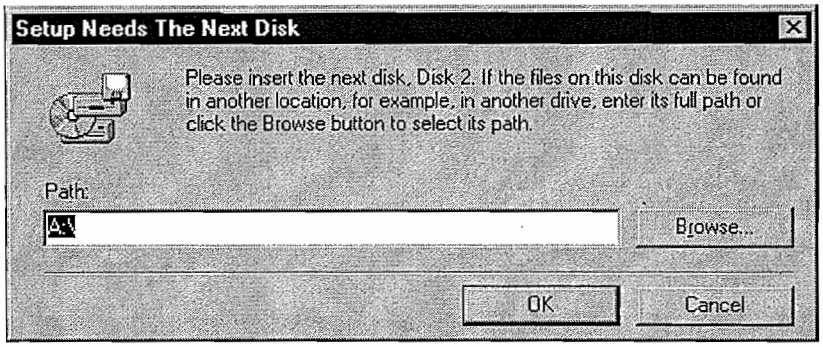
[3] This address may have changed by the time you read this manual. To obtain the current address, you can call the helpline at 888-ECON-SPT.



The second screen offers you the opportunity to designate a directory in which to store the model. The default directory is "c:\BENPRJ" (assuming that your local hard drive is c:\). If you wish to save the model to a different directory, press **[Browse]** and choose your desired directory. To proceed with the BEN/PROJECT installation, press **[Next]**. The next setup screen allows you to choose a program folder name as shown below:



The default folder name is EPA Models, which you may alter. To continue installation press **[Next].** BEN/PROJECT will partially install and then prompt you for Disk 2, as shown below:



If the files are not on Disk 2 you may type their location or use browse to find them. Press **[OK]** when the path is correct. If the program is on two disks, simply insert Disk 2 and press **[OK]**. The setup program will create icons for BEN and PROJECT and finish installing them. When you have completed the installation process, you should reboot your computer prior to using the BEN model or any other software package.

Once BEN has been loaded onto your hard drive, simply double-click the model icon to start the program. If you are running Windows™ 95 or higher, and did not change the default directory and folder, BEN and PROJECT will automatically be listed on the start menu under programs in the "EPA Models" folder.

After installing the model, you may wish to create a subdirectory for storage of all your case files. Alternatively, you may also choose to save your case files in any pre-existing directories corresponding to different cases or projects

C. DATA ENTRY

BEN is a Windows™-based computer program. Like other Windows™-based programs it uses the mouse or the Enter and Tab keys to move from entry to entry or from screen to screen. Hold down the Shift key while pressing Tab to return to previous entries. Each screen has several options and spaces for input.

BEN will accept several entry formats. Numerical values can include but do not require commas. Monetary values may include decimals but will be rounded to the nearest dollar. They may be entered with or without dollar signs. Rates or percentages should be entered as a decimal number without a percent symbol (e.g., enter 0.20 to represent 20 percent). If you type 2.5 for an inflation rate, BEN will read it as an inflation rate of 250 percent.

BEN converts all dates to a "1-Jan-1998" format, but can understand almost any sensible format. If you enter an atypical date format, be sure to check that BEN has interpreted it as you intended. If you do not enter a day, BEN will assume the first day of the month.

Be careful to use only number keys to enter numerical values. A frequent mistake is typing the lowercase letter **L** instead of a number **1**. Another error occurs when the capital letter **O** is typed instead of the number **0** (zero).

BEN will tell you if the format for the entry is incorrect. If this happens, correct the number and enter it again. Some inputs are limited to a range of values. If an entered value falls out of this range, BEN will display an error message with the allowable range of values. Other error messages will appear if you did not enter data in a required field. You may enter variables on the same screen in any order. The only exception to this is that you must have entered all of the inputs for a case before you create a run. Therefore you will receive non-entry error messages only when moving from screen to screen or creating a run.

After typing your entry you might discover that you have typed an incorrect letter or number. Typing errors are easy to correct: simply return to the relevant value and type over the mistake. Like all computer programs, BEN follows the GIGO protocol: "Garbage In, Garbage Out." Verifying your data inputs is therefore extremely important.

D. CALCULATING AND PRINTING RESULTS

To perform an economic benefit calculation, select the desired run title from the list on the main screen and press **[Calculate]**. You may calculate multiple runs and display the results simultaneously by selecting multiple run titles (i.e., select a run and then click on subsequent desired runs, while simultaneously holding down the Control key). A new screen will display a summary of the results.

You can may print either a summary of the results or detailed background spreadsheet pages. The "Summary" option will print only the information contained in the summary results screen. The "Detail" option will print, separately for each run, a summary page and spreadsheet pages that include: (1) Illegal Competitive Advantage, which lists possible sources of additional economic benefit (omitted if the user does not check off any such conditions for the case inputs); (2) Discount/Compound Rate Calculation, which provides the details for the cost of capital calculation (omitted if the user overrides BEN's calculations on the Options screen); (3) Calculations for Specific Cost Estimates, which essentially prints the similarly named screen (omitted if the user overrides BEN's calculations on the Options screen); and (4) Cash Flow (maximum of four pages), which show the annual cash flow and net present value calculations.

For more information on interpreting these pages, consult Appendix A of the *BEN User's Manual*, or call EPA's toll-free enforcement economics support helpline at 888-ECON-SPT (326-6778).

Although printing is done from the output screen, the printer setup is controlled by the pull-down menu on the main screen. The printer setup allows you to shift between landscape and portrait printing, as well as choose more advanced options.

E. EXITING AND SAVING

You exit BEN just like any other standard Windows application. From the main screen, select Exit under the File pull-down menu at the top left corner of your screen, or click on the **[x]** button at the top right corner of your screen. You can also double-click on the BEN icon at the top left corner of your screen. BEN will ask you if you want to save your work before you exit.

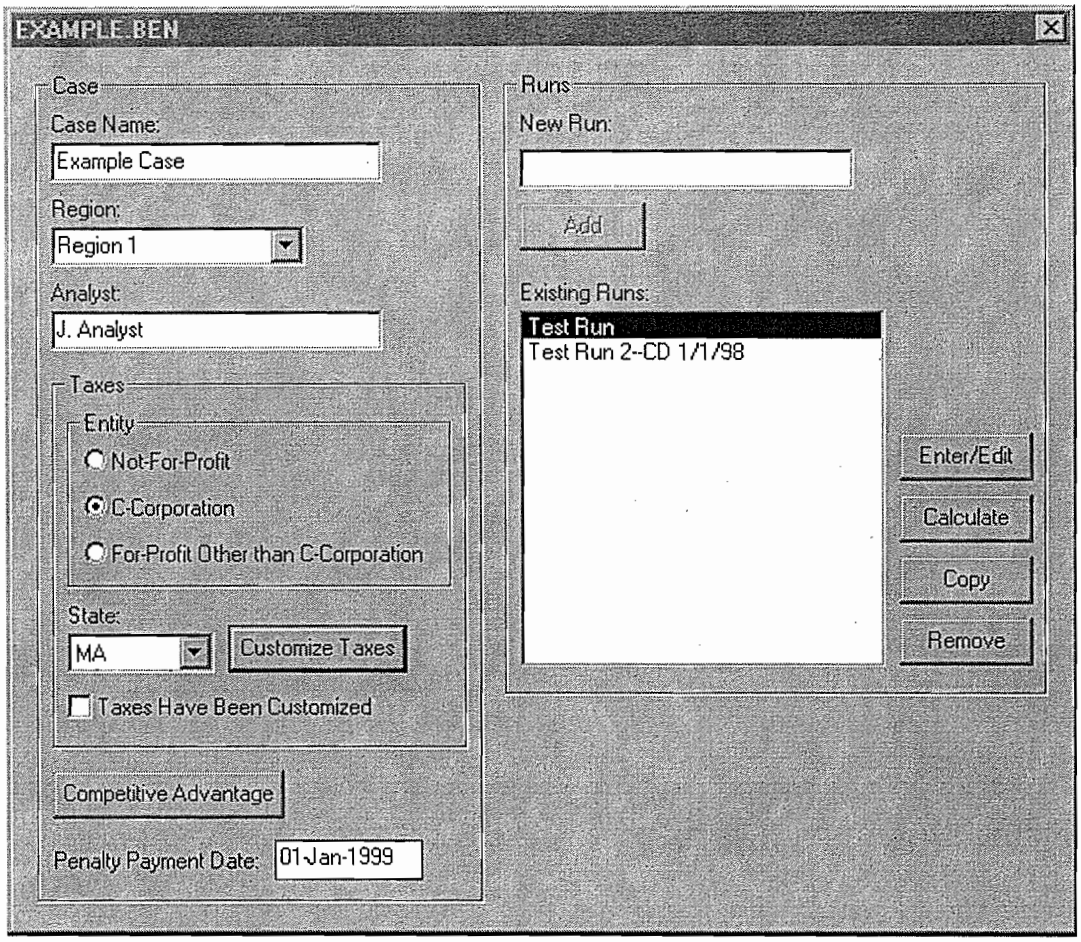
Be sure to save your case(s) before you exit. You save a case by selecting "Save" under the File menu (or give the case a new name by selecting "Save As..."), or the Ctrl+S shortcut. BEN cases are automatically saved with the extension ".ben" and can be accessed using the "Open" command under the File menu or the Ctrl+O shortcut. You can save cases in any folder, and switch between different folders at any time. Runs are automatically saved as part of a case.

To run BEN, you enter certain data, including the entity's tax status and state; the dates for penalty payment, noncompliance, and compliance; and the compliance cost estimates and estimate dates. BEN provides standard values — which you can modify — for tax, inflation, and discount rates, as well as the capital equipment's number of replacement cycles and useful life, and the one-time nondepreciable expenditure's tax deductibility. This chapter explains these variables (in the order in which you enter them in BEN), covering the criteria for developing input values and the basis for the standard values. Each explanation also states how a change in each variable's value will affect the economic benefit result, as summarized below (holding all other variables constant).

Input Item	Direction of Change	Impact on Economic Benefit
Marginal Tax Rate	increase	decrease
Penalty Payment Date	later	increase
Cost Estimates	increase	increase
Noncompliance Date	later	decrease
Compliance Date	later	increase
Discount/Compound Rate	increase	increase
Number of Replacement Cycles	increase	increase
Useful Life of Capital Equipment	increase	decrease
Projected Rate for Future Inflation	increase	varies
Cost Index for Inflation	PCI to other index	varies
Tax-Deductibility of One-Time, Nondepreciable Expenditure	tax deductible to not tax deductible	increase

A. CASE SCREEN

The case screen shown below is what you see when you first open BEN. This is where you enter the following variables: case name, office/agency, analyst name, entity tax status, state, marginal tax rate, penalty payment date, and run name. It is also where you consider questions of competitive advantage. The right side of the case screen is where you create, edit, calculate and remove runs.



1. Case Name, Office/Agency, Analyst Name

Case name, office/agency (formerly EPA Region), and analyst name are the first three inputs in BEN. They are for reference purposes only and do not affect the calculation. Each of them will appear along with the current date on the bottom of every page of the results.

a. Case Name

Case name is the first input in BEN. This name can be any length and can contain letters, spaces, punctuation and numbers (although you may not leave it blank). It will appear along with the current date, analyst name, and EPA region on each page of the results. Since its sole purpose is documentation, this label can contain anything you choose. It can reflect the violator's name or a characteristic of the specific case (e.g., "Payment on July 15, 1999"). Each case can contain several runs, so you will not need to alter the case name to save individual calculations.

b. Office/Agency

Like case name, office/agency is for reference purposes only (although you may not leave it blank). It will appear along with the current date, case name, and analyst name on each page of the results. A pull down menu to the right of the cell lists all ten EPA regions, EPA headquarters, and the option of "other." You may also type in a different entry.

c. Analyst Name

Like case name and office/agency, analyst name is for reference purposes only (although you may not leave it blank). This name can be of any length and can contain letters, spaces, punctuation and numbers. It will appear along with the current date, case name, and EPA region on each page of the results. It can be anything you choose, but it is most appropriate simply to enter your own name.

2. Entity Type, State, Customized Tax Rate

BEN needs to know the violator's tax rate to calculate economic benefits, as compliance costs are usually tax-deductible. Because tax-deductible expenses and depreciation associated with capital investments reduce taxable income they result in tax savings. The higher the tax rate, the higher the tax savings, and therefore the lower the economic benefit of noncompliance. BEN uses the marginal tax rate to account for the tax effects of compliance costs. Changing the violator's state or tax status changes the violator's marginal tax rate and thus alters economic benefit.

a. Entity Type

BEN asks you to designate the tax filing status of the entity. The three options are: Not-For-Profit, C-Corporation, or For-Profit Other than C-Corporation. Choosing the correct tax status is critical, because it determines BEN's application of the tax rate and the discount/compound rate. BEN will default to C-Corporation status.

A C-Corporation files a federal tax Form 1120 or Form 1120-A. These companies are taxed at corporate income tax rates. Virtually all publicly traded companies are C-Corporations, but small privately held firms can also be C-Corporations.

For-profit entities other than C-corporations may be S-corporations, partnerships, or sole proprietorships (e.g., a corner grocery store). These entities file federal tax returns other than 1120 or 1120-A (e.g., an S- corporation files a Form 1120-S and a Schedule K for each shareholder). The income and expenses of these organizations are divided among the shareholders and reported on their individual income tax returns. Income is therefore taxed at the individual income tax rate.

