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The Feasibility of Effluent Trading in the Energy Industries

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The Feasibility of Effluent Trading in the Energy Industries

by

John A. Veil

Executive Summary

In January 1996, the U.S. Environmental Protection Agency (EPA) released a policy statement endorsing effluent trading in watersheds, hoping to spur additional interest in the subject. The policy describes five types of effluent trades — point source/point source, point source/nonpoint source, pretreatment, intraplant, and nonpoint source/nonpoint source. This report evaluates the feasibility of effluent trading for facilities in the oil and gas industry (exploration and production, refining, and distribution and marketing segments), electric power industry, and the coal industry (mines and preparation plants). Nonpoint source/nonpoint source trades are not considered since the energy industry facilities evaluated here are all point sources.

EPA has administered emission trading programs in its air quality program for many years. Programs for offsets, bubbles, banking, and netting are supported by federal regulations, and the 1990 Clean Air Act (CAA) amendments provide a statutory basis for trading programs to control ozone and acid rain. Different programs have had varying degrees of success, but few have come close to meeting their expectations.

Few trading programs have been established under the Clean Water Act (CWA). One intraplant trading program was established by EPA in its effluent limitation guidelines (ELGs) for the iron and steel industry. The other existing effluent trading programs were established by state or local governments and have had minimal success.

The potential for effluent trading in the energy industries is summarized in Table S-1.

There is good potential for other types of water-related trades that do not directly involve effluents. Examples of these types of trades include wetlands mitigation banking and voluntary environmental projects (VEPs). Wetlands mitigation banking can save time and costs for projects that need to dredge or fill existing wetlands. Wetland mitigation banks would be valuable to the exploration and production segment, the coal industry, and for the construction of pipe line and power line corridors. Several electric power utilities, after offering to conduct VEPs, have been able to expeditiously conclude permit negotiations. Had the negotiations continued, the final permits could potentially have cost the utilities millions of dollars more in additional study costs or in requirements to construct expensive cooling system modifications.

The potential for effluent trading in the energy industries and in other sectors would be enhanced if Congress amended the CWA to formally authorize trading.

Table S-1 - Potential for Effluent Trading in the Energy Industries

Industry	Point/ point	Pretreat- ment	Intraplant	Point/ nonpoint
Exploration & Production	L	L	L	L
Petroleum Refining	M	M	H ^a	M
Petroleum Distribution & Marketing	L	L	L	L
Electric Power	M	L	M ^b	M
Coal	M	L	M ^b	H ^c

L low potential

M moderate potential

H high potential

^a A single set of limits is set for the whole refinery under the refining ELGs .

^b ELGS for the electric power and coal industries anticipate that individual waste streams may be combined before treatment.

^c Coal remining projects can improve acid mine drainage from abandoned mines.

Chapter 1 - Introduction

Background

Environmental release trading occurs when one source of a pollutant, which is able to remove more of the pollutant than it is required to do, trades the excess allowance of the pollutant to a second source of the pollutant, which uses the allowance in lieu of making expensive operational or treatment modifications. For wastewater discharges from point and nonpoint sources, this type of trading is known as effluent trading.

The Clean Water Act (CWA) does not specifically approve or prohibit effluent trading. Consequently, few trades of water-borne pollutants have been undertaken. In January 1996, the U.S. Environmental Protection Agency (EPA) released a policy statement endorsing effluent trading in watersheds, hoping to spur additional interest in the subject. A copy of this policy statement is provided as Appendix A. The policy statement is brief; it outlines EPA's support for five types of effluent trading:

- Point source/point source trading - trading of pollutant allowances between two or more industrial dischargers or publicly owned treatment works (POTWs);
- Pretreatment trading - trading of pollutant allowances between indirect dischargers to a POTW;
- Intraplant trading - trading among outfalls within a single facility;
- Point source/nonpoint source trading - trading of pollutant allowances between an industrial discharger or a POTW and a nonpoint source of pollutants; and
- Nonpoint source/nonpoint source trading - trading of pollutant allowances between two or more nonpoint sources of pollutants.

To supplement the policy statement, EPA published a draft framework document that provides much more information on implementation of effluent trades (EPA 1996). EPA plans to modify this document based on comments received during the summer and fall of 1996.

Purpose of Report

One of the U.S. Department of Energy's (DOE's) missions is ensuring that adequate, reasonably-priced energy supplies are available in this country. To fulfill this mission, DOE monitors regulatory developments that could affect the cost of energy production. Effluent trading holds the potential for significant cost savings depending on the circumstances of the trade.

Following release of EPA's policy statement on effluent trading, DOE commissioned Argonne National Laboratory to study the feasibility of effluent trading for the energy industries. This report covers the potential for effluent trading in various segments of the following industries: oil and gas (exploration and production facilities, petroleum refineries, and storage and distribution terminals); electric power (generating stations); and coal (mines and preparation plants).

In its trading policy and draft framework document, EPA is enthusiastic about the potential for effluent trading under many circumstances. That document is intended to raise awareness and enthusiasm about effluent trading. This report is intended to provide a more objective view of the real potential for effluent trading in the energy industries under the current CWA language.

Organization of Report

Before beginning an evaluation of the feasibility of effluent trading in the energy industries, it is useful to set the stage by summarizing the types of effluent trading programs that have been tried already. EPA has administered emission trading programs in its air quality program for many years. Programs for offsets, bubbles, banking, and netting are supported by federal regulations, and the 1990 Clean Air Act (CAA) amendments provide a statutory basis for trading programs to control ozone and acid rain. Chapter 2 reviews the types of air emission trading programs that have been instituted and discusses some of the reasons for their success or failure.

Chapter 3 reviews several water trading programs that have been proposed or implemented. Some are true effluent trading programs, while others involve habitat trading (i.e., wetlands mitigation banking). Chapter 4 discusses some issues that should be considered before undertaking a trade.

Chapters 5, 6, and 7 discuss the feasibility of effluent trading for the oil and gas industry, the electric power industry, and the coal industry, respectively. Chapter 8 provides conclusions.

Chapter 2 - Trading under the Clean Air Act

Emissions trading has been allowed under the CAA since the 1970s through a variety of different mechanisms. This chapter provides an overview of the various CAA trading mechanisms and programs. The American Petroleum Institute has published several reports that provide a more detailed analysis of CAA trading issues (Anderson et al. 1990; Crookshank 1994; and Anderson 1995).

CAA Background

The 1970 amendments to the CAA directed the EPA to establish National Ambient Air Quality Standards (NAAQSs) that must be met throughout the country. States have the responsibility to ensure that NAAQSs are met, which is done through state Implementation Plans (SIPs); the SIPs include schedules and implementation actions that must take place to attain the standards.

Areas that are in compliance with all NAAQSs are called attainment areas. EPA's regulations allow emissions in attainment areas to increase incrementally beyond a historical baseline up to a maximum level. Existing sources are grandfathered, but new sources or modifications to existing sources have to meet technology standards. Some new sources or modifications in attainment areas could result in exceedances of NAAQSs, and therefore their operators could be required to obtain credits.

Areas that cannot meet all NAAQSs are considered to be nonattainment areas and are subjected to more restrictive requirements than are attainment areas. All sources in nonattainment areas must meet technology standards. New sources and major modifications to existing sources in nonattainment areas must meet a level of technology standards that is more stringent than that applied in attainment areas. In addition, new sources and major modifications are required to obtain credits ("offsets") from other sources.

The 1990 CAA amendments included many revisions and new programs to improve air quality. Several of these programs increased the emphasis on emissions trading. The existing programs to control emissions of ozone, carbon monoxide, and particulate matter were strengthened. Ozone nonattainment areas were redefined by the severity of the area's air pollution problem as marginal, moderate, serious, severe, and extreme. Carbon monoxide and particulate matter nonattainment areas were classified as either moderate or serious. The poorer the air quality in a nonattainment area, the more controls that must be implemented by sources within the area.

The 1990 CAA amendments also established a new program to reduce acid deposition through reductions in emissions of sulfur dioxide (SO₂) and nitrogen oxides (NO_x). This program included active allowance trading. Another program utilizes the trading mechanism

adopted by EPA by regulation to phase out the production of substances (such as chlorofluorocarbons and halon) that deplete the stratospheric ozone layer.

Emissions Trading Mechanisms

Historically, EPA utilized four mechanisms for trading air emissions: offsets, bubbles, netting, and banking. These mechanisms are described in a 1986 emissions trading policy statement (51 FR 43814; December 4, 1986). Each mechanism relies on emission reduction credits as the trading commodity. A source can earn credits by emitting fewer pollutants than its legal baseline level. Reduced levels of emissions can be accomplished by a number of actions, including discontinuing or reducing a production process; changing to a process that generates fewer emissions; replacing a piece of process equipment with one that generates fewer emissions; closing an entire facility; adding air pollution controls, and others. All credits must be approved by the states involved before they can be used or traded.

EPA places restrictions on the circumstances under which credits can be earned. To be eligible as tradeable credits, reductions in emissions must be surplus, enforceable, permanent, and quantifiable. To be considered surplus, reductions must go beyond an acceptable baseline and must not be used to fulfill current or planned requirements. To be considered enforceable, reductions that are used in a bubble, netting, offset, or banking transaction must be approved by the state and be federally enforceable. To be considered permanent, reductions must be assured through enforceable permit limits for the term of the bubble, netting, or offset transaction. The term can be unlimited or limited to the life of a permit. To be considered quantifiable, the level of reduction must be calculated before and after the reduction and must be characterized as to the way the credit will be used.

Credits can be used by the source that generated them at a later date or can be traded to another source. The second source can be internal (another source at the same facility or at a nearby facility owned by the same company) or external (a totally different company).

Offset Policy

The offset policy was initially authorized in 1976 (41 FR 55524; December 21, 1976) to address the problem that no new sources or modified existing sources could be constructed in nonattainment areas after NAAQS compliance dates had passed. The 1976 offset policy allowed new sources entering a nonattainment area or existing sources in a nonattainment area that wanted to expand to obtain credits (offsets) from other sources as long as the resulting total emissions following the trade were sufficiently less than the total emissions from existing sources. Congress incorporated offsets into the 1977 CAA amendments. EPA has formally codified offsets in Appendix S to 40 CFR 51.

The number of offset credits required in a transaction is generally greater than the amount of new emissions being created (an offset ratio of greater than 1:1), so that the overall level of emissions will decrease. Under the 1990 CAA amendments, the magnitude of offset ratios were based on the degree of nonattainment. Offsets must be obtained from the same nonattainment area in which the credits would be applied, unless the source can obtain offsets from another nonattainment area with equal or worse nonattainment classification. Offsets must be made for the same pollutant for which emissions will be increased.

Theoretically, all new major or modified sources in nonattainment areas would be required to obtain offsets. Hahn and Hester (1989) estimate that about 2,000 sources used offsets between 1977 and 1986. Anderson (1995) reports that about 2,500 offset transactions have taken place in the United States, with 90 percent of these being in California. The potential market for offsets is much larger than this. Crookshank (1994) provides several reasons why offsets have not been traded more widely:

- Only *major* new sources or modifications are required to offset. Few major sources have been constructed in nonattainment areas. Nonmajor sources continue to be constructed but are either exempted from needing offsets or are able to obtain offsets from community (small facility) banks at no cost.
- In the early years of the offset program, when sources were required to upgrade their technology to meet NAAQSs, banking was not permitted. Companies had to devote excessive resources to identify a trading partner for offsets and consequently found other means to achieve their emissions requirements.
- Once a source installs the technology needed to meet the required standards, there are few remaining emissions that would require offsets.
- Many companies choose to generate offset credits internally rather than purchasing them from external sources. Anderson (1995) reports that about 90 percent of all offset credits are generated internally. Thus, the commercial market for offset credits is limited.
- In most transactions, the offset ratio is larger than 1:1. As the offset ratio increases, the desirability of using offset credits diminishes.

Bubble Policy

The CAA places specific technology standards on many sources. In 1975, EPA proposed the concept that a facility could be treated as if an imaginary bubble were placed over it. A company could construct new sources or modifications to existing sources so long as the total emissions within the bubble did not exceed the allowable total. If a company did not have sufficient source reduction in its own operations, bubble credits could be purchased from a

nearby source. This approach gives greater flexibility to plant managers in selecting the lowest cost solutions to meeting CAA requirements. The 1975 proposal was rejected by the courts, but a 1979 policy (44 FR 71779; December 11, 1979) opened the door for bubbling to be employed. EPA's policy on bubbling was further clarified in the 1986 emissions trading policy statement. Key elements of that policy relating to bubbles include the following:

- The baseline emission level for bubble calculations is more clearly defined.
- Bubbles may not increase the applicable net baseline emissions.
- Bubbles may be approved in nonattainment areas provided that certain demonstrations are made.
- State generic bubble guidelines are established that can be used to reduce the lengthy delays in obtaining approval of bubbles.
- Bubbles cannot be used to increase the level of emissions of any hazardous pollutant.
- Bubbles must not impede the ability of states to take enforcement action against sources that have failed to take the necessary steps to meet control requirements on time.

Although the bubble policy has been available to emission sources for over 15 years, not many facilities have taken advantage of bubbles. Hahn and Hester (1989) report that as of 1986, 89 generic bubbles had been approved by states, 42 bubbles had been approved by EPA, and 91 were under review or development. Hahn and Hester (1989) found that the vast majority of bubbles involved internal transfers. Of the more than 200 bubbles they examined, only two involved external transfers of credits.