Not-for-profit entities, such as municipalities, public authorities, and charitable organizations, generally have a tax-exempt status. When you indicate that the violator is a not-for-profit entity, BEN sets the marginal income tax rate to zero. (Although rare, certain not-for-profit companies are subject to taxation. You should verify the status of the not-for-profit in question and adjust the tax rates accordingly.)

b. State

This is the state in which the entity conducts the majority of its business, which is not necessarily the state in which it is incorporated. Selecting the correct state is important because BEN uses state-specific tax rates in its calculations. The pull-down menu lists all fifty states plus "AVG" and "BEN." "AVG" is an average of all state tax rates (appropriate if the noncompliant facilities span several states). "BEN" is similar to "AVG", but instead of adjusting the state average each year, it uses one state average for the period 1987-1992 and another for 1993 and beyond. This option is appropriate only for replicating prior calculations from the DOS version of BEN, which used these rates as its standard value.

c. Customized Tax Rate

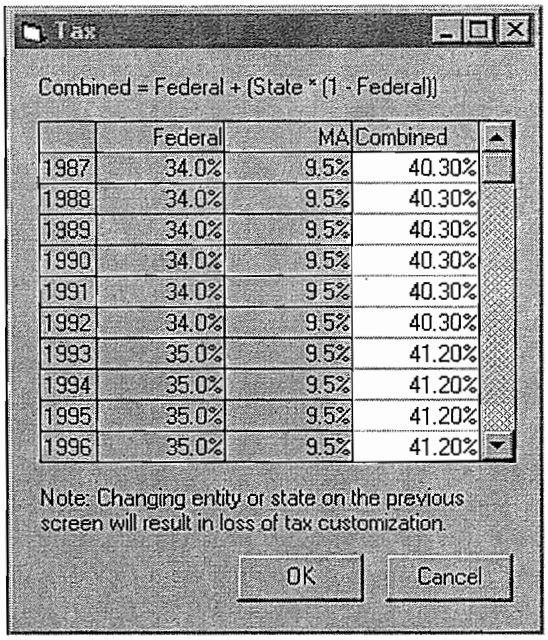
After you have entered the tax status and state of the violator, BEN will automatically calculate the combined marginal income tax rate. The marginal tax rate is the fraction of the last dollar of taxable income that a defendant would pay to federal and state governments. BEN uses the marginal tax rate, not the average tax rate (i.e., total tax divided by total taxable income), because the marginal tax rate is the rate that applies to incremental changes in the violator's tax-deductible expenses.

State tax rates must be adjusted to reflect the fact that you can deduct state taxes from federal taxable income. The adjustment is made by multiplying the marginal state tax rate by a factor equal to one minus the marginal federal tax rate, as shown in the following formula:

Combined tax rate = Federal rate + [State rate x (1 - Federal rate)]

State income taxes do not include sales tax, inventory tax, charter tax, or taxes on property. One-time tax payments, such as taxes on the purchase of equipment, should be included in the capital investment or in the one-time nondepreciable expenditure. If the tax recurs regularly, then it should be included in the annually recurring cost. For example, sales tax would be included in the capital cost while property tax would be included in the annual cost.

You may have information that supports the use of tax rates other than those supplied by the BEN model (e.g., the entity was not subject to the highest marginal rate). In these situations you can modify the annual rates individually by pressing **[Customize Taxes]**. The tax customization window shown below will appear and you can simply type in your customized values.

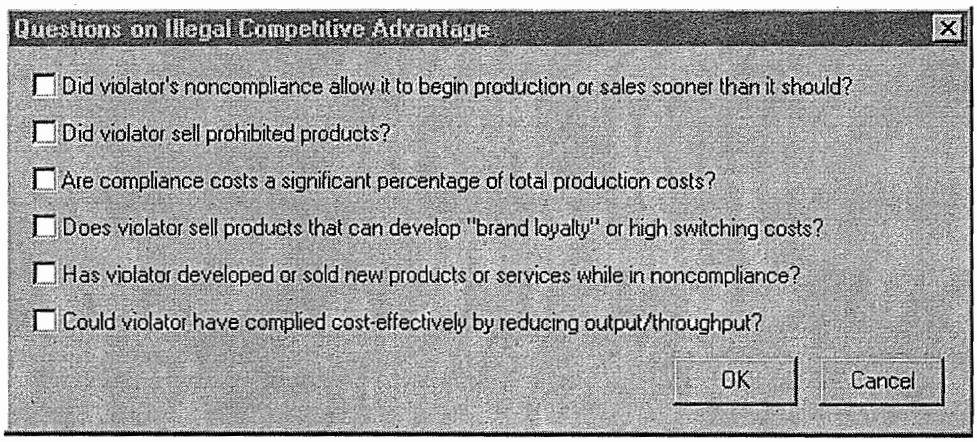


The "Taxes Have Been Customized" box on the case screen will be checked when modifications have been made to the tax rates. Similarly, this information will appear in the BEN run results and print-out. Note that once tax rates are modified, re-designation of the state or entity tax status will result in a loss of the customized information.

3. Competitive Advantage

BEN — or any computer model — is incapable of calculating economic benefit from illegal competitive advantage, leading to a possible underestimate of economic benefit in certain cases. Therefore BEN provides a **[Competitive Advantage]** button and asks questions for case attributes indicative of illegal competitive advantage, providing suggestions for further research and analysis.

You must read the competitive advantage screen and press **[OK]** before BEN will allow you to create a run.



Below are the responses that appear in BEN's results if you check a question box.

1. *Did violator's noncompliance allow it to begin production or sales sooner than it should?*
Violator may have received "early-mover advantage" by beginning production or sales sooner than it should.

2. *Did violator sell prohibited products?*
Violator's net profits from illegally sold products may constitute economic benefit, and if the violator continues to sell similar now-legal products in same market, then lasting market share effect may constitute an additional benefit.

3. *Are compliance costs a significant percentage of total production costs?*
Violator may have benefitted from market share gains by undercutting its competitors through price advantages from noncompliance.

4. *Does violator sell products that can develop "brand loyalty" or high switching costs?*
Violator may have benefitted from market share gains because it sells products that can develop "brand loyalty" or high switching costs.

5. *Has violator developed or sold new products or services while in noncompliance?*
Violator may have gained "early mover" market share and been able to discourage competitors by keeping prices low, since it developed or sold new products/services while in noncompliance.

6. *Could violator have complied cost-effectively by reducing output/throughput?* Incremental net profit from higher output/throughput could constitute economic benefit, since violator could have complied cost-effectively by output/throughput reduction.

If you answer affirmatively to any of these questions, further research and analysis is necessary to determine the full extent of the violator's economic benefit. You might wish to consult U.S. EPA's guidance on illegal competitive advantage, or contact EPA's enforcement economics support helpline, at 888-ECONSPT (326-6778).

4. Penalty Payment Date

The penalty payment date is the date you expect the violator to pay the civil penalty. Dates may be entered as month/day/year (i.e., 7/31/98) or written out (i.e., July 31, 1998). BEN will accept two-digit years, but four-digit years are preferable. You must enter dates to the day.

BEN automatically calculates the final economic benefit as of the penalty payment date and assumes that the violator earns a return on the benefit until that date. Therefore, the benefit figure increases for later penalty payment dates, holding all other variables constant.

A considerable time lag often occurs between when the violator signs the consent decree and when it actually pays the penalty. If the violator is willing to transfer the entire penalty figure to an interest-bearing escrow account on a date before entry of the consent decree, this escrow date may be used as the penalty payment date. Upon entry of the consent decree, the escrowed penalty plus any interest should accrue to the enforcement agency.

You should be certain that the violator knows: (1) the penalty payment date used in your economic benefit calculation; and, (2) that if the penalty payment date is actually later than you have assumed, the economic benefit will be higher. On the other hand, if the violator settles the case and pays its penalty prior to the date you used in your calculation, or if it agrees to escrow the economic benefit amount, the benefit component of the penalty will be lower. By conveying this information early in a negotiation with a violator, you will give the violator added incentive to settle promptly. In addition, this approach will allow you to avoid giving the violator any "unpleasant surprises" should you need to increase the benefit component as a result of a delay in the settlement.

5. Creating/Adding, Copying, and Removing Runs

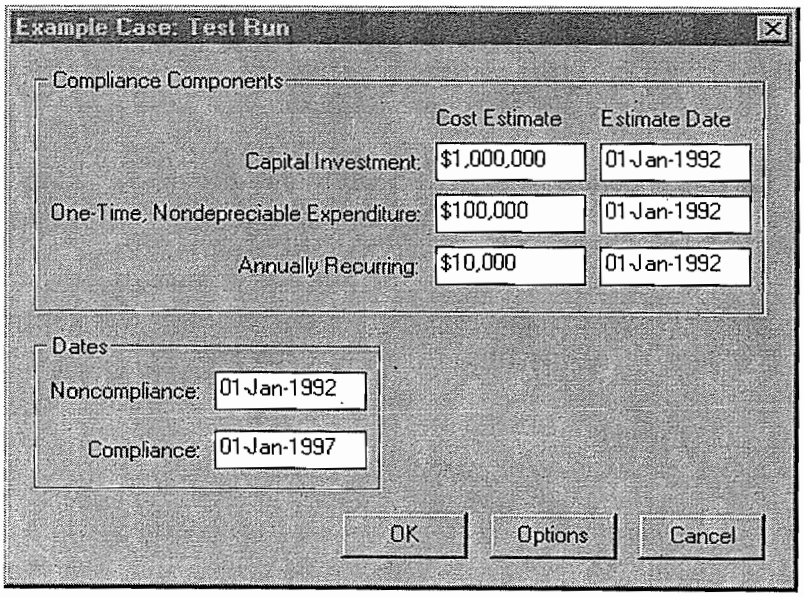
You must create a run before you can enter compliance cost information. To add a new run, enter the run name under "New Run:" and press **[Add]**. BEN will save the new run and list it under "Existing Runs." Run names can be any length and include any letter, punctuation or number. Each case may contain multiple runs.

To copy an existing run select the run you wish to copy from the list of existing runs and press **[Copy]**. A window will appear asking you to enter a name for the new run. No two runs can have the same name. Enter the new name and press **[OK]** to save the new run or **[Cancel]** to delete it. The copy will contain all of the information from the original. Copies are particularly useful when making only minor changes in cost information from run to run, because they can carry over consistent data.

To remove a run select it from the existing run window and press **[Remove]**. A window will appear asking you if you are sure. Press **[Yes]** and the run is deleted. Remember that BEN does not have a "trash bin" to hold deleted runs, so you will have no way to retrieve a run once you have removed it.

B. RUN INPUT SCREEN

To access the run input screen, select a run and press **[Enter/Edit],** or simply double click on the run name. Here you enter cost estimates for three possible compliance components: capital investments, one-time nondepreciable expenditures and annually recurring costs. Each cost component requires a cost estimate and an estimate date. At the bottom of the run screen you must enter the noncompliance and compliance dates.



1. Compliance Cost Components

This is where you enter the costs of the equipment/labor/activities necessary to achieve compliance. Engineers and technical staff in your enforcement program are usually aware of what reasonable costs might be for pollution control technologies and remedial activities, and might also know of standard cost information that exists in publications. Another potential source of information is the violator, who might willingly give you the required data. Otherwise, you can take a number of legal approaches to obtain the data from the violator. The EPA usually has authority to request the necessary information. With a legal issue like this one, the appropriate attorney(s) should also be consulted. In cases where cost data is available, but the required compliance measures are still unclear, two general guidelines will assist you:

(1) The best evidence of what the violator should have done to prevent the violations is what it eventually did (or will do) to achieve compliance. This rule is instructive in those cases where the violator may appear to be installing a more expensive pollution control system than EPA staff believe is necessary to achieve compliance. In such situations, the proper cost inputs in the BEN model are usually still based on the actual (more expensive) system being installed. This is because the EPA should not second guess the business decisions of a violator. A violator often will have sound business reasons to install a more expensive compliance system (e.g., it may be more reliable, easier to maintain, or have a longer useful life).

(2) Costs not truly associated with pollution control efforts to remedy the violations alleged in the complaint should be excluded from BEN inputs, but the violator must present convincing evidence that the costs were not associated with the operation of the pollution control system. For example, if the violator is adding additional capacity to handle a waste stream from a new production line, the incremental costs associated with treating the new waste stream should not be included in the BEN run (based on the assumption that the additional capacity for treatment of wastes from new production was not needed to achieve compliance under previous levels of production). Similarly, if the violator is adding capacity to accommodate normal anticipated business growth, and on-time compliance would not have entailed such additional capacity, then you should exclude the incremental costs of the additional capacity.

You may enter compliance costs with or without commas or dollar signs. BEN will accept decimals but will round the amount to the nearest whole dollar. Enter a zero for any component category where expenses would not be incurred. All else being equal, larger compliance costs will result in a higher economic benefit of noncompliance.

a. Capital Investment

The capital investment cost estimate should include all depreciable investment outlays necessary to achieve compliance. Generally these are expenditures the violator delayed making (although they could sometimes be avoided altogether). Enter a zero if no capital investment was

required for compliance. Holding all other inputs constant, the economic benefit from delay will be greater for larger capital investment outlays.

Depreciable capital investments are made for things that wear out such as buildings, equipment or other long-lived assets. Note that land is not a depreciable capital investment; land costs should instead be input as a one-time non-depreciable expenditure. Typical environmental capital investments include groundwater monitoring wells, stack scrubbers, and wastewater treatment systems. In estimating capital cost, keep in mind this includes all costs associated with designing, installing, shipping, and purchasing the necessary equipment (including sales tax) and associated facilities.

If the capital investment is avoided (i.e., the violator is not just delaying making the investment, but will never make the investment), after entering all the required information on the run inputs screen, on the options screen uncheck the "Delayed, Not Avoided" box and set the replacement cycles to 0. (If a replacement cycle has also been avoided, then retain the default cycle of 1.)

If you have capital investment costs with significantly different cost estimate dates, you should perform separate runs for each, which you can add together to produce a total economic benefit result.

b. One-Time, Nondepreciable Expenditure

This category includes compliance expenditures that need to be made only once and are non-depreciable (i.e., do not wear out). Enter a zero if no one-time nondepreciable expenditure was required for compliance. Holding all other inputs constant, the economic benefit from delay will be greater for larger one-time nondepreciable expenditures.

Such an expenditure could be purchasing land, setting up a record-keeping system, removing illegal discharges of dredged and fill material, disposing of soil from a hazardous-waste site, or initial training of employees. However, if training or record keeping must occur over time and regularly, these costs should be entered as annually recurring costs. If the one-time nondepreciable expenditure involved is avoided (i.e., the violator is not just delaying making the expenditure, but will never make the expenditure), on the options screen uncheck the "Delayed, Not Avoided" box.

Most one-time nondepreciable expenditures are tax-deductible; with the primary exception being purchases of land. Land is an asset and, therefore, cannot be deducted as an expense from taxable income. BEN assumes that the expenditure is tax-deductible unless otherwise specified. To change this assumption uncheck the "Tax Deductible" box on the options screen.

c. Annually Recurring Costs

Annually recurring costs are costs associated with operating and maintaining pollution control equipment. Enter a zero if no (additional) annual costs were required to operate the necessary pollution control equipment. Holding all other inputs constant, the economic benefit from delay will be greater for larger annually recurring costs.

This cost estimate should reflect the average annual incremental cost of operating and/or maintaining the required environmental control measures. These expenditures should include any changes in the cost of labor, power, water, raw materials and supplies, recurring training of employees, and any change in annual property taxes associated with operating the new or improved pollution control equipment. Note that annually recurring costs may be negative if compliance increases efficiency. Include any lease payments for equipment, but not expenses such as annualized capital recovery, interest payments, or depreciation.

Any operating and maintenance (O&M) offsetting credits should also be considered in determining the incremental annual costs. Such credits might represent actual O&M cost savings: heat recovery, product or byproduct recovery, and so forth. To be included, such savings must be proven by the violator, not just asserted. For example, the installation of new pollution control equipment may reduce certain costs (such as sludge disposal) associated with operations during the noncompliance period. If the resulting incremental O&M cost is negative, the net cost savings may be used in determining annual costs. Credit is given only for annually recurring cost savings that are both documented and directly related to compliance.

Annual costs must be equal for each year of the violation, differing only by inflation, to enter them into BEN. If they vary only slightly, you can enter an average estimate of the different yearly figures. If they vary significantly, then you can create separate runs corresponding to the different years of the violation. Each run's noncompliance and compliance dates should reflect the beginning and ending dates for the year of the specific annual cost.

If the annual costs are delayed, and not avoided, then enter them as one-time nondepreciable expenditures. You can either enter the entire sum of the annual costs that have been delayed over the entire noncompliance period, or you can create a separate run for each year of delayed costs. Either way, the noncompliance date should be the midpoint of when the annual costs should have been incurred (i.e., the midpoint of the entire noncompliance period, or the middle of the year), and the compliance date should be the midpoint of when the costs were or will be incurred.

2. Cost Estimate Dates

Each cost estimate needs a date, reflecting the date on which the estimate is premised. Dates may be entered as month/day/year (i.e., 7/31/98) or written out (i.e., July 31, 1998). BEN will accept two-digit years, but four-digit years are preferable. You must enter dates to the day. If you do not

have date information to the day, use the day that falls in the middle of the time frame you have. For example, if all you know is that the estimate was made in May of 1998, use May 15, 1998 as the estimate date. If all you know is that the estimate was made in 1998, use July 1, 1998 as the estimate date. If you have multiple costs for the same component with different dollar-years, enter them as separate runs, and sum the results.

3. Noncompliance and Compliance Dates

For all dates you can use any format, but be sure to enter the year, month, and day. (If you do not enter a day, BEN will assume the first day of the month.) Also, BEN will not accept any dates before July 1, 1987.

The noncompliance date is generally when the first violation of the environmental requirement occurred. BEN uses this as the proxy for when the violator should have actually incurred the expenditures necessary for compliance. Since compliance expenditures must often occur far in advance of actual legal compliance, it is highly conservative to use the date by when the violator should have completed installation of the necessary pollution control equipment and had such equipment fully operational. The benefit from delayed and/or avoided expenditures generally increases with the length of the delay period. An earlier noncompliance date (holding the compliance date constant) will, in virtually all cases, increase the benefit figure. Hence, if you were to use the actual date when the compliance expenditures would have been incurred — if this information were available — the economic benefit would be substantially higher than how EPA typically calculates it.

The compliance date is when the violator came into compliance with environmental requirements or the date when you expect the violator to achieve compliance. BEN once again uses this as the proxy for when the violator actually did — or will — incur the expenditures necessary for compliance. The date when the equipment was initially installed is not necessarily sufficient: the violator needs to be in compliance (for consistency with the noncompliance date), and have already incurred all of the capital and one-time costs and started to incur the annual costs. (Often a significant amount of time is required to "break-in" the equipment and adjust it; thus the compliance date is when compliance is actually achieved.)

Remember though that BEN is ultimately concerned with financial — not legal — dates: your object should be to "follow the money." (In an extreme example, if a violator were to install the required capital equipment — yet for some reason not operate it — then for the purposes of BEN's calculations of the capital investment economic benefit the violator is in compliance.) Using the legal dates of noncompliance and compliance can be a useful proxy, and will keep the noncompliance time period the correct length, but it will generally underestimate the true economic benefit (since the noncompliance period is being artificially shifted closer to the penalty payment date).

Note that in economic benefit analyses, the compliance date must occur after the noncompliance date. A later compliance date (holding the noncompliance date constant) will, in virtually all cases, increase the economic benefit figure. If you are running BEN to calculate the after-tax net present value of an "early compliance" supplemental environmental project, then enter the date when the violator will comply early as the noncompliance date, and the date when the violator is required to comply as the compliance date.

The dates are a major consideration in the BEN analysis. As the interval of non-compliance increases, the economic benefit generally increases. For each month that the violator delays compliance, it delays capital and one-time costs and avoids operation and maintenance expenses. In practice, the period of violation is sometimes not clear. Proving the entire period of violation might encounter evidentiary problems. It might be helpful to perform several different BEN runs to show the impact of different violation periods on economic benefit.

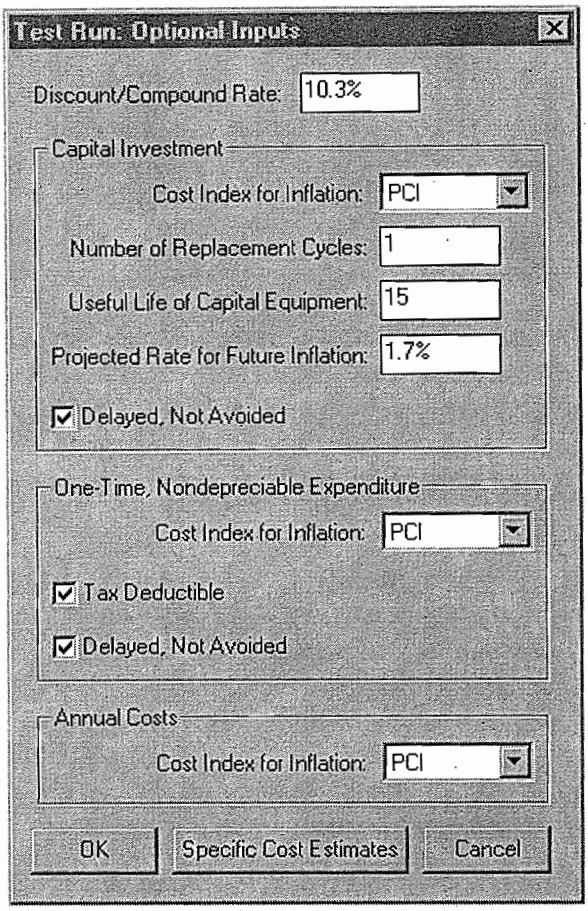
Although a statute of limitations may apply in your case, it should generally affect only the maximum penalty you can assess (i.e., the statutory cap). Since you are only trying to calculate the amount the violator gained by violating the law, you may go beyond any statute of limitations, as long as you do not exceed the statutory cap. Should your case go to trial or hearing, you should consult your legal staff before going forward with a benefit amount based on the earlier violations.

Another point to keep in mind is that as of the date the BEN analysis is performed, the violator might not yet be in compliance. Therefore, you must make an assumption regarding the date of eventual compliance. In discussions with the violator about the BEN calculation, you should be explicit about your compliance date assumption. You should then make clear to the violator that further delays in compliance will yield a higher economic benefit, and thus a higher penalty. Conversely, earlier compliance will yield a lower penalty. By conveying this information up front, you will give the violator added incentive to comply early, and will also avoid having to give the violator any "unpleasant surprises" should you have to increase the benefit component of the penalty.

C. OPTIONS

The standard values in BEN are updated annually to reflect changes in interest rates, tax law, and so forth. Although these values are updated, the assumptions upon which they are based remain the same. If the case you are analyzing is significantly different from that represented by the standard values, you may wish to customize some of the optional inputs. In particularly complicated cases, you might also want to consult the EPA helpline (888-ECON-SPT).

The options screen allows you to modify the discount/compound rate, cost indices for inflation, number of replacement cycles, whether a cost is delayed or avoided, the useful life of capital equipment, future inflation rate, and the tax deductibility of one-time nondepreciable expenditures. You should customize these variables only if you have reliable information to substantiate the change.



1. Discount / Compound Rate

To compare the on-time and delayed compliance costs from different dates in a common measure, BEN adjusts both streams of costs (i.e., "cash flows") for inflation as of the date of initial noncompliance. After determining the initial economic benefit as of the noncompliance date (i.e., the difference between the on-time-case present value and the delay-case present value), BEN compounds this amount forward to the penalty payment date. To perform these present value calculations, BEN must employ a discount/compound rate that reflects the violator's "time value of money."

For a for-profit entity's discount/compound rate, BEN uses the weighted-average cost of capital (WACC) for a typical company, reflecting the cost of debt and equity capital weighted by the value of each financing source. A company must on average earn a rate of return necessary to repay its debt holders (e.g., banks, bondholders) and satisfy its equity owners (e.g., partners, stock holders). While companies often earn rates in excess of their WACC, companies that do not on average earn at least their WACC will not survive (i.e., their lenders will not receive their principal and/or interest payments, and their owners will be dissatisfied with their returns). The WACC represents the return

a company can earn on monies not invested in pollution control, or, viewed alternatively, represents the avoided costs of financing pollution control investments. Thus, a company should make its business decisions by discounting cash flows at its WACC, and BEN follows the internal analysis a company will normally perform.

For a not-for-profit discount/compound rate, BEN uses a typical municipality's cost of debt, based on interest rates for general obligation bonds.

You can view BEN's discount/compound rate calculation by selecting the detail printouts after you calculate a run. BEN calculates the rate in each year, then uses the average of the annual rate over the period from the year of initial noncompliance through the year of penalty payment. Each year EPA appends the BEN model so that it contains another year of data for the annual rates.

Some violators will argue for rates tailored to their industry, company, or specific division, or, for a not-for-profit entity, actual bond issues or debt ratings. In general, you should involve a financial analyst or contact the U.S. EPA enforcement economics toll-free helpline at 888-ECONSPT (326-6778) if the violator raises an issue about the cost of capital. Also, you should inform the violator that a case-specific cost of capital could result in a higher discount/compound rate, which will increase the economic benefit result.

If you customize the discount rate, be sure to enter it as a decimal. BEN will automatically convert it to a percentage.

2. Inflation Indices and Projected Inflation Rate

For actual historical inflation, BEN adjusts each cash flow from the date of the cost estimate by referencing a look-up table of cost index values.[4] The default cost index is the Plant Cost Index, from the magazine *Chemical Engineering*. This particular index may not be appropriate for every case. Thus BEN offers a pull-down menu for each compliance component listing other available cost indices. The inflation rate for each compliance cost category may be modified individually because the different cost categories may be affected by different inflationary trends. The table on the next page summarizes the optional indices. (EPA modifies the BEN model each year to include

[4] Unlike the earlier DOS version, BEN no longer applies an explicit inflation rate, although an annualized rate could be imputed from the model's data. For example, suppose a $200 cost estimate from 1991 must be adjusted for inflation to the same day in 1992. The 1991 cost index value is 100, whereas the 1992 index value is 103. The calculation the model performs is $200 * 103 / 100 = $206 (i.e., multiplying the original cost estimate by the ratio of the cost index values from the date on which the cost is actually incurred, and the date on which the estimate is made). The index change from 1991 to 1992 does represent an annual inflation rate of three percent (i.e., 103 / 100 = 1.03 - 1 = 0.03), but the model does not directly apply this rate. A calculation that uses the ratio of the index values is both more precise and more simple than one that calculates multiple annual inflation rates over different periods for historical costs.

new data from each index.) For projected future inflation, BEN extrapolates each cost index forward in time at a separate forecasted rate.[5]

INFLATION INDICES			
Abbreviation and Full Name		**Description**	**Typical Applications**
BCI	Building Cost Index	building costs; based on 1.128 tons Portland cement, 1,088 bd. ft. 2x4 lumber, 68.38 hrs. skilled labor	general construction costs, especially structures
BEN	current BEN model's constant inflation rate	average of PCI's last 10 years; i.e., a constant 1.8% increase each year	replication of results from current BEN model version
CCI	Construction Cost Index	construction costs; same as BCI, except 200 hrs. common labor	general construction projects, especially where labor costs are a high proportion of total costs
CPI	Consumer Price Index	representative consumer goods	compliance somehow involves consumer goods
ECIM	Employment Cost Index: Manufacturing	employment costs for the manufacturing industry	one-time nondepreciable expenditures or annual costs that comprise mainly labor
ECIW	Employment Cost Index: White Collar	employment costs for white collar labor	same as ECIM, except professional labor (e.g., permits)
PCI	Plant Cost Index	plant equipment costs	standard value

In addition to the option of selecting an alternative to the PCI, BEN offers two other ways to modify its inflation adjustments.

First, BEN uses a separate projected future inflation rate for any additional recurring capital replacement cycles after the first one. You can override the standard value, which is based on the PCI projected rate for future inflation. If you modify the inflation rate, be sure to enter it as a decimal. BEN will automatically convert it to a percentage.

---

[5] This is based upon a consensus forecast for the Consumer Price Index (CPI) and each individual index's historical relationship to the CPI. The rationale for the calibration of the other indices to the CPI is that the CPI has widely available forecasts for projected inflation, but the others do not.

Second, on the "Specific Cost Estimates" screen, you can override BEN's inflation adjustments for the capital investment and one-time nondepreciable expenditure, and instead enter separate estimates for these compliance costs as of the noncompliance date, compliance date, and the initial recurring cycle start dates. This customized data entry can represent another alternative cost index, case-specific inflation assumptions, or entirely different actions for on-time and delayed compliance.

3. Capital Investment Replacement Cycles and Useful Life

You can specify the number of replacement cycles for the capital equipment, and the useful life of the equipment (i.e., the years between replacement cycles). A violator who delays installing pollution control equipment for, say, five years, benefits not only by delaying the initial expenditure five years, but also by postponing the second and potentially subsequent replacement cycles by the same five years.

The BEN model defaults to one replacement cycle, although you can specify as many as five. Because the present value of future costs decreases rapidly the further they occur from the present, additional replacement cycles after the first cycle typically have almost no significant impact upon the economic benefit result.

Not all capital investments need to be replaced at the end of their useful lives. For example, groundwater monitoring wells or other equipment used to close a RCRA site may not need to be replaced. By contrast, water and air pollution control equipment are typically replaced since this equipment is generally needed to support compliance for the foreseeable future. Most capital investments will be replaced. In identifying equipment as a one-time purchase, you should be convinced that the equipment will not require future replacement. If this is indeed the case, set the number of replacement cycles to zero.