Those companies that took advantage of bubbles have benefitted. Hahn and Hester (1989) estimate that bubbles approved and employed prior to 1986 resulted in savings of about \$435 million in control costs relative to traditional regulatory approaches and that those under review or consideration at the time could yield additional savings of \$215 million.

Netting Policy

Under EPA's netting policy, sources in nonattainment areas that propose to make major modifications can reduce emissions at other sources under their control such that a significant plant-wide increase in emissions does not occur. By doing so, the company can avoid having the modification classified as a major modification and can avoid preconstruction permit requirements under new source review. This can yield great savings in cost and in the time needed for approving the modification.

EPA's regulations for new source review (40 CFR 51.165, 51.166, 52.21, and 52.24) authorize netting. The term "significant" when applied to increased emissions is defined differently for nonattainment areas [40 CFR 51.165(a)(1)(x)] than for attainment areas [40 CFR 51.166(b)(23)].

Netting can only be done for sources within the same plant boundaries. In attainment areas, the scope for netting transactions is anywhere within the plant boundaries. For nonattainment areas, the scope can be the same plant-wide definition or a dual definition. Under the dual definition, significant increases at either the plant as a whole or at individual emitting sources can trigger a new source review.

Netting appears to be the most commonly used form of emission trading. Hahn and Hester (1989) estimate that between 5,000 and 12,000 netting transactions had occurred by 1985. They estimated the average savings in avoided capital costs per netting transaction as \$100,000 to \$1 million. This results in a total estimated range of \$500 million to \$12 billion. In addition, companies that utilize netting avoid permitting costs estimated at \$5,000 to \$25,000 per transaction. This results in an additional cost savings of \$25 million to \$300 million (Hahn and Hester 1989).

Banking Policy

Under EPA's banking policy, companies may deposit eligible emission credits into a bank, where they are maintained until that company elects to use or trade them. Rather than being a separate mechanism unto itself, banking can be used to implement any one of the other trading mechanisms. For example, a company needing offset credits could search to find a trading partner and obtain the credits at that time; the company could go to a bank and purchase credits; or the company could claim its own credits that were deposited in the bank months or years earlier.

EPA's 1976 offset policy did not allow emission credits to be banked. This position was changed in the 1979 offset policy (44 FR 3274; January 16, 1979) and is now part of 40 CFR 51, Appendix S. If an emission reduction is made that is larger than is needed to meet the requirements under the offset policy, the excess reduction can be banked and used in the future as long as the banked credits are identified and accounted for in the SIP control strategy. Banked credits cannot be used as an offset for a new source if the new source would interfere with the SIP control strategy.

EPA's 1986 emissions trading policy statement provided further clarification on banking requirements. Banked emission credits must be enforceable by states to be allowable as credits. Banked credits may not be used for netting if the trading partner is an external source. For banks to be EPA-approvable, they must include, at a minimum,

- Designation of a responsible entity for administering the bank;
- Requirements that banked credits be surplus, permanent, quantifiable, and enforceable;
- Restrictions on the use of credits for new source permitting;
- Requirements for sources to bank credits at the earliest possible time;
- Procedures for banking surplus emission reductions;
- Determination of ownership rights;
- A registry for tracking ownership, use, and transfer of banked credits; and
- Adjustments to credits based on enforcement considerations and ambient attainment considerations.

Hahn and Hester (1989) report that an emissions bank in Louisville, Kentucky, received deposits of 26,000 tons per year of credits from 18 companies. Out of these credits, offsets had been provided for 9 external and 19 internal trades. Hahn and Hester (1989) suggest several reasons why other banking programs have not been as effective. Some are located in attainment areas; therefore, offsets are not needed. Other banks place strict limitations on how and when credits can be used. The uncertainty about ownership of credits and the ability to use banked credits in the future is a disincentive for companies considering banking.

Crookshank (1994) identified 24 banks in existence as of January 1993. He noted differences in the way banks handled

- Credits earned due to shutdowns and curtailment of operations;
- Reductions in the quantity of banked credits at the time of deposit;
- Time limits on the life of banked credits; and
- Moratoria on the use of banked credits.

Banking was used successfully in EPA's lead trading program, which is described in the next section.

Lead Trading and Banking Programs

Throughout the 1970s, EPA mandated reductions in the lead content of gasoline. In 1982, EPA adopted regulations to set the maximum allowable lead content in leaded gasoline as 1.1 grams per gallon, calendar quarter average (47 FR 49322; October 29, 1982). The regulations allowed for trading of lead rights among refiners and importers beginning in late 1982. Refiners and importers that had quarterly average gasoline lead levels lower than the EPA standard earned rights that could be traded to other refiners or importers.

To facilitate and encourage early reductions, EPA subsequently lowered the average lead content standard to 0.10 gram per gallon by 1986 (50 FR 9386; March 7, 1985). EPA allowed banking of lead rights that could be used until the end of 1987 (50 FR 13116; April 2, 1985). This allowed rights earned in 1985 to be saved and used at any time until the program expired in 1987. However, to prevent the lead content from falling below the level that some automobile engines would need to prevent excessive valve seat wear, EPA did not allow credits to be earned for lead contents below 0.10 grams per gallon.

Anderson et al. (1990) summarize the level of activity in the lead trading program. The number of participants in the trading program grew from 165 in the third quarter of 1983 to a peak of 537 in the third quarter of 1985. In the first quarter of 1985, the first quarter in which the banking program was initiated, 315 participants made banking deposits. This peaked at 416 depositors in the second quarter. The number of withdrawals peaked in the second quarter of 1986 at 213.

EPA had estimated that about 9.1 billion grams of lead would be banked, saving refiners \$226 million. In actuality, the program is believed to have banked over 10 billion grams of lead, with an average savings of 2.5 cents per gram (Anderson et al. 1990). The high level of lead trading and banking was due to the relatively low degree of procedural requirements for trading. The lead credit program demonstrated for the first time that widespread trading could achieve large cost savings for industry¹.

Acid Rain Program

The 1990 CAA amendments established the Acid Rain Program to reduce emissions of SO₂ and NO_x, the primary causes of acid rain. The SO₂ reduction program's goal is reduction of annual SO₂ levels by 50% over 1980 baseline levels. The reductions are accomplished in two phases. Phase I began in 1995 and affects primarily the large coal-fired electric generating plants in the East and Midwest. Phase II begins in 2000. It reduces the emission allocations to the plants covered in Phase I and also sets restrictions on smaller, cleaner plants.

¹ Personal communication between Alan Loeb and John Veil, both of Argonne National Laboratory, Washington, DC, on October 8, 1996.