The useful life determines the number of years between replacement cycles. Equipment with a long useful life is replaced less frequently than equipment with a short useful life. Assuming the same investment cost per replacement cycle, the total present value of the costs of replacement for the longer-lived equipment would be lower (since each subsequent investment occurs later). Therefore, a longer useful life reduces the benefit of delaying compliance — holding all other inputs constant — although this impact might be offset somewhat if the shorter useful life triggers a more rapid depreciation schedule.

If your capital investment reflects different pieces of equipment with significantly different replacement cycles and/or useful lives, you need to create separate BEN runs for the differing equipment. You can add together the results from the two calculations to determine the total economic benefit.

4. Avoided vs. Delayed

BEN's default assumption is that both the capital investment and the one-time nondepreciable expenditure are delayed, not avoided. If the violator will instead never incur such compliance costs, then uncheck the "Avoided, Not Delayed" delayed boxes. Also, for an avoided capital investment, you should change the replacement cycles to 0, unless the violator has avoided not only the initial installation but also its replacement.

5. Tax Deductibility of One-Time Nondepreciable Expenditure

Most one-time nondepreciable expenditures are tax-deductible; with the primary exception being purchases of land. Land is an asset and, therefore, cannot be deducted as an expense from taxable income. BEN assumes that the expenditure is tax-deductible unless you uncheck the box.

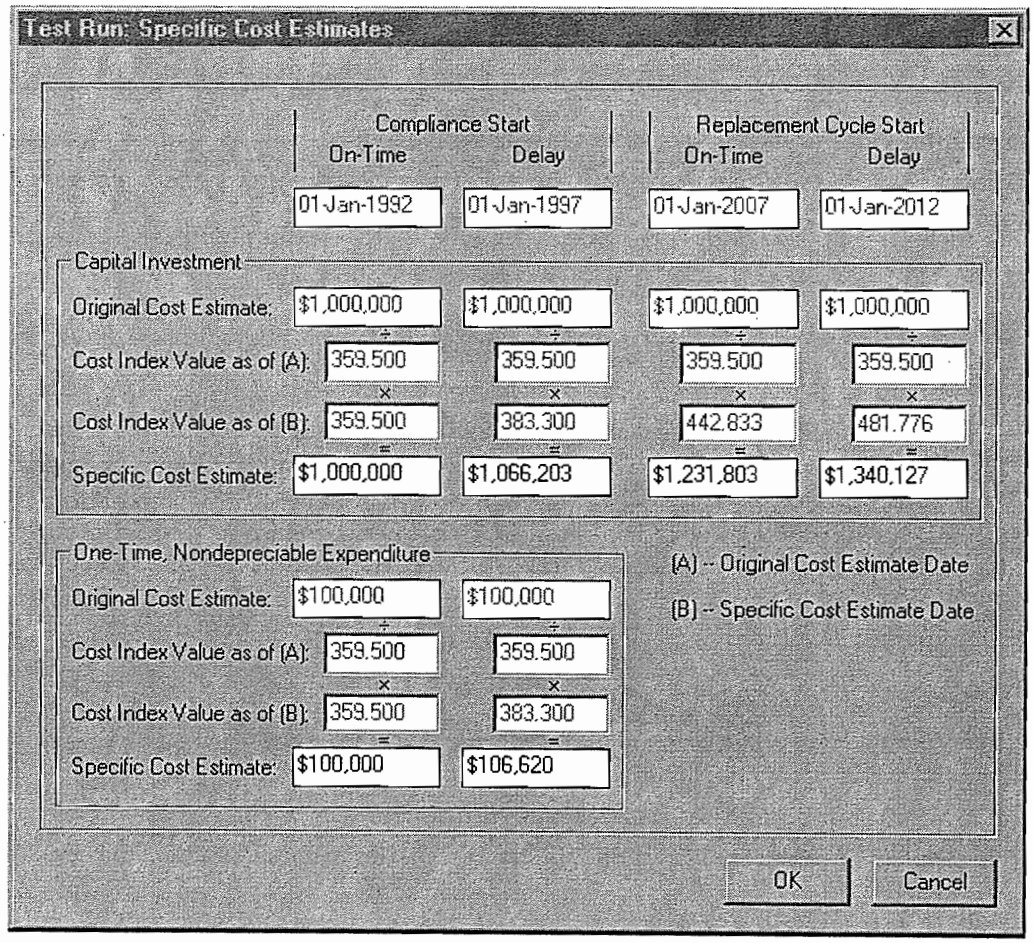
D. SPECIFIC COST ESTIMATES

The specific cost estimate screen allows you to view BEN's inflation adjustments, which calculate specific cost estimates for certain dates, extrapolating from the original single cost estimate (which you enter on the earlier screen for compliance components data). This screen also allows you to override BEN's calculations for the specific cost estimates. You reach the specific cost estimates screen by pressing **[Specific Cost Estimates]** at the bottom of the options screen.

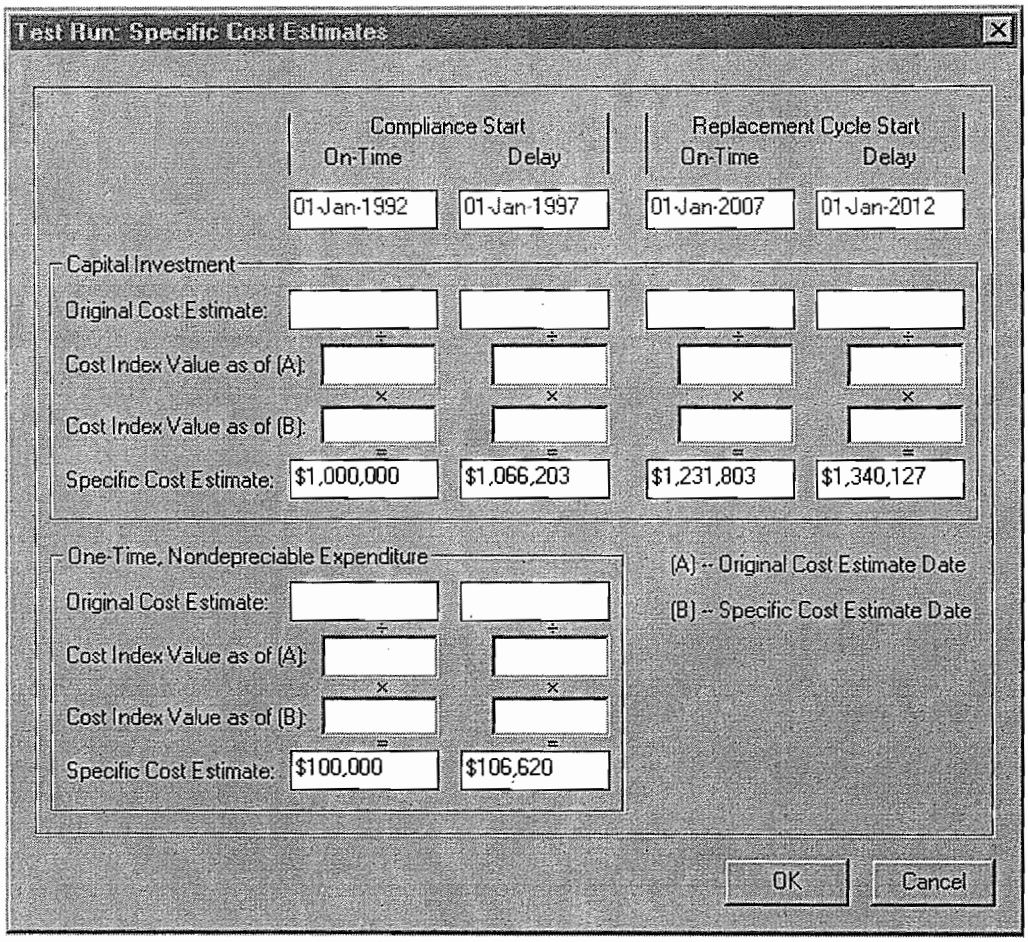
All data except for the specific cost estimates are "grayed out", since BEN allows to you override only the final estimates, not the intermediate calculations. Changing your inputs on prior screens, however, will have an impact on the "grayed-out" data, unless you click **[OK]** on this screen, which will lock in your inputs on prior screens. (BEN takes this action because otherwise it would not know whether you intended subsequent changes to prior screens to affect the customized data you have entered on this screen.) Clicking **[OK]** on this screen will also visually erase all of the other data when you return to this screen in the future. (BEN takes this action because it does not know how much of the other data you incorporated into your customized specific cost estimates.)

BEN displays four separate columns of data, corresponding to the start dates of the on-time compliance scenario (i.e., the noncompliance date), the delay compliance scenario (i.e., the compliance date), the on-time replacement cycle (i.e., the noncompliance date plus the useful life of capital equipment), and the delay replacement cycle (i.e., the compliance date plus the useful life). The first row simply provides the date for each scenario, as calculated above. The next rows are divided into two groupings: the first for capital investments, and the second for one-time nondepreciable expenditures.

Each grouping starts with a row for the single cost estimate you originally entered on the basic run input screen. The second row then displays the value of the selected cost index (the Plant Cost Index is the default) as of the cost estimate date, and the third row displays the value for the same cost index as the specific cost estimate date. The final row (as the operator signs between the rows indicate) is equal to the first row divided by the second row, multiplied by the third row.



If you click **[OK]** on the specific cost estimate screen, exit it and then later return, all of the intermediate calculations will be blank, and only the final specific cost estimates will appear:

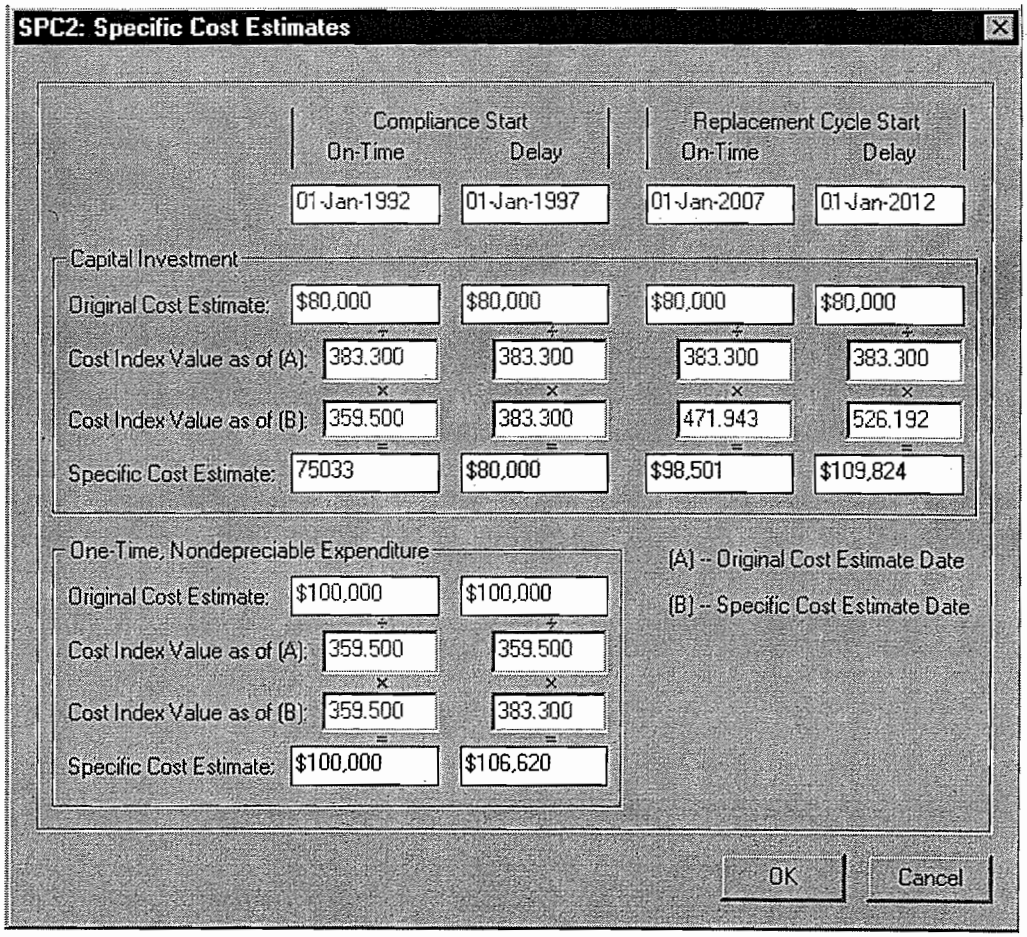


Reasons for modifying BEN's calculations can include the following, but be prepared to document your actions and rationale.