The Acid Rain Program relies on allowance trading to use market incentives to minimize costs to SO₂ sources. Each source covered by Phase I receives a specific number of allowances, each of which authorizes the source to emit one ton of SO₂ during a particular year. The Phase I allocation of allowances is based on the product of an emission rate of 2.5 lb SO₂ per million Btu multiplied by the unit's baseline fuel input in Btu as listed in Table A of §404 of the CAA. A few affected units in Illinois, Indiana, and Ohio are given additional allowances under Phase I. In Phase II, the allocation to each source is reduced by using an emission rate of 1.2 lb SO₂ per million Btu multiplied by the unit's baseline fuel input. The total pool of allowances is limited to 8.95 million.

The market-based trading system provides the flexibility to regulated sources to operate within the number of allowances granted to them by the Acid Rain Program or to purchase allowances from other sources that have excess allowances or through EPA-sanctioned fixed sales or auctions. Sources that are able to reduce their actual SO₂ emissions below their allowances can sell the excess allowances or save the allowances for use in a future year. Other sources that generate SO₂ emissions but that are not specifically included in the Acid Rain Program may also elect to participate through an Opt-in Program. Such sources would voluntarily ask to be covered under the Acid Rain Program and would receive allowances. By reducing SO₂ emissions below allowance levels, the Opt-in sources could sell their excess credits.

Accounting of allowances and trades is accomplished through an Allowance Tracking System (ATS). Each source under the Acid Rain Program has an account in the ATS that maintains the number of allowances, transfers of allowances, and deduction of allowances for compliance purposes. At the end of each calendar year, sources must have sufficient allowances in their ATS accounts to equal or exceed the amount of SO₂ emitted during the year. Any excess of allowances over actual emissions may be carried over and used in a future year. If annual emissions exceed the number of allowances in the ATS account, the source is subject to a penalty of \$2,000 per ton (adjusted for inflation) for each excess ton of SO₂.

The NO_x reduction program follows some of the same principles as the SO₂ program, but there are two important differences. First, the total NO_x emissions are not subject to an overall cap, and second, no allowance trading system is employed. However, two or more affected units having the same owner or operator may average emission rates rather than meeting emission targets separately at each unit. This is the only form of emission "trading" permitted under the NO_x reduction program.

Anderson (1995) reviewed the selling prices of SO₂ allowances during the first few years of the trading program and found that selling prices have not met preliminary expectations. In private transactions prior to the first EPA auction (March 1993), several private sales were reported in the range of \$250 to \$350 per allowance; this was lower than EPA's projected \$700 per allowance. At the March 1993 auction, allowances sold for \$131 to \$450 for Phase I allowances and \$122 to \$310 for Phase II allowances. Anderson reports that prices dropped to

an average of \$159 per allowance during the March 1994 auction, and spot market prices were even lower, averaging \$130 per allowance. Anderson suggests that the drop in selling price of allowances is an indication that the allowance system may have driven technological advances that allowed cheaper compliance with the Acid Rain Program targets.

Not as many utilities as predicted have participated in allowance trading. Among the reasons cited by Bailey et al. (1993) and Anderson (1995) were

- Many utilities, as a result of the existence of the allowance market, switched to burning low-sulfur coal, which was abundant and reasonably priced, or to blending low-sulfur coal with the higher sulfur coal they already were burning.
- Some utilities chose to scrub their emissions even though the cost of scrubbing is much higher than the cost of purchasing allowances. This may be attributable to issues relating to preference for their existing sources of high-sulfur coal or to the fact that the higher costs of scrubbing could be recovered through rate increases. A utility representative offered a different explanation of why utilities elected to scrub emissions. Bailey (1996) suggests that this decision was more attributable to early forecasts of much higher allowance prices, which would have made scrubbers more economically competitive. Because of the long lead time needed to design and install scrubbers, utilities made commitments for scrubbers during the early years of the allowance program.
- Other utilities have utilized alternative mechanisms to reduce SO₂ emissions such as adding lime during combustion.
- In some states, utilities selling allowances may have to rebate the proceeds to ratepayers, thereby reducing their incentive to use an innovative approach. Historically, many utilities have chosen compliance options that reduce risks to the greatest extent rather than options that necessarily result in the lowest costs.

However, those utilities that did participate in SO₂ trades project large cost savings. The Government Accounting Office (GAO) (1994) reports that four utilities estimate savings of \$90-300 million through purchases of allowances.

EPA held its latest auction in March 1996. The downward trend in allowance selling price continued, with current year allowances selling for \$66-68. Future allowances were sold for use in 2002 and 2003. These sold for approximately \$65 and \$64, respectively (BNA 1996a).

According to the Bureau of National Affairs (BNA) (1996a), an EPA official reported that the utilities affected by Phase I had already reduced 5.6 million tons of SO₂ from their baseline of 10.9 million tons of SO₂. This degree of progress puts the utilities well ahead of

sources, and mobile sources. The 1994 regulations are general in nature, offering guidelines rather than specific details. EIPs must include

- Goals and rationale;
- The scope of sources that are included under the EIP;
- A description of the baseline that will be used for calculating credits;
- Procedures for determining how changes in emissions will be quantified for credits;
- Monitoring, reporting, and recordkeeping procedures;
- Projections of the anticipated emissions reductions that the EIP will accomplish, including consideration of uncertainty factors;
- A schedule for implementing the EIP;
- Administrative procedures to implement the EIP; and
- Procedures for enforcing EIP actions.

Open Market Trading Rule

EPA recognized that progress toward meeting ozone standards was not happening as quickly as desired and in mid-1995, EPA proposed the Open Market Trading Rule (OMTR) for ozone smog precursors (60 FR 39668; August 3, 1995 and 60 FR 44290; August 25, 1995). The OMTR would allow trading of credits known as discrete emission reductions (DERs) for volatile organic compounds (VOCs) and NO_x. DERs are not long-term emission rate reductions but are specific reductions generated over discrete periods of time. DERs are usually expressed in tons.

Many other trading actions require lengthy modifications to SIPs or operating permits before approval for the trade is granted, but the OMTR avoids these delays. The OMTR includes model language, which if adopted by states, would be immediately approved by EPA. States are free to modify the model language but then must have the trading program approved by EPA.

Unlike some of the other trading programs, the OMTR does not have a cap on the number of credits that can be traded. Any VOC or NO_x source can generate DERs by taking actions to reduce their emissions below their baseline level. Once generated, DERs could be used at any time in the future. Sources generating DERs must submit a Notice and Certification

of Generation when they are generated. For credits to be eligible as DERs, they may not be generated

- Through shutdowns, curtailments, or modification of activities that are in violation of any laws;
- Through emissions reductions required to meet other CAA ozone requirements or hazardous air pollutant requirements;
- As credits under some other CAA trading program; or
- Prior to the start of the 1995 ozone season.