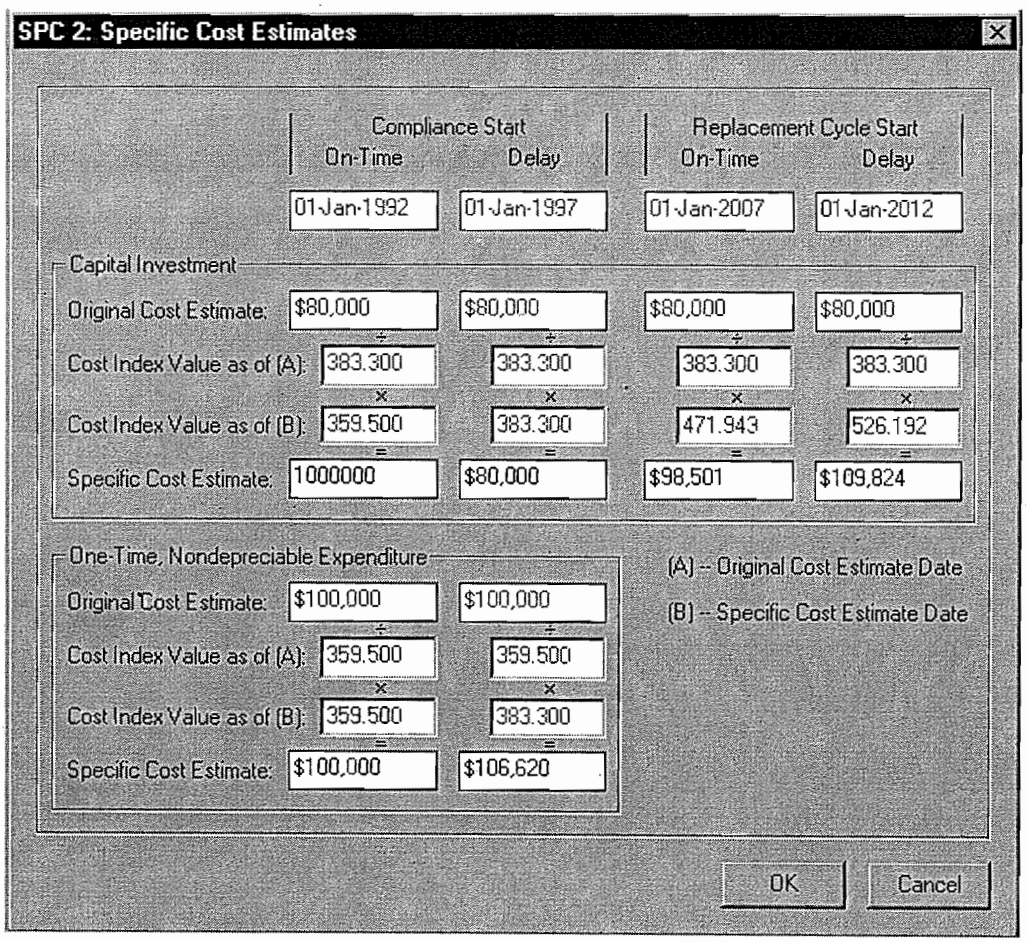
1. Separate Cost Estimates for Noncompliance and Compliance Dates

This could reflect several scenarios: the violator obtained a cost estimate at the noncompliance date, even though it did not comply until later; technological change between the noncompliance and compliance dates implies that different compliance measures were available at the two dates; or, regulatory change over time mandated different compliance measures at the noncompliance vs. compliance dates. Under such scenarios, use the most recent data for the original capital cost estimate so that it reflects the delay compliance scenario (ensuring that any future capital equipment replacement cycles are calculated correctly). Then, override the specific cost estimate in the first column (i.e., on-time scenario compliance start) with the correct estimate.

In the example below, the violator obtained a cost estimate for required capital investments of $100,000 at the date of noncompliance (January 1, 1992), but because of technological change it only had to spend $80,000 when it came into compliance on January 1, 1997. The user entered the $80,000 estimate (with an estimate date of January 1, 1997) as the capital investment cost on the initial input screen. The specific cost estimate screen then appears as:



However, had the violator actually complied on time it would have faced a capital investment of $100,000 (the estimate it received in 1992), not $75,033 (the specific cost estimate as calculated from the 1997 estimate). To reflect this, the user changed the on-time compliance specific cost estimate to $100,000.



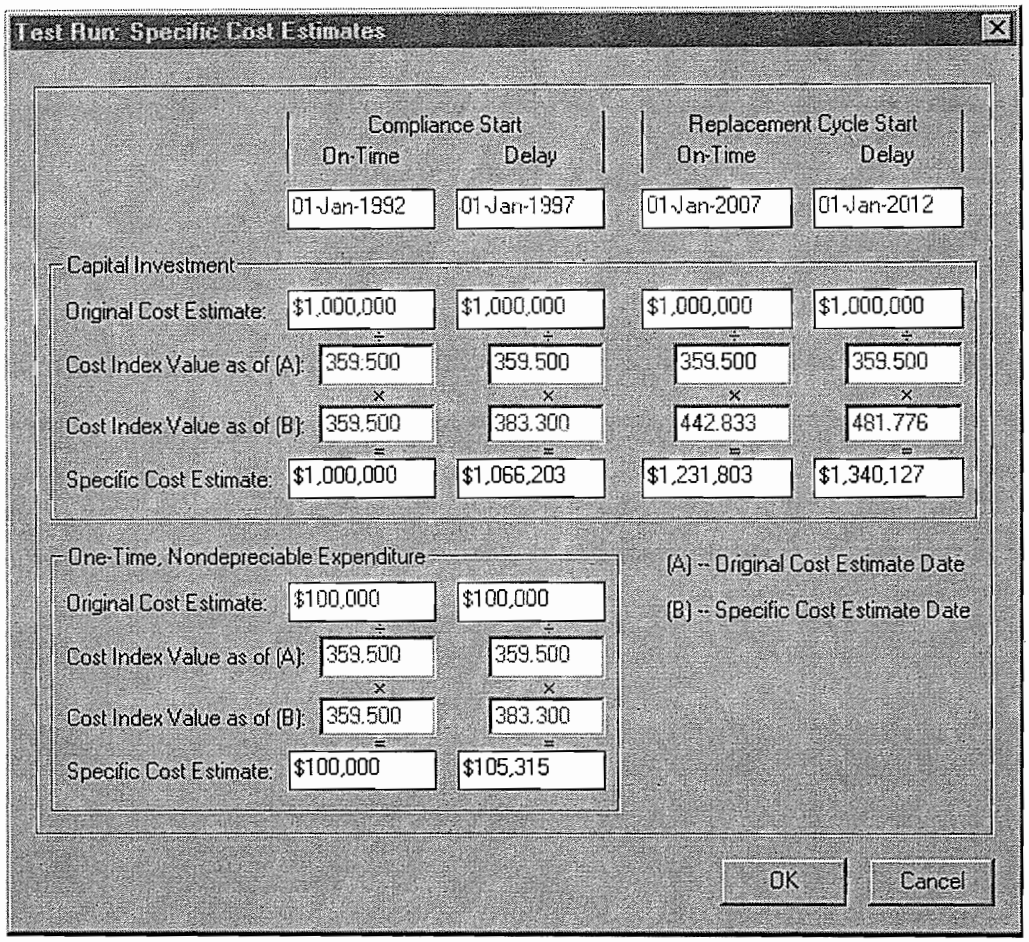
2. Inflation Data More Appropriate than BEN's

Although BEN offers many other alternative cost indices in addition to its default Plant Cost Index, occasionally some other inflation adjustment may be necessary. If so, override whichever specific cost estimates you believe are inaccurate. (If you are using some other index, you might want to create a spreadsheet that mimics the BEN screen, substituting your index's values for the ones on the screen.)

In the following example, the one-time nondepreciable expenditure consists mostly of chemicals. A subset of the Producer Price Index for chemicals will give a more precise inflation adjustment than the various indices BEN offers. You can use this chemical index to adjust the original cost estimate for inflation as shown in the table below:

Specific Cost Estimate Transportation Equipment Index		
	On-Time (1/1/1992)	Delay (1/1/1997)
Original Cost Estimate	100,000	100,000
	÷	÷
Cost Index Value as of original estimate date	111.0	111.0
	x	x
Cost Index Value as of specific cost estimate date	111.0	116.9
	=	=
Specific Cost Estimate	1,000,000	105,315

Once you have calculated the appropriate specific cost estimates, you can incorporate them into the BEN calculation by overriding the values on the specific cost estimate screen, as shown on the next page.


Test Run: Specific Cost Estimates
Compliance Start
On-Time
Delay
Replacement Cycle Start
On-Time
Delay
01-Jan-1992
01-Jan-1997
01-Jan-2007
01-Jan-2012
Capital Investment
Original Cost Estimate:
$1,000,000
$1,000,000
$1,000,000
$1,000,000
÷
÷
÷
÷
Cost Index Value as of (A):
359.500
359.500
359.500
359.500
×
×
×
×
Cost Index Value as of (B):
359.500
383.300
442.833
481.776
=
=
=
=
Specific Cost Estimate:
$1,000,000
$1,066,203
$1,231,803
$1,340,127
One-Time, Nondepreciable Expenditure
Original Cost Estimate:
$100,000
$100,000
÷
÷
Cost Index Value as of (A):
359.500
359.500
×
×
Cost Index Value as of (B):
359.500
383.300
=
=
Specific Cost Estimate:
$100,000
$105,315
(A) -- Original Cost Estimate Date
(B) -- Specific Cost Estimate Date
OK
Cancel

Section A of this chapter provides guidance for addressing common arguments made by violators. Section B discusses how to characterize more complicated compliance scenarios.

A. COMMON VIOLATOR ARGUMENTS

1. *Cost of roof on new treatment building should be excluded since roof is not needed to operate treatment system.*

In virtually all cases BEN should include the cost of the roof unless the violator can conclusively prove that the treatment system would operate just as effectively and efficiently without the roof (all else being equal) and that the roof is not a customary part of such treatment systems. A violator can almost never support this claim, since it must essentially argue that installing a roof was a waste of money (serving no sensible business purpose).

2. *Cost of painting walls and landscaping treatment building should be excluded since they are unnecessary for compliance.*

While such items may not be directly necessary to achieve compliance, if these items are normally part of such projects, then BEN should include their costs. Such expenditures often provide intangible and tangible benefits, such as improving the appearance of the facility, reducing erosion and dust, preserving the building, and creating a more attractive environment for employees, visitors, and customers. Presumably these expenditures would have been necessary for on-time compliance, and hence the violator benefitted by delaying them.

3. ***Cost of an extra (backup) pump should be excluded, since it is unlikely ever to be used.***

While the pump may never be used, if reasonable engineering practice would include an extra pump (or any other backup systems), then BEN should include its cost. Given that the violator did (or will) purchase the extra pump, the burden is on the violator to show that it is unnecessary to achieve and consistently maintain compliance. Further, even if the cost of the extra pump were subtracted from the capital investment, annual operation and maintenance costs might need to be increased to reflect the greater importance of maintaining the existing pumps.

4. ***Cost of building second floor above treatment plant should be excluded since it is used exclusively for purposes unrelated to compliance.***

If the second floor does not support the pollution control system, then the incremental cost of building the second floor may be subtracted from the capital investment.

5. ***Cost of building tertiary treatment system should be excluded since only primary and secondary treatment systems were necessary to remedy violations.***

If the tertiary treatment system really was unnecessary to prevent the violations alleged in the complaint, but rather is necessary for achieving compliance with future standards, then subtract its cost from the capital investment. Recall that the capital investment should reflect the pollution control system that was necessary to remedy the violations at the time and under the conditions alleged in the complaint. The violator, however, must convince EPA that the additional cost is truly unrelated to remedying the violations alleged in the complaint.

6. ***No additional labor is necessary to operate new pollution control system, since existing employees operating old system will operate it.***

If the existing employees were operating an old pollution control system replaced by the new system, then this claim may be correct. Presumably the total labor costs associated with the old pollution control system (replaced by the new system) are less than or equal to the labor costs for the new system. If the new system is more efficient to operate, even less labor may be required. Your entry for annually recurring costs should reflect this and can even be negative.

7. ***Labor costs for new system are really zero because we are reassigning workers from another part of plant; thus, since we are not hiring additional workers to run system, we have no incremental labor costs.***

This claim is not correct since the employees who will operate the new system are not coming from the old pollution control system that is being replaced. Rather, they are coming from

another part of the facility and the facility will be deprived of the productive work these employees were doing. If the violator had complied on-time, it would have had to shift these employees to pollution control and given up the work these employees otherwise would have done somewhere else (e.g., the production line) during the period of noncompliance. This is the concept of opportunity cost: the cost of resources for a particular use is measured by the benefit lost in forfeiting their most profitable alternative use.

B. CHARACTERIZING COMPLIANCE SCENARIOS

1. *Violator Spends $100,000 on System that Does Not Work.*

The violator should have spent $1,000,000 to install a satisfactory system, but instead spent $100,000 on-time for a system that did not work. If the system did not result in compliance, it is questionable that the system's expenditures were in fact intended for compliance. Unless some other factor is present, the correct entry for the capital cost should be $1,000,000.

The enforcement team might find that the violator had some reasonable basis or justification for selecting the inexpensive technology. If the violator went to a reputable firm, the firm recommended the system that failed, and the violator's reliance on the recommendation was reasonable, then you should offset the economic benefit by the after-tax present value of the unsuccessful expenditure. You could use BEN to calculate this offset, although remember that this is a case-specific judgement for the litigation team.

2. *System "Works," But Is Too Small.*

The violator spent $100,000 on-time for a system that was too small to solve the pollution problem, but the existing system can be incorporated into the final, fully sized system. The Agency should subtract from the total required investment the $100,000 already spent; the BEN capital investment input would be $900,000. The reason for this treatment is that the violator gained a benefit on only the $900,000 that it did not spend, not the $100,000 it did spend.

3. *Same as Scenario 2, But Violator Has Letter from Government Official Approving System.*

While the violator has a reason for being out of compliance, it still had the benefit of using the $900,000 for other purposes while it was in violation. Thus, BEN's capital investment is still $900,000. BEN is "no-fault" in nature. Regardless of how good the violator's excuse is, it still had the use of the $900,000 over the period of the violation. The only difference between this and scenario 2 is the existence of an arguable approval by the regulatory agency, but this is a legal distinction, not an economic one, possibly affecting the gravity component of the penalty, but not the economic benefit component.

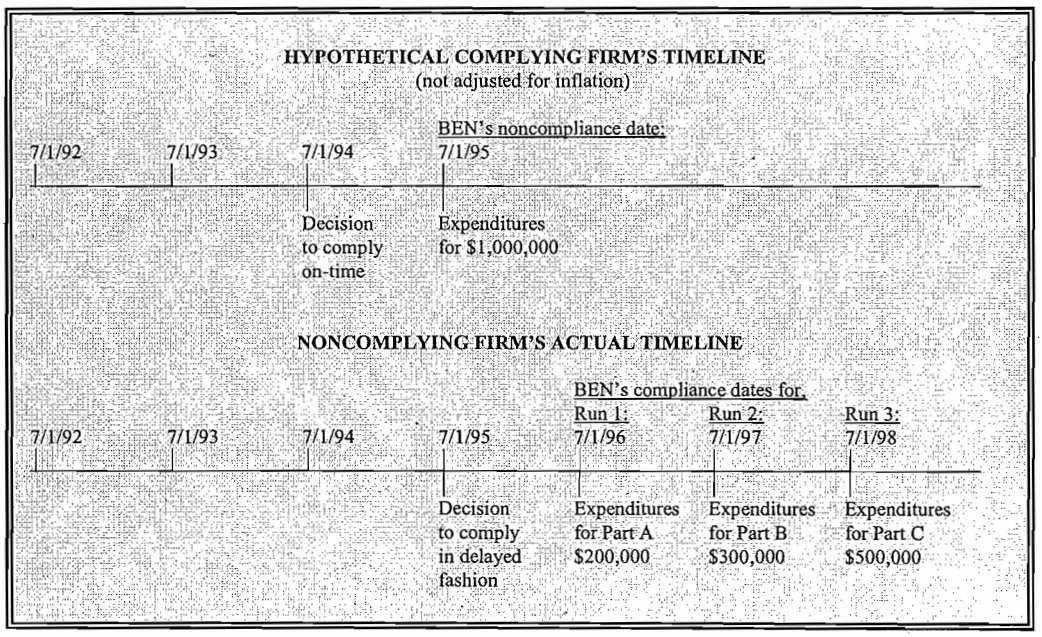
4. ***Violator Complies in Stages.***

The violator put part of the pollution system into operation (with actual pollution reduction) one year after the noncompliance date at a cost of $200,000. One year later (and two years after the noncompliance date), the violator put a second piece of the system costing $300,000 into operation (which resulted in additional pollution reduction). Three years later the entire system was in operation, and the final piece cost $500,000.