Prior to using DERs, a source must submit a Notice of Intent to Use and a Notice and Certification of Use to the state. DERs may only be used if they are acquired prior to the compliance period in which they will be used. DERs cannot be used to "make up for" a noncompliance. When DERs are used, an additional 10 percent of the DERs must be retired, thereby providing a net environmental gain. For example, if a source uses 100 DERs for compliance, the source must purchase 110 DERs and retire 10 of them.

The OMTR places temporal and geographical restrictions on trades. DERs generated during times other than the ozone season cannot be used to comply with emission requirements during the ozone season. VOC reductions generated outside an ozone nonattainment area may not be used for compliance within a nonattainment area. NO_x emissions generated outside an SIP's modeling domain may not be used for compliance within the modeling domain.

One key area in the OMTR that is unresolved is who is responsible for ensuring that DERs are fully valid before they are used for complying with emissions requirements. As proposed, the OMTR placed full responsibility for the validity of the DERs on the buyer and none on the seller. More recent reports, however, indicate that EPA is leaning towards a liability scheme that would hold both buyers and sellers accountable for ensuring that credits are valid (*Inside EPA* 1996b). The final outcome on this issue will play an important role in determining how effective the OMTR will be as an economic incentive.

Other Air Emission Trading Programs

The CAA contains a variety of other emission trading programs that are summarized by Anderson (1995). They include programs for

- Allowing manufacturers of heavy-duty-truck engines to average the emissions performance of all engines they produce;

- Encouraging states to meet oxygenated gasoline requirements through adoption of averaging programs using marketable oxygen credits;
- Creating a pilot program in California offering marketable credits for manufacturers of clean-fuel vehicles (credits can be averaged, traded, banked, and borrowed); and
- Establishing baseline allowances for producers of chlorofluorocarbons, combined with trading opportunities and a subsequent phase-down in allowances.

Anderson (1995) also describes two trading programs established by local governments. The first of these is a wood-burning fireplace/stove permit system in Telluride, Colorado. Construction of a new fireplace or stove will not be approved unless the owner can acquire two permits from existing fireplace or stove owners.

The second local program, Regional Clean Air Incentives Market (RECLAIM), is operated by Southern California's South Coast Air Quality Management District. Under RECLAIM, sources are subjected to progressively stricter emissions limits. One means of meeting the limits is through purchasing excess credits from other sources. Anderson (1995) reports that the program is expected to reduce NO_x emissions by 8.3 percent and SO₂ emissions by 6.8 percent. Compliance costs for the RECLAIM program are estimated to be 42 percent lower than a typical command and control approach. This could save from \$81-139 million per year.

Chapter 3 - Trading under the Clean Water Act

Unlike CAA trading programs, which are mandated by the CAA itself, CWA trading programs have been developed through cooperative efforts of a variety of stakeholders. Only one CWA trading program, the iron and steel intraplant trading program, has a federal regulatory basis. This program is described in a later section of this chapter.

Appendix C to EPA's draft framework document (EPA 1996) summarizes 26 existing or potential effluent or wetlands trading programs. Table 1 shows how these trading programs are distributed.

Table 1 - Summary of Types of CWA Trading Programs Identified by EPA

Type of Trading Program	Wetlands	Nutrients	Other
Existing Programs	6	6	1
Proposed Programs	0	7	6

Source: EPA (1996).

Wetlands Trading

Of the existing trading programs identified by EPA (1996), about half are wetlands trading programs. In fact, there are many more operating wetlands mitigation banks in service or in development, across the country. Crookshank (1995) indicated that as of early 1995, there were approximately 50 wetlands mitigation banks in operation. Wilkey et al. (1994) surveyed 17 wetlands mitigation banks ranging in size from 1.2 to 5,000 acres. The costs for operating those banks ranged from \$18 to \$113,761 per acre, with 13 of the 17 banks surveyed having costs less than \$10,000 per acre.

Wetlands trading programs, such as wetlands mitigation banks, make good sense in many situations. Several bills were introduced in Congress during the last two years that would formally sanction mitigation banking, but none passed. Mitigation banks can provide a large area of contiguous wetlands acreage rather than having numerous small isolated patches of wetlands in the same watershed. They provide the opportunity for a professional land manager to manage the wetlands areas rather than leaving small, isolated wetlands to fend for themselves. They can be cost-effective for entities needing to drain or fill existing wetlands as part of a construction project.

Hayes et al. (1995) suggest that projects involving impacts to small wetlands are the most efficient projects to be mitigated by a wetlands mitigation bank. Examples of these projects

from the energy industries include (a) long linear projects like construction of natural gas pipelines or power line corridors and (b) small wetlands imbedded at a surface coal mine site.

Some of the wetlands programs identified in EPA (1996) operate differently from traditional mitigation banks. Under these "fee-based systems," regulatory agencies collect a fee from developers for each acre of wetlands dredged or filled. The fees are placed into a fund that is used to mitigate wetlands or conduct other environmental projects. In an *a priori* wetlands mitigation bank, the bank is established and wetlands are created or restored before credits can be sold to developers, whereas in a fee-based system, the fee is paid up front, before any wetlands are created or restored.

In spite of the benefits of wetlands mitigation banks, they are not really examples of effluent trading. They fall under the large umbrella of CWA trading programs but cannot legitimately be considered effluent trading programs. Instead, they represent habitat trading.

Nutrient Trading

The majority of existing and proposed effluent trading projects are designed to trade allowances for nutrients, namely nitrogen and phosphorus. There are several reasons for this. First, there are many point and nonpoint sources in most watersheds that can serve as trading partners for nutrients. All POTWs discharge nutrients, as do agricultural activities and some industries.

The second reason for the greater interest in nutrient trading is that there is likely to be a significant discrepancy in the cost of removing nutrients between a point source and a nonpoint source. Point sources are likely to seek out low-cost solutions to nutrient removal problems. If control of nearby nonpoint sources can remove the necessary quantity of a pollutant at a lower cost, there is a greater incentive to develop a trade whereby the point source pays to remove the desired quantity of pollutants from the nonpoint source.

A third reason for the stronger emphasis on nutrient trading has to do with the way nutrients affect water quality. In general, the effect of nutrients is to stimulate growth of phytoplankton or other aquatic organisms, which subsequently depletes the dissolved oxygen in downstream waters. The effect of nutrients is not a direct toxic effect that occurs within a short distance from the point of discharge. Nutrients typically affect a watershed through the total load of nutrients added, rather than by the specific locations where the nutrients are added. Because specific locations are less important for nutrients than for toxic pollutants, the ability to trade nutrients with partners can be allowed over greater distances within watersheds.

The following paragraphs describe several well documented examples of nutrient trading programs.

Tar-Pamlico Basin - The Tar River and Pamlico Rivers form a 5,400 square mile watershed in North Carolina, with the lower portions of the watershed being estuarine waters. In 1989, the North Carolina Environmental Management Commission (EMC) designated the basin as Nutrient Sensitive Waters, thereby requiring identification of nutrient sources, nutrient limitation objectives, and development and implementation of a nutrient control plan. In the basin, nitrogen is the limiting nutrient, but phosphorus contributes to localized water quality problems.

In response to the designation of the basin as Nutrient Sensitive Waters, the Department of Environmental Management proposed limits on nitrogen and phosphorus on new or expanded point sources. Point source dischargers in the basin became alarmed at the estimated cost to meet the proposed limits (\$50-100 million). As an alternative to the Department's proposed limits, a coalition of point source dischargers and environmental groups, the Tar-Pamlico Association, proposed a two-phase strategy to achieve the nutrient reduction goals.

Green (1996) describes the strategy and how it has been implemented. During the first phase of the strategy, the involved parties (a) developed an estuarine model for the basin, (b) provided engineering evaluations of existing wastewater treatment plants to develop low-cost operational improvements to reduce nutrient loads, and (c) developed a nutrient reduction trading program. The results of the modeling were used to set a Phase II nitrogen goal of 30 percent reduction from 1991 conditions. Any loading above the target load in any year or any nutrient loading from new dischargers would have to be offset by purchasing nutrient reduction credits through funding nonpoint source controls. Credits are priced at \$29/kg of nitrogen reduced for 1995 and 1996. The rate is reviewed every two years.

Dillon Reservoir - Dillon Reservoir, located about 70 miles west of Denver, Colorado, supplies about half of Denver's drinking water. Four POTWs discharge into Dillon Reservoir, which by 1982, was becoming eutrophic due to excessive phosphorus loading. To maintain water quality and to allow increased growth, phosphorus loadings had to be reduced. Representatives from state and local governments, sanitation districts, a mining company, the Denver Water Board, EPA, and environmental groups formed a committee to develop the Dillon Water Quality Management Plan. The plan included limits on total phosphorus loadings to the reservoir, with specific allocations to each source, and a point/nonpoint source trading program. Under the trading program, a point source could control two pounds of nonpoint source phosphorus for every pound of phosphorus by which it exceeds its allocation. New nonpoint sources need to reduce existing nonpoint sources of phosphorus by a 1:1 ratio.

As of 1995, there have been only three trades, which is a result of a slowdown in population growth and opportunities for less expensive tertiary treatment at the POTWs (Anderson 1995). Further inexpensive treatment opportunities are limited, and population is expected to grow, suggesting that trading will be more important in the future.

Other Colorado Reservoirs - At least two other areas in Colorado have the potential for point/nonpoint trading for phosphorus. For the Cherry Creek Reservoir, a trading program was established in the mid-1980s, but to date no trades have occurred. Chatfield Basin, which drains to Chatfield Reservoir, is suggested as a good candidate for point/nonpoint source trading, but no trading program has been established yet (Apogee 1992).

Trading for Other Pollutants

Although EPA (1996) describes a variety of other existing or hypothetical trading programs, there have been very few actual trades for pollutants other than nutrients. In Providence, Rhode Island, the city's Water Department is paying the Transportation Department to use deicing chemicals other than the sodium chloride normally used in the water supply recharge area. As a result, the Water Department can meet its sodium standards without adding expensive treatment.

A second example is found in an area along the Fox River in Wisconsin, where there is a high concentration of paper mills. The State of Wisconsin established a trading program in 1981 for trading biochemical oxygen demand (BOD) credits among paper mills and POTWs. Because of restrictions in the trading program, only one trade has taken place. In that case, a paper mill closed its internal wastewater treatment plant and sent its wastewater to a POTW, which also received traded BOD credits from the paper mill.

A third example, taken from the Boulder Creek, Colorado, watershed, involves a combination of POTW upgrades, best management practices for restoring the riparian zone, and instream habitat improvements (EPA 1993). These three activities will allow Boulder Creek to meet the state water quality standard for un-ionized ammonia. Although trading of credits is not envisioned in this example, the concept of evaluating both point and nonpoint source contributions to ammonia toxicity and using a combination of measures to control both sources of ammonia is somewhat akin to trading.

Clearly, there is potential for cost savings through effluent trading, as indicated by the case studies summarized by Anderson (1995) and Industrial Economics (1992). However, given the current statutory and regulatory environment, few of these potential trades are occurring.

Intraplant Trading in the Iron and Steel Industry

As a general rule, pollutants cannot be traded to supersede National Pollutant Discharge Elimination System (NPDES) permit limits set on a technology basis, such as through EPA's effluent limitation guidelines (ELGs). In one case, however, such trades were allowed, but only through federal regulations and following lengthy litigation and negotiation. As EPA was developing ELGs for the iron and steel industry in the early 1980s, the agency announced that it was considering the use of a water bubble. For pollutants regulated by the ELGs and discharged at more than one outfall at a facility, the permittee could trade allowances between

the outfalls. The final ELGs for the iron and steel industry, including a water bubble, were published on May 27, 1982 (47 FR 23284).

The Natural Resources Defense Council (NRDC), an environmental group, and the American Iron and Steel Institute, an industry association, both sued EPA over a variety of issues, including the bubble language. The parties reached a consent agreement that resulted in revised bubble language being adopted on May 17, 1984 (49 FR 21028).

The final bubble language allowed intraplant trades with certain restrictions:

- Trades can only involve the same pollutants;
- Wastewater from cokemaking or cold forming cannot be used in trading;
- Each outfall must have a specific, fixed effluent limit for each pollutant being traded in the permit (this means that the limits could not float from week to week or month to month);
- Trades must reduce the total net quantity of each traded pollutant by 10-15 percent, depending on the pollutant;
- Alternative effluent limits cannot result in a violation of water quality standards; and
- Trades may be made only at existing facilities.

Kashmanian et al. (1995) report that of 443 direct dischargers covered by the iron and steel ELGs, 10 facilities traded effluents internally. As of 1994, five facilities had intraplant trades in their permits and were actively using the trades. Another facility had an intraplant trade in its permit but was no longer using the trade because it had changed processes. The other four facilities had a trade in their permits at one time, but no longer did because the facilities either closed down or were reconfigured.

Kashmanian et al. (1995) requested cost savings information from the ten facilities that had used an intraplant trade. Based on responses from seven of the facilities, intraplant trading had saved an estimated \$122.8 million of present value costs in 1993 dollars. Individual facility savings ranged from \$3.3 million to \$69.8 million of present value costs in 1993 dollars.

Other Types of Informal Water-Related Trades

Some of the formal trading programs either for effluents or for wetlands are described above. There are other types of informal trading programs that are probably equally important

in terms of costs savings and of practicing the principles of trading that are less well-publicized. These are described below.