If on-time compliance could have been achieved in one stage instead of three (see timeline below), create three separate BEN runs, each with the same noncompliance date:

- $200,000 capital investment, and a one-year period of noncompliance;
- $300,000 capital investment, and a two-year period of noncompliance;
- $500,000 capital investment, and a three-year period of noncompliance.

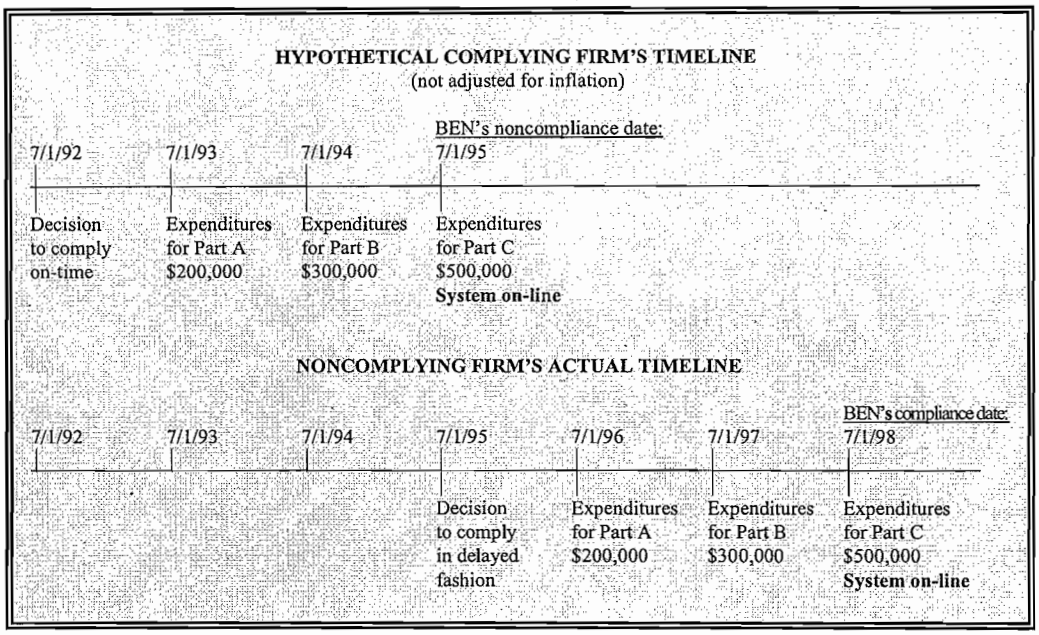
As the violator paid for each component, it was no longer delaying the purchase of that equipment. Add the results from the three runs to determine the total economic benefit.



5. *System is Operational at Conclusion of Series of Expenditures.*

This is similar to scenario 4 (where the violator purchased and installed the various system components over three years), except that here the system is put into operation only after all of its components are installed, instead of sequentially.

You should create one BEN run with a capital investment of $1,000,000 and a three-year noncompliance period. This assumes that on-time compliance would have been accomplished the same way as delayed compliance, in three separate stages. For both on-time and delayed compliance, three years are necessary to comply, and therefore if the violator had complied on time it would have needed to start three years before the compliance date.



Note that BEN's calculation here is based upon the simplifying assumption that all the money was spent on a single date, i.e., the day compliance was achieved. Instead of this simplifying assumption, you could instead create three separate BEN runs, with different noncompliance and compliance dates (yet hence the same-length noncompliance period). This will yield a slightly higher BEN result, although the additional complexity may not be worth the additional accuracy (especially if the noncompliance period is long relative to the period over which the actual expenditures are spread out).

6. ***Pollution Control Equipment Will Be Leased, Not Purchased.***

The violator is actually leasing the equipment it needs to comply for $125,000 per year. Rather than entering the $1,000,000 as a capital cost, you should enter a zero for capital investment and $125,000 as an annually recurring cost.

7. ***Compliance is "Cheaper" than Noncompliance.***

The violator comes into compliance late and finds that it has been saving money since it installed the new technology. This may occur because the compliant technology allows the violator to recover materials and/or reduce operation and maintenance costs. BEN produces a negative result, seemingly confirming that the violator would have been better off had it complied on-time. Other factors may have caused the violator to delay compliance, or perhaps the violator was unaware not only of the potential cost savings from compliance but also the status of its noncompliance.

Be wary of such negative economic benefit results! For example, the violator might have felt that the new processes and technology needed to comply would have adversely affected its product quality. In that case, the violator probably realized an economic benefit from not having its product quality adversely affected by the compliant technology. This constitutes illegal competitive advantage, and typically requires additional research into the alternative compliance scenarios and their financial impacts.

Even if the economic benefit really is negative, the enforcement team should carefully consider the appropriate gravity component of the penalty, since the violations might still be serious, despite the lack of economic gain to the violator.

This technical appendix explains in detail how the BEN computer program calculates the economic benefit a violator gains from delaying or avoiding compliance with environmental regulations. The first section is an introduction to the theory and underlying assumptions of BEN. The second section is a step-by-step explanation of a sample economic benefit calculation.

A. THEORY AND OVERVIEW

Economic benefit represents the financial gains that a violator accrues by delaying and/or avoiding pollution control expenditures. Funds not spent on environmental compliance are available for other profit-making activities or, alternatively, a defendant avoids the costs associated with obtaining additional funds for environmental compliance. (This concept is known in economics as opportunity cost.) Economic benefit is "no fault" in nature: a defendant need not have deliberately chosen to delay compliance (for financial or any other reasons), or in fact even have been aware of its noncompliance, for it to have accrued the economic benefit of noncompliance.

The appropriate economic benefit calculation should represent the amount of money that would make the violator indifferent between compliance and noncompliance. (BEN implicitly assumes a 100-percent probability of the violator paying that sum of money in the form of a civil penalty, but as that probability declines, the amount of money increases that would make the violator indifferent between compliance and noncompliance.) If the enforcement agency fails to recover through a civil penalty at least this economic benefit, then the violator will retain a gain. Because of the precedent of this retained gain, other regulated companies may see an economic advantage in similar noncompliance, and the penalty will fail to deter potential violators. Economic benefit does not represent compensation to the enforcement agency as in a typical "damages" calculation for a tort case, but instead is the minimum amount by which the violator must be penalized so as to return it to the position it would have been in had it complied on time.

The economic benefit calculation must incorporate the concept of the "time value of money." In simple terms, a dollar yesterday is worth more than a dollar today since yesterday's dollar had

investment opportunities. Thus, the further in the past the dollar is, the more it is worth in "present value" terms. The greater the time value of money (i.e., the greater the "discount" or "compound" rate), the more value past costs have in present value terms.

Pollution control expenditures can include: (1) Capital investments (e.g., pollution control equipment), (2) One-time nondepreciable expenditures (e.g., setting up a reporting system, or acquiring land), (3) Annually recurring costs (e.g., operating and maintenance costs, or off-site disposal of fluids from injection wells). Each of these expenditures can be either delayed or avoided. BEN's baseline assumption is that capital investments and one-time nondepreciable expenditures are merely delayed over the period of noncompliance, whereas annual costs are avoided entirely over this period. BEN does allow you, however, to analyze any combination of delayed and avoided expenditures.

BEN derives a violator's economic benefit in several steps. First BEN adjusts compliance costs from the cost estimate date to the date when they would have been expended had the violator complied on time (on-time scenario) and to the date when they will be expended as the violator comes into compliance (delay scenario). Next BEN uses these costs to compute the total cost of complying on-time and of complying late, adjusted for inflation, depreciation and taxes. BEN also calculates the present value of both scenarios as of the date of initial noncompliance, so that they can be compared in a common metric. Then BEN subtracts the delayed scenario present value from the on-time scenario present value to determine the initial economic benefit as of the noncompliance date. Finally, BEN compounds this initial economic benefit forward to the penalty payment date.

A violator may gain illegal competitive advantages in addition to the usual benefits of noncompliance. These may be substantial benefits, but they are beyond the capability of BEN or any computer program to assess. Instead BEN asks you a series of questions about possible illegal competitive advantages so that you may identify cases where they are relevant. If illegal competitive advantage is an issue you should consult the EPA enforcement economics toll-free helpline at 888-ECON-SPT (326-6778) or benabel@indecon.com. If you need legal or policy guidance, please contact Jonathan Libber, the BEN/ABEL coordinator at 202-564-6102, or e-mail him at libber.jonathan@epamail.epa.gov.

B. CALCULATIONS AND SPREADSHEET

BEN references a Microsoft Excel™ spreadsheet to perform all of its economic benefit calculations, although you do not need Excel to run BEN. The data you enter into the program is automatically transferred to the spreadsheet. The spreadsheet calculates economic benefit and returns the result to the program for output. This section illustrates a BEN calculation by taking you step-by-step through relevant portions of the underlying spreadsheet. Italicized comments within brackets are added to explain the calculations, and are not part of the spreadsheet itself.

The spreadsheet is in your BEN folder (on your C drive or wherever else you installed BEN), filename "ben****.xls". (The asterisks represent the most recent year for which EPA has performed updates for the spreadsheet.) You may open the file, but it has been write-protected to preserve the integrity of the calculations. This spreadsheet contains necessary formulas and background information like tax rates, discount rates, and inflation indices. The background information will be updated once a year, but the calculations themselves will remain the same.

1. Inputs and Variables

The first section of the spreadsheet contains the variables entered by the user. These are a prerequisite for the calculations. The following page lists BEN's basic inputs, along with inputs from an example case.

Tax rates are contained in the spreadsheet as tables that contain corporate and individual tax rates and state tax rates from 1987 to 2010, (with rates for future years assumed to remain the same). Annual updates will keep tax rates current and add future years. When you designate a state and tax status for the violator, BEN finds the appropriate federal and state tax rates and calculates a combined tax rate. State taxes are deductible from federal taxable income, so the combined tax rate calculation is:

Combined = Federal + (State * (1 - Federal)).

The spreadsheet also contains a table for the BCI, BEN, CCI, CPI, ECIM, ECIW and PCI inflation indices. (See Chapter 3 for a complete explanation of these difference indices.) Inflation indices are more precise than an annual inflation rate, but they require an index value for every relevant month. Therefore, BEN contains a database of monthly index values for every index from 1987 to 2029. Annual updates will keep indices current and add future values. For projected future inflation, BEN extrapolates each cost index forward in time at a separate forecasted rate, which is based upon a consensus forecast for the Consumer Price Index (CPI) and each individual index's historical relationship to the CPI. (The rationale for the calibration of the other indices to the CPI is that the CPI — yet not the more specialized indices — has widely available forecasts for projected inflation.)

Inputs	Example	*Comments*
Case Name	Example Case	
Analyst Name	Jon Analyst	
EPA Region	EPA Region I	
Tax Status	c-corp	*[Also known as "Entity Type"]*
State	MA	
Customized Tax Rates?	n	*[You may customize tax rates, in which case BEN will use the*
Penalty Payment Date (PPD)	01-Jan-1999	*customized rates instead of its internal table]*
Run Name	Test Run	
Discount/Compound Rate	10.0%	*[BEN calculates this from tax status, state, & relevant dates]*
Customized Discount/Compound Rate?	n	*[You may customize the discount rate]*
Customized Specific Cost Estimates?	n	*[You may customize the specific cost estimate screen]*
Capital Investment:		
Cost Estimate	$1,000,000	
Cost Estimate Date	01-Jan-1992	
Cost Index for Inflation	PCI	*[You may choose from several indices]*
Cost Index Value	359.500	*[This is the index value as of the cost estimate date]*
Number of Replacement Cycles	1	*[This is the default value]*
Useful Life of Capital Equipment	15	*[This is the default value]*
Projected Rate for Future Inflation	2.2%	*[This is the default value]*
One-Time, Nondepreciable Expenditure:		
Cost Estimate	$100,000	
Cost Estimate Date	01-Jan-1992	
Cost Index for Inflation	PCI	*[You may choose from several indices]*
Cost Index Value	359.500	*[This is the index value as of the cost estimate date]*
Tax Deductible?	Y	*[This is the default setting]*
Annually Recurring Costs:		
Cost Estimate	$10,000	
Cost Estimate Date	01-Jan-1992	
Cost Index for Inflation	PCI	*[You may choose from several indices]*
Cost Index Value	359.500	*[This is the index value as of the cost estimate date]*
Noncompliance Date (NCD)	01-Jan-1992	
Compliance Date (CD)	01-Jan-1997	
Question 1	n	*[These are the competitive advantage questions. If you*
Question 2	n	*answer yes to any of them a warning that possible illegal*
Question 3	n	*competitive advantage exists appears in the results.]*
Question 4	n	
Question 5	n	
Question 6	n	

2. Discount/Compound Rate Calculation

Once the entity type and relevant dates have been entered, BEN can then calculate the violator's discount/compound rate. This is based on entity type and financial information from the date of noncompliance to the penalty payment date. (An industry- or company-specific discount rate can be calculated by experts, but cannot be calculated by BEN.) The discount/compound rate quantifies the time value of money. BEN discounts and compounds all cash flows at the cost of capital, averaged over the time period from the noncompliance date to the compliance or penalty payment date, whichever is later.

For a for-profit entity's discount/compound rate, BEN uses the weighted-average cost of capital (WACC) for a typical company, reflecting the cost of debt and equity capital weighted by the value of each financing source. A company must on average earn a rate of return necessary to repay its debt holders (e.g., banks, bondholders) and satisfy its equity owners (e.g., partners, stock holders). While companies often earn rates in excess of their WACC, companies that do not on average earn at least their WACC will not survive (i.e., their lenders will not receive their principal and/or interest payments, and their owners will be dissatisfied with their returns). The WACC represents the return a company can earn on monies not invested in pollution control, or, viewed alternatively, represents the avoided costs of financing pollution control investments. Thus, a company should make its business decisions by discounting cash flows at its WACC, and BEN follows the internal analysis a company will normally perform.

For a not-for-profit discount/compound rate, BEN uses a typical municipality's cost of debt, based on interest rates for general obligation bonds.

Discount/Compound Rate Calculation

Notes:

(1) Corporate Bonds: All Industries; Federal Reserve Bulletin, Table 1.35. *[Average industry cost of debt]*

(2) Combined state/federal marginal tax rates: federal+(state*(1-federal)); Federation of Tax Administrators.

(3) Calculated as: (1) * (100%-(2)).

(4) Standard & Poor's Analyst's Handbook, S&P Industrials Sample Balance Sheet, Liabilities section. *[Average Industry debt weight]*

(5) Federal Reserve Bulletin Table 1.35. *[Used as a risk-free rate, Capital Asset Pricing Model (CAPM)]*

(6) Beta is a measure of risk relative to the overall market. *[A value of 1.00 assumes risk is same as overall market]*

(7) Differences of historical arithmetic mean returns from 1926 to prior year; Ibbotson Associates Handbook, *[Representing expected return on an average risk investment]*

(8) Calculated as (6) * (7). *[This equals (7) for average risk, because average risk has a beta of 1]*

(9) Calculated as (5) + (8). *[Risk-free rate of return plus the risk premium]*

(10) Calculated as 100% - (4). *[Total financing - debt = equity financing]*

(11) Calculated as (3) * (4) + (9) * (10). *[(Debt cost x debt weight) + (equity cost x equity rate)]*

average from: 1992 to: 1998 = **10.0%** *[Final result]*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
YEAR	Cost of Debt	Tax Rate	After-Tax Debt Cost	Debt Weight	5-Year Treasury Notes	Beta	Intermed. Horizon Risk Prem	Company Risk Premium	Equity Cost	Equity Weight	Rate
1987	9.9%	40.3%	5.9%	43.0%	7.94%	1.00	7.7%	7.7%	15.6%	57.0%	
1988	10.2%	40.3%	6.1%	52.0%	8.47%	1.00	7.3%	7.3%	15.8%	48.0%	
1989	9.7%	40.3%	5.8%	49.0%	8.50%	1.00	7.4%	7.4%	15.9%	51.0%	
1990	9.8%	40.3%	5.9%	50.0%	8.37%	1.00	7.8%	7.8%	16.2%	50.0%	
1991	9.2%	40.3%	5.5%	49.0%	7.37%	1.00	7.5%	7.5%	14.9%	51.0%	
1992	8.6%	40.3%	5.1%	47.0%	6.19%	1.00	7.7%	7.7%	13.9%	53.0%	**9.8%**
1993	7.5%	41.2%	4.4%	47.0%	5.14%	1.00	7.6%	7.6%	12.7%	53.0%	**8.8%**
1994	8.3%	41.2%	4.9%	44.0%	6.69%	1.00	7.6%	7.6%	14.3%	56.0%	**10.2%**
1995	7.8%	41.2%	4.6%	42.0%	6.38%	1.00	7.4%	7.4%	13.8%	58.0%	**9.9%**
1996	7.7%	41.2%	4.5%	37.0%	6.18%	1.00	7.8%	7.8%	14.0%	63.0%	**10.5%**
1997	7.5%	41.2%	4.4%	37.0%	6.22%	1.00	7.9%	7.9%	14.1%	63.0%	**10.5%**
1998	7.0%	41.2%	4.1%	37.0%	5.50%	1.00	8.2%	8.2%	13.7%	63.0%	**10.2%**

3. Specific Cost Estimates

After the compound/discount rate, BEN calculates specific cost estimates. This calculation adjusts costs from the cost estimate date to the date on which they should have been spent (on-time compliance scenario) and the date on which they will be spent (delay compliance scenario). These calculations are visible and may be altered on the specific cost estimates screen. (If the violator will avoid compliance completely, rather than simply delay it, you must modify this screen by changing the delay cost of compliance to zero.) The specific cost estimate calculations are shown below.

Calculations for Specific Cost Estimates

	Compliance Start:		Replacement Cycle Start:	
	On-Time	Delay	On-Time	Delay
Date:	01-Jan-1992	01-Jan-1997	01-Jan-2007	01-Jan-2012
Capital Investment:				
Original Cost Estimate	$1,000,000	$1,000,000	$1,000,000	$1,000,000
	÷	÷	÷	÷
PCI Value as of Cost Estimate Date, 01-Jan-1992	359.500	359.500	359.500	359.500
	x	x	x	x
PCI Value as of Specific Estimate Date	359.500	383.300	471.943	526.192
	=	=	=	=
Specific Cost Estimate,	**$1,000,000**	**$1,066,203**	**$1,312,777**	**$1,463,677**
reflecting implicit annualized inflation rate of:	N/A	1.3%	1.8%	1.9%
One-Time, Nondepreciable Expenditure:				
Original Cost Estimate	$100,000	$100,000		
	÷	÷		
PCI Value as of Cost Estimate Date, 01-Jan-1992	359.500	359.500		
	x	x		
PCI Value as of Specific Estimate Date	359.500	383.300		
	=	=		
Specific Cost Estimate,	**$100,000**	**$106,620**		
reflecting implicit annualized inflation rate of:	N/A	1.3%		

Note that the specific cost estimate and the original cost estimate are the same here for the "Compliance Start: On-Time" scenario. This is because the cost estimate was made on the on-time date, so no inflation adjustment was needed.

4. Capital and One-Time Costs

Now BEN can calculate the total costs of compliance for both scenarios. First it calculates the costs of compliance as of the on-time and delay scenarios. Then BEN adjusts both sets of costs to the noncompliance date so that they can be compared to each other.

Each scenario is divided into an initial cycle and a replacement cycle. The initial cycle covers the cost of installing equipment, while the replacement cycle covers the cost of replacing that

equipment when its useful life is over. The number of replacement cycles defaults to one, and the useful life of equipment defaults to fifteen years.

Because of the time value of money, the farther in the future costs are, the less value they have in present terms. Therefore, replacement cycles after the first one have almost no impact on economic benefit. They are cumulatively calculated from the value of the first replacement cycle.

The present value (as of the noncompliance date) of each date's cash flow is equal to the cash flow multiplied by that date's present value factor. The PV factor uses the discount/compound rate to determine a dollar's equivalent value in noncompliance date dollars. Therefore, the PV factor for any date is equal to the sum of one plus the discount/compound rate, raised to the difference in the number of years (including any fractions) between that date and the noncompliance date.

A) On-Time Capital & One-Time Costs: Initial Cycle

	01-Jan-1992	01-Jul-1992	01-Jul-1993	01-Jul-1994	01-Jul-1995	01-Jul-1996	01-Jul-1997	01-Jul-1998	01-Jul-1999
One-Time, Nondepreciable Expenditure	(100,000)	*[From specific cost estimates]*							
Capital Investment	(1,000,000)	*[From specific cost estimates]*							
Depreciation	0	(142,860)	(244,897)	(174,935)	(124,953)	(89,243)	(89,243)	(89,243)	(44,626)
Marginal Tax Rate	40.3%	40.3%	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%
Net After-Tax Cash Flow	(1,059,700)	57,573	100,898	72,073	51,481	36,768	36,768	36,768	18,386
PV Factor: Adjusts Cash Flow to NCD	1.0000	0.9536	0.8669	0.7881	0.7164	0.6511	0.5919	0.5381	0.4892
PV Cash Flow as of NCD	(1,059,700)	54,900	87,468	56,800	36,883	23,941	21,765	19,786	8,995

Net Present Value (NPV) as of NCD:	
Initial Cycle	($749,162)
Subsequent Replacement Cycles	($216,058)
Total -- All Cycles	**($965,220)**

[Companies may deduct the depreciation of capital equipment from their taxable income. Below is the standard 7-year depreciation schedule, using the half-year convention.]

Depreciation (MACRS):	14.2860%	24.4897%	17.4935%	12.4953%	8.9243%	8.9243%	8.9243%	4.4626%	

B) Delay Capital & One-Time Costs: Initial Cycle

	01-Jan-1997	01-Jul-1997	01-Jul-1998	01-Jul-1999	01-Jul-2000	01-Jul-2001	01-Jul-2002	01-Jul-2003	01-Jul-2004
One-Time, Nondepreciable Expenditure	(106,620)	*[From specific cost estimates]*							
Capital Investment	(1,066,203)	*[From specific cost estimates]*							
Depreciation	0	(152,318)	(261,110)	(186,516)	(133,225)	(95,151)	(95,151)	(95,151)	(47,580)
Marginal Tax Rate	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%
Net After-Tax Cash Flow	(1,128,896)	62,755	107,577	76,845	54,889	39,202	39,202	39,202	19,603
PV Factor: Adjusts Cash Flow to NCD	0.6206	0.5919	0.5381	0.4892	0.4446	0.4042	0.3675	0.3341	0.3036
PV Cash Flow as of NCD	(700,589)	37,148	57,891	37,593	24,405	15,846	14,405	13,096	5,952

Net Present Value (NPV) as of NCD:	
Initial Cycle	($494,254)
Subsequent Replacement Cycles	($149,541)
Total -- All Cycles	**($643,796)**

A) On-Time Capital & One-Time Costs: First Replacement Cycle

	01-Jan-2007	01-Jul-2007	01-Jul-2008	01-Jul-2009	01-Jul-2010	01-Jul-2011	01-Jul-2012	01-Jul-2013	01-Jul-2014
One-Time, Nondepreciable Expenditure	0	*[Zero because this is the replacement cycle, and one-time costs do not occur again by definition]*							
Capital Investment	(1,312,777)	*[From specific cost estimates]*							
Depreciation	0	(187,543)	(321,495)	(229,651)	(164,035)	(117,156)	(117,156)	(117,156)	(58,584)
Marginal Tax Rate	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%
Net After-Tax Cash Flow	(1,312,777)	77,268	132,456	94,616	67,583	48,268	48,268	48,268	24,137
PV Factor: Adjusts Cash Flow to NCD	0.2391	0.2281	0.2073	0.1885	0.1713	0.1558	0.1416	0.1287	0.1170
PV Cash Flow as of NCD	(313,940)	17,625	27,460	17,832	11,579	7,518	6,833	6,212	2,824

Total NPV of First Replacement Cycle as of NCD	($216,058)	
"i", where i = (1+futureinflation)/(1+discountrate)	0.9291	
"u", where u = useful life of capital equipment	15	
"n", where n = number of replacement cycles	1	
"f", where f = sum [from i = 1 to i = n] of: r ^ (u * (i-1))	1.0000	*[This is where the value of future replacement cycles is calculated]*
Total NPV of All Replacement Cycles as of NCD	**($216,058)**	= f * First Replacement Cycle

	Depreciation (MACRS):	14.2860%	24.4897%	17.4935%	12.4953%	8.9243%	8.9243%	8.9243%	4.4626%

B) Delay Capital & One-Time Costs: First Replacement Cycle

	01-Jan-2012	01-Jul-2012	01-Jul-2013	01-Jul-2014	01-Jul-2015	01-Jul-2016	01-Jul-2017	01-Jul-2018	01-Jul-2019
One-Time, Nondepreciable Expenditure	0								
Capital Investment	(1,463,677)								
Depreciation	0	(209,101)	(358,450)	(256,048)	(182,891)	(130,623)	(130,623)	(130,623)	(65,318)
Marginal Tax Rate	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%	41.2%
Net After-Tax Cash Flow	(1,463,677)	86,150	147,681	105,492	75,351	53,817	53,817	53,817	26,911
PV Factor: Adjusts Cash Flow to NCD	0.1484	0.1416	0.1287	0.1170	0.1064	0.0967	0.0879	0.0799	0.0726
PV Cash Flow as of NCD	(217,282)	12,195	19,005	12,342	8,014	5,202	4,729	4,299	1,954

Net Present Value (NPV) as of NCD:		
Total NPV of First Replacement Cycle as of NCD	($149,541)	
Total NPV of All Replacement Cycles as of NCD	**($149,541)**	*[Calculated using the same formula as on-time all replacement cycles above]*

5. Avoided Annually Recurring Costs

Annual costs are avoided, not merely delayed. Therefore BEN does not need to calculate and compare two different scenarios for annual costs. Instead, it computes the costs avoided each year, then adjusts those costs to the noncompliance date. Finally it adds the present values of the costs avoided each year to compute the total net present value of avoided costs.

C) Avoided Annually Recurring Costs

PCI value as of cost estimate date= 359.500

PCI mid-point value:	356.100	359.400	368.000	381.900	381.800
Period of Avoided Annual Costs; From:	01-Jan-1992	01-Jan-1993	01-Jan-1994	01-Jan-1995	01-Jan-1996
To:	31-Dec-1992	31-Dec-1993	31-Dec-1994	31-Dec-1995	31-Dec-1996
Annual Costs Avoided	(9,933)	(9,997)	(10,236)	(10,623)	(10,649)
Marginal Tax Rate	40.3%	41.2%	41.2%	41.2%	41.2%
Net After-Tax Cash Flow	(5,930)	(5,878)	(6,019)	(6,246)	(6,262)
PV Factor: Adjusts Cash Flow to NCD	0.9535	0.8667	0.7879	0.7163	0.6511
PV Cash Flow as of NCD	(5,654)	(5,095)	(4,742)	(4,474)	(4,077)
NPV of Avoided Annual Costs as of NCD	**($24,042)**				

Note that BEN determines the cost index value for the midpoint of the period in question to account for inflation. BEN also adjusts the annual cost for any partial years.

6. Economic Benefit Results

Now that BEN has computed the present values (PVs) of complying on-time and complying delayed, it compares the two. Economic benefit is the PV of complying on-time, minus the PV of complying delayed, plus the PV of the avoided annually recurring costs. The initial economic benefit is calculated as of the noncompliance date, and then brought forward to the penalty payment date at the discount/compound rate.

The initial economic benefit is multiplied by the sum of one plus the discount/compound rate, raised to the difference in the number of years (including any fractions) between the noncompliance and penalty payment dates.