Centralized Wastewater Treatment - Many large industrial facilities are governed by ELGs that have specific limits for several different processes. Yet the facilities pipe all or most of their wastewater from different processes to a centralized treatment plant. Since the wastewater from each process is not treated separately, it is impossible for the permit writer to place individual limits on each process. The permit writer will typically employ the "building block approach," through which permit limits are derived by adding the limits for each process that contributes wastewater to the centralized treatment plant.

The author, a former state NPDES permit writer and NPDES program manager, is personally familiar with permits issued to facilities from the iron and steel and the aluminum smelting industries that employ the building block approach. The permits place pounds per day limits on each pollutant based on the sum of allowances for a variety of processes regulated by the ELGs and other allowances for processes not included in the ELGs. The building block approach effectively accomplishes a trade by allowing a facility to combine the allowances for several processes together under a single limit. There may be hundreds of NPDES permits that have been written on this basis.

Common Sense Bubbling - A second type of informal trading can occur through the inexperience of a permit writer, who may not recognize that the NPDES regulations do not authorize water bubbling. In the early 1980s, while a fledgling NPDES permit writer, the author wrote a permit for an inorganic chemical manufacturing facility that operated two distinct processes with separate outfalls. Each discharge contained ammonia. Rather than placing limits on ammonia on each outfall individually, the permit writer required monitoring without limits for ammonia at each outfall and placed a technology-based, pounds-per-day limit on ammonia as the sum of the discharges from both outfalls. This informal trade may not have been completely in conformance with national NPDES regulations, but it made good sense to write the permit that way. Since the permit was not controversial, no outside parties scrutinized the permit or objected to it. Although this example comes from the early 1980s, the permit was renewed in 1996 and it continues to incorporate this informal trade. Conceivably, this could be an isolated incident, but more likely, this sort of common sense bubbling occurs periodically without being recorded by EPA's Office of Water as a formal trade.

Voluntary Environmental Projects - Under a voluntary environmental project (VEP), a facility that is involved in a dispute over a complicated water-related impact may volunteer to undertake an environmental improvement project that will contribute toward mitigating the impact that is under dispute. Under a VEP, individual pollutants are not traded; environmental projects are voluntarily conducted so that overall impacts to the water body are reduced. VEPs are particularly effective when the voluntary project directly benefits a resource that may be damaged as a result of an effluent discharge. Two examples of VEPs are given in Chapter 6.

VEPs are not the same as supplemental environmental projects (SEPs). SEPs are projects performed by an entity that has violated an environmental permit. Instead of paying a civil penalty in money, a permittee may request that partial or full payment be made through conduct of an SEP. While the choice of conducting an SEP is voluntary, the need to pay the civil penalty is not. Although VEPs represent a form of trading analagous to wetland mitigation banking, SEPs cannot be construed as trading.

Other Issues

One reason that water trading programs have not proliferated is that there is no language in the CWA establishing or authorizing effluent trading. Trading is not specifically prohibited, but it is certainly not emphasized. To some extent, companies that elect to trade do so at their own risk.

The potential for effluent trading in the energy industries and in other sectors would be enhanced if Congress amended the CWA to formally authorize trading. Conservative corporate and municipal government managers would be more willing to undertake trades if they felt their risk of future litigation and liability were reduced.

Chapter 4 - Considerations before Engaging in Effluent Trading

Before engaging in an effluent trade, dischargers must weigh many factors to determine if trading is feasible or prudent. The following sections describe several key considerations from the perspective of a point-source energy industry discharger. Nonpoint source/nonpoint source trades are not considered in this report since the energy industry facilities evaluated here are all point sources.

Effluent Trading Versus Other Means of Compliance

A company may look to trade when the cost of trading for effluent allowances is less than the cost of making operational or treatment changes at the facility in question. The cost to trade generally must be significantly lower than the cost of meeting permit limits through other means, because by trading, the company buying the allowances (the buyer) loses some measure of control over its compliance ability. The buyer may be held liable for failure to comply with permit limits if its trading partner (the seller) is unable to make the pollutant reductions needed to generate the allowance. To expose itself to this risk, a buyer must expect to save substantial compliance costs. Most companies will not expose themselves to this type of liability risk for only a small cost savings. Therefore, in order to trade, a buyer must find a seller willing to trade allowances at a highly favorable price. If no such seller is available, trading will probably not make sense.

Need for Water Quality-Based Limits

One reason why effluent trading has not occurred more frequently is that until recently, relatively few industrial NPDES permits contained water quality-based limits. Since the CWA does not allow trades to be made to meet technology-based limits, trading will only be possible when permits contain water quality-based limits. A spokesman for the Utility Water Act Group, an electric power industry CWA organization, indicated that few power plant permits to date have included water quality-based limits except for limits on temperature and maybe chlorine². Neither temperature nor chlorine are good candidates for trading since power plants are not likely to find other large heat or chlorine sources nearby with which to trade. A permit writer with the Maryland Department of the Environment provided a similar response, indicating that water quality-based limits are not normally used for coal mining operations in Maryland and that only recently has the state been including water quality-based limits on copper in some power plant NPDES permits³.

² Personal communication between Steven J. Koorse, Hunton & Williams, Richmond, VA, counsel to Utility Water Act Group, and John Veil, Argonne National Laboratory, Washington, DC, on February 9, 1996.

³ Personal communication between David Fluke, Maryland Department of the Environment, Baltimore, MD, and John Veil, Argonne National Laboratory, Washington, DC, on August 28, 1996.

Although few energy industry NPDES permits have included water quality-based limits in the past, the situation is changing. States were required by the 1987 amendments to the CWA to develop water quality standards for toxics. Most states had accomplished that by the early 1990s. As permits are developed after that time, greater emphasis is placed on toxics. Veil (1996) summarizes the increased level of toxics control in several EPA regional NPDES general permits for oil and gas exploration and production activities. Permits issued in the 1990s are far more stringent and include new toxics limits compared to permits issued in the 1980s.

Type of Pollutants Traded

In order to trade allowances for a pollutant, the pollutant must be subject to a water quality-based limit. This means that the state must have adopted a water quality standard for that pollutant. Typically, states adopt standards for basic water quality parameters (e.g., pH, dissolved oxygen, temperature, turbidity) and toxics. Some states may have adopted standards for nutrients. States do not normally adopt standards for pollutants like oil and grease or solids.

Most existing trading programs have involved nutrient trading. Other than petroleum refineries, facilities in the energy industries do not discharge nutrients in large quantities and are consequently not candidates for nutrient trading. Although potentially refineries could engage in nutrient trades, the only type of pollutant realistically suitable for trading in the energy industries is toxics.