Run Name = Test Run

Present Values as of Noncompliance Date,	01-Jan-1992	
A) On-Time Capital & One-Time Costs	$965,220	*[Sum from on-time scenario calculations]*
B) Delay Capital & One-Time Costs	$643,796	*[Sum from delay scenario calculations]*
C) Avoided Annually Recurring Costs	$24,042	*[Sum from avoided annually recurring cost calculation]*
D) Initial Economic Benefit (A-B+C)	$345,466	*[Economic benefit as of the date of noncompliance]*
E) Final Econ. Ben. at Penalty Payment Date, *01-Jan-1999*	**$673,567**	*[Final result, economic benefit as of the penalty payment date]*

Expert Report February 3, 2009

Flexographic Presses VOM Emissions
Packaging Personified, Inc.

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ATTACHMENT B

MPE Project Number: M061706

Expert Report

Flexographic Presses VOM Emissions

1. Introduction

MPE was retained to evaluate compliance options related to VOM control from flexographic presses operated by Packaging Personified, Inc. ("PPI") at the company's Carol Stream, Illinois plant.

The author's qualifications for performing this type of review and evaluation are described in the curriculum vitae attached to this report. My hourly billing rate for this project is $158 per hour.

2. Issue History and Details

PPI manufactures polyethylene packaging used in a variety of industries, such as the consumer products, food and medical industries. PPI produces polyethylene film on site. Flexographic printing presses are used to print images and text on some of this film, according to customer specifications. Most of the film is then converted to plastic bags which are shipped in bulk to PPI's customers.

The flexographic printing presses which are or have been in use at the facility are described as follows:

- Press #1 – This press was installed in 1992. It is used to print on film, using low-VOM water-based inks. Its emissions are not controlled by an add-on control device.

- Press #2 – This press was installed in 1992. It is used to print on film, using low-VOM water-based inks. Its emissions are not controlled by an add-on control device.

- Press #4 – This press was installed in 1992. It was used to print on film, using VOM-based inks. Its emissions were not controlled by an add-on control device. It was decommissioned in December 2002 and moved to PPI's Sparta, Michigan plant in December 2004.

- Press #5 - This press was installed in 1995. It is used to print on film, using VOM-based inks. Its emissions formerly were controlled by a recirculating drying oven which destroyed VOM released in the drying process. A Permanent Total Enclosure was installed in November 2006 to control

fugitive emissions from this press. A Regenitive Thermal Oxidizer (RTO) was installed in December 2006 to provide additional control of VOM emissions.

- Press #6 – This press was installed in December 2006. It is used to print on film, using VOM-based inks. A Permanent Total Enclosure was installed in December 2006 to control fugitive emissions from this press. A Regenerative Thermal Oxidizer (RTO) was installed in December 2006 to provide control of VOM emissions.

Much of the film produced by PPI is "high-slip" film that contains a significant amount of wax on the surface of the film. "High slip" is an important consideration for many customers, in order to ensure that their packaged products move freely from each other when stored or on display.

I was retained by PPI to evaluate the compliance status of the facility, shortly after an inspection by Illinois EPA revealed that emissions units at the facility (Presses #1, #2, #4 and #5) were not permitted under Illinois EPA's permit program. I personally inspected all of the presses, reviewed PPI production records, observed the production process, interviewed PPI employees and reviewed Material Safety Data Sheets, as a part of this project. I concluded that Presses #1 and #2 were in compliance with the control requirements of 35 IAC 218.401 (see Section 3, below) by virtue of using water-based inks that contained no more than 25% of the VOM by volume of the volatile content of the ink. I further concluded that Press #4 was not in compliance with the control requirements of 35 IAC Section 218.401.

With regard to Press #5, PPI indicated that the press was designed with a recirculating drying oven that destroyed Volatile Organic Material (VOM) released from the solvent-based inks used on the press. In order to determine whether or not the oven destroyed 90% or more of the VOM emitted before control, as required by 35 IAC Section 218.401(c), I designed and managed an emissions test program to measure the VOM destruction efficiency of the oven.

This test was conducted following USEPA Methods 1, 2, 3 and 25A (40 CFR, Part 60, Appendix A). Gas flow and VOM concentrations were measured at the inlet and outlet of the drying oven while Press #5 was operating. VOM mass emission rates at the inlet and outlet of the oven were then calculated, based on these measurements. The test program revealed that VOM destruction within the drying oven exceeded 99%.

I did not directly measure the VOM capture efficiency of Press #5 as part of this test program. Measurement of VOM capture efficiencies is a time consuming and expensive process, and neither PPI nor I felt that the investment in time and the cost were justified at that time, since our efforts were directed toward making a reasonable determination of compliance status and bringing the facility into compliance as quickly as possible. In order to meet the overall control efficiency of 60% applicable to Press #5 (35 IAC Section 218.401(c)), given a destruction efficiency in excess of 99%, the VOM capture efficiency of Press #5 would have to exceed 60%.

Based on my inspection of Press #5, its design and my professional experience conducting capture efficiency tests on similar flexographic printers, it was my professional opinion that the capture efficiency of Press #5 exceeded 60%. It is, in my professional opinion, extremely unlikely that the capture efficiency of Press #5 would not meet this benchmark. Press #5 is a central impression (CI) flexographic press, equipped with localized pick-up hoods at each printing station, doctor blades to minimize ink usage, covered ink pans and a drying oven operating at negative pressure. These design features are consistent with best management practices used in the flexographic printing industry and would enable the Press #5 to achieve high capture efficiencies.

Based on the emissions test that I conducted and my evaluation of the VOM capture system, it was and is my professional opinion that Press #5 met the control requirements of 35 IAC Section 218.401(c).

3. Regulatory Background

The flexographic printing presses at PPI are subject to Flexographic Printing rules found at 35 IAC Section 218.401 through 35 IAC Section 218.404. These rules provide three options to comply with emissions limitations:

- Use of compliant inks that contain no more than 40% VOM by volume, not including water or exempt compounds, or that contain no more than 25% of VOM by volume of the volatile content of the ink (35 IAC Section 218.401(a)), or

- Daily weighted averaging across multiple printing lines to demonstrate compliance with the above VOM content limitations (35 IAC Section 218.410(b)), or

- Use of a control device that that reduces the mass emission rate of captured VOM emissions by at least 90% and use of a capture and control system that reduces overall VOM emissions by at least 60% (35 IAC Section 218.401(c)).

In addition to the above compliance options, the Illinois Environmental Protection Act (the Act) provides for a mechanism for a source to seek relief from regulatory requirements by seeking an Adjusted Standard. The Illinois EPA and Illinois Pollution Control Board (IPCB) are required to consider a number of factors when considering a petition for an Adjusted Standard (415 ILCS 5/28.1 and 35 IAC Section 104.400). These factors include, but are not limited to:

- Evaluating the cost of control, in dollars per ton of pollutant controlled, on an annual basis. If the cost of control exceeds generally-accepted guidelines for Reasonable Available Control Technology (RACT), Illinois EPA and the IPCB will generally consider an Adjusted Standard petition more favorably.

- Determining the technical feasibility of compliance options. If the compliance options listed in the regulation(s) in question are not technically feasible, Illinois EPA and the IPCB will generally consider an Adjusted Standard petition more favorably.

- Considering the environmental effect of granting an Adjusted Standard. If it can be shown that no significant environmental harm will be caused by granting an Adjusted Standard, Illinois EPA and the IPCB will generally consider an Adjusted Standard petition more favorably.

4. Compliance History

Upon discovering non-compliance with 35 IAC Section 218.401 in 2002, PPI examined the compliance options available to the company. The evaluation revealed the following:

- Required permit applications, records and reports had not been filed with the Illinois EPA. I was authorized to rectify these oversights by PPI. Specifically I prepared and, where appropriate, submitted to the Illinois EPA documents which include, but are not limited to, the following:

  a. A construction permit application for the facility.

  b. An operating (CAAPP) permit application for the facility.

  c. Retroactive Annual Emissions Reports.

  d. Retroactive Seasonal Emissions Reports.

  e. A recordkeeping system in accordance with 35 IAC Section 401 through 35 IAC Section 404.

  I have been working with PPI since 2002 to ensure that they are in compliance with applicable rules, periodically reviewing the company's records and filing required reports with Illinois EPA.

- Presses #1 and #2 were and had been in compliance with control requirements by virtue of using inks that met the VOM content limitations set forth at 35 IAC Section 218.401(b). These presses process low-slip or no-slip film, therefore water-based inks could be and were used for printing.

- Press #5 was and had been in compliance by virtue of a recirculating oven that destroyed at least 90% of captured VOM and that provided overall VOM control of at least 60%, thus meeting the requirements of 35 IAC Section 218.401(c).

- Press #4 was not in compliance with 35 IAC Section 218.401. The options available to control this press were:

  a. Pursuit of relief through an Adjusted Standard: Illinois EPA indicated that it would not support PPI if the company pursued an Adjusted Standard. It should be noted that PPI's processes and products are substantially the same as three other flexographic printers who make packaging products from polyethylene film: Formel Industries, Inc., Bema, Inc. and Vonco Products, Inc. These companies were granted an Adjusted Standard in January 2001.

     I served as lead consultant for the three companies listed above during the Adjusted Standard process. It is my professional opinion that, had PPI been aware of the Flexographic Printing rules, and had PPI joined the group of flexographic printers referenced above, PPI would also have been granted relief in the form of an Adjusted Standard.

     The overall cost to the group of three flexographic printers who were granted the Adjusted Standard was approximately $90,000, split roughly evenly between attorney fees and consultant costs. Each company's share, therefore came to $30,000. Had Illinois EPA supported PPI's request to receive an Adjusted Standard, it is my professional opinion that $30,000 represents the maximum that PPI would have had to pay its consulting/legal team. The reasons for this are twofold: 1) much of the language needed for the petition to be filed would have already been developed from the previous filing and was publicly available; and 2) although some site-specific information would have had to be developed for PPI, much of that information would have been developed in order to submit a permit application, and any increased costs in this regard would not be enough to offset the cost-reduction referenced.

  b. Move Press #4 to PPI's Sparta, Michigan plant. The cost of moving the press was determined to be approximately $15,000.

  c. Purchase of an add-on control system (35 IAC Section 218.401(c)): This option was technically feasible. Control of Press #4 would have required purchase of a thermal oxidizer of approximately 5,000 scfm capacity. A used thermal oxidizer of this size was found and it was determined that the installed cost for this oxidizer would have been approximately $75,000.

  d. Use of water-based inks (35 IAC Section 218.401(a)): This option was not technically feasible, because Press #4 was used to print high-slip film and water-based inks do not adhere to high-slip film.

  e. Cross-line averaging (35 IAC Section 218.401(b)): This option was not technically feasible, because a large percentage of PPI's customer base

require high-slip film, which in turn requires solvent-based inks. PPI did not and does not have enough business for low-slip or no-slip film to utilize enough water-based inks such that cross-line averaging would be a possible compliance solution.

PPI chose option (b), moving Press #4 to the Sparta, Michigan plant in December 2004 and it began operation there in February 2005. Subsequently, in 2006, it was decided to purchase a new, high-speed flexographic press to be installed at the Carol Stream, Illinois facility. This was designated Press #6. This decision was made, in part, to ensure the continuing viability of the Carol Stream, Illinois plant.

As a part of this project, PPI added a thermal oxidizer to control Press #6 and reconfigured Press #5 to vent to the thermal oxidizer. Press #5 was vented to the thermal oxidizer in order to eliminate the need for oven recirculation, which improved press performance and allowed for higher printing speeds with a wider variety of inks. The project also increased the overall VOM emissions reduction efficiency associated with Press #5, from the estimated 60% before installation of the thermal oxidizer and PTE to approximately 99% afterward. This increase in overall control was necessary so that the project would not constitute a major modification and trigger Non Attainment New Source Review. The thermal oxidizer was rated at 15,000 scfm, large enough to accommodate a third press, should future expansion occur.

Finally, PPI also decided to construct a Permanent Total Enclosure (PTE) to capture 100% of VOM emissions from Presses #5 and #6. Although a PTE is not required under applicable rules, PPI voluntarily took this action so as to ensure continuous compliance and to further reduce VOM emissions from the facility.

PPI applied for a construction permit in 2006 with the Illinois EPA. This application requested permission to install Press #6, to install the thermal oxidizer, to construct the PTE and to redirect the VOM emissions captured from Press #5 to the thermal oxidizer. Illinois granted this construction permit, date October 10, 2006 (Application No.: 06020062). This permit limited VOM emissions to the following:

- Presses #1 and #2: 2.00 tons/year
- Presses #5 and #6: 18.00 tons/year
- Clean up solvents and other materials: 4.90 tons/year

Total VOM emissions, for the facility as a whole, were thus limited to 24.90 tons per year.

Following installation of the thermal oxidizer and construction of the PTE, an emissions test was conducted by ARI Environmental of Wauconda, Illinois. This test was conducted in accordance with construction permit conditions. A test protocol was submitted to and accepted by Illinois EPA, and Illinois EPA was invited to witness the test program. The test program demonstrated that the thermal oxidizer was destroying over 90% of captured VOM, that the enclosure constructed around Presses #5 and #6 met the criteria for a PTE

as described in 40 CFR Part 51, Appendix M, and that the overall control efficiency of the system exceeded 60%.

Based on the date of installation for Presses #1, #2, #4 and #5, and the actual VOM emission rates calculated based on historical material use rates, it was determined that PPI had never triggered Non-Attainment New Source Review (NANSR) and Illinois EPA verbally agreed with this determination.[1] The construction permit issued in 2006 resulted in facility-wide VOM emissions that were less than previous emitted and that were below the Major Source Threshold applicable to sources in the Chicagoland Ozone Non-Attainment Area. Accordingly, NANSR was not triggered by this project either.

As part of the construction permit application filed in 2006, PPI also asked Illinois EPA to grant the facility a Federally Enforceable State Operating Permit (FESOP). Illinois EPA has not yet granted PPI a FESOP, nor has Illinois EPA requested additional information in regard to this application, nor has Illinois EPA responded to requests to issue the FESOP.

The above report represents my professional opinion, based on the facts known to me, my training and my experience.

Rich Trzupek

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Richard Trzupek, Principle Consultant
Mostardi Platt Environmental

Date

[1] After submission of PPI's emissions history to Illinois EPA, several meetings and teleconferences were held with Illinois EPA in an effort to reach a Compliance Commitment Agreement (CCA). During at least one of these discussions, representatives of the Illinois EPA verbally indicated that PPI was not then, and never would have been, subject to NANSR.