Toxics trading presents unique problems. The water quality impacts from nutrients are not specific to a place or a time but are attributable to the overall loading of the nutrient to a watershed or stream segment over an extended period of time. Conversely, the primary water quality impact from toxics is the short-term or long-term effect on aquatic organisms in a mixing zone surrounding the outfall. Under state water quality programs, discharges must not exceed water quality standards outside of mixing zones.

Trading Partners

In order to trade effluent allowances, a company must find a trading partner located within the same watershed that also discharges the pollutant for which a trade is desired. EPA (1996) suggests that trading area boundaries should generally coincide with watershed or water body segment boundaries and that trading areas should be of a manageable size. EPA does not provide a precise definition of what constitutes a watershed for the sake of trading, but the agency indicates that trading area boundaries may be different for different pollutants, based on the way in which a pollutant causes water quality impacts.

The buyer must find a seller that discharges the same pollutant and is willing to engage in a trade. For the energy industries, the first place to look for a trading partner is another facility from the same industry. Typically for the oil and gas and coal industries, multiple facilities operated by different companies are located in the same geographic area to take

advantage of the energy resources located there. However, there are some reasons why facilities from the same industry may not agree to trade. First, companies in the same industry are in competition with one another. By trading with a competitor, a company may strengthen the competitor or may in some way allow the competitor to learn proprietary information about its operations. Second, other companies in the same industry may face the same magnitude of compliance costs as does the facility in question. Unless one company agrees to build a wastewater treatment facility several times larger than needed and accept wastewater from other nearby companies, trading with the same industry may not work.

Energy industries that trade in toxics may look for other industrial sources nearby that discharge the same toxic pollutant. An energy industry company could seek out as a trading partner a nonpoint source like contaminated sediments in the same stream segment or an abandoned coal mine.

Chapter 5 - Feasibility of Trading for the Oil and Gas Industry

Industry Description

The major segments of the oil and gas industry are exploration and production, refining, and distribution and marketing. Facilities in all segments are required to obtain NPDES permits for their discharges. ELGs have been promulgated for the exploration and production and refining segments. Details on the nature of the wastewater and the regulatory requirements for each segment are provided below.

Exploration and Production Segment - The two major waste streams associated with the exploration and production segment are drilling wastes and produced water. Drilling wastes include the drilling fluids used to lubricate the drill bit and support the drill string while the well is being drilled and drill cuttings, the particles of rock and soil that have been cut away by the drill bit. Produced water is brine that is brought to the surface along with oil and gas. Drilling wastes contain solids, oil and grease, metals, and a limited amount of organics. Produced water contains oil and grease, organics, and a limited amount of metals.

EPA's ELGs for the exploration and production segment of the oil and gas industry (40 CFR 435) are subdivided into five subcategories -- offshore, onshore, coastal, agricultural and wildlife water use, and stripper. For the offshore subcategory, limits are placed on mercury, cadmium, and acute toxicity for drilling wastes and on oil and grease for produced water. For the onshore subcategory, no discharge is allowed at all. For the coastal subcategory, neither drilling wastes nor produced water are allowed for discharge, except in Cook Inlet, Alaska. Discharges to Cook Inlet must meet the offshore limits.

The agricultural and wildlife water use subcategory authorizes only produced water discharges, and limits are placed on oil and grease. The stripper subcategory applies to onshore wells producing 10 barrels per day or less of crude oil. No ELG limits are set for these facilities; discretion on setting limits is left to state or EPA permit writers.

Few, if any, of the facilities in the exploration and production segment discharge wastewater to POTWs. Therefore pretreatment trading is not relevant to this segment.

Petroleum Refining Segment - The refining segment is somewhat more complicated than the exploration and production subcategory. Crude oil enters the refinery and is subjected to many processes that generate wastewater. Many refineries operate centralized wastewater treatment systems where the wastewater from several processes are treated together. Some refineries discharge their wastewater to POTWs and are therefore subject to pretreatment standards.

EPA's ELGs for the refining segment of the oil and gas industry (40 CFR 419) are subdivided into five subcategories -- topping, cracking, petrochemical, lube, and integrated.

Limits for all five subcategories are placed on BOD, total suspended solids (TSS), oil and grease, pH, chemical oxygen demand (COD), phenolic compounds, total chromium, hexavalent chromium, ammonia, sulfide, and total organic carbon (TOC). In addition to the pollutants limited by the ELGs, refinery wastewater includes other organics and metals and cyanide.

Distribution and Marketing Segment - After the petroleum products have been made at the refinery, they are distributed to end users through various marketing terminals (tank farms). The primary wastewater from tank farms is stormwater runoff contaminated by oil and grease and solids. Other wastes, including tank bottoms, may be discharged following treatment. Tank bottoms contain oil and grease, solids, organics, and metals.

EPA has not developed ELGs for tank farms. Large tank farms may be required to monitor toxics or meet permit limits for toxics. This segment also includes gasoline service stations, but these are rarely subject to NPDES permit requirements. Consequently, trading is not needed for service stations.

Opportunities for Effluent Trading in the Exploration and Production Segment

Point/Point Source Trading - Potential opportunities for trading in this segment are minimal. The majority of U.S. oil wells are regulated under the onshore subcategory of the ELGs, which requires zero discharge. By not discharging, a facility is never in the position to need to trade. The final coastal ELGs, published in December 1996, also require zero discharge for drilling wastes and produced water for Gulf of Mexico coastal dischargers. Most facilities discharging to coastal waters of the Gulf of Mexico are currently operating under an EPA Region 6 general permit that requires zero discharge of these waste streams. Consequently, coastal oil and gas dischargers are not good candidates to take advantage of trading.

Discharges regulated by the agricultural and wildlife water use subcategory are considered to be relatively clean already, since they are discharged to streams used for agricultural or wildlife propagation. Consequently, it is unlikely that such permits would include extensive water quality-based limits that would create an opportunity for trading.

Stripper wells are small producers that have little margin of profit. If permitting agencies require rigorous water quality-based limits, operators of stripper wells are likely to shut in the wells. In 1992, West Virginia issued a general permit for stripper well discharges (Permit No. WV0113506). The permit includes limits on iron, oil and grease, and TSS, all set on a technology basis, which precludes any opportunity for trading. The permit also has a water quality-based limit for pH. To the author's knowledge, nobody has yet discussed the possibility of trading for pH. This would be complicated since pH is not measured in pounds. If a pH trade were contemplated, the trade could be expressed in terms of acidity or alkalinity instead. It is unlikely that pH trading has much potential, since most NPDES permits place a technology-based limit on pH.

Discharges of drilling wastes and produced water are allowed under the exploration and production segment of the offshore subcategory and for facilities discharging to Cook Inlet, Alaska. In the current round of general permits for these areas, dischargers must meet both technology-based and water quality-based limits. The pollutants for which water quality-based limits have been set include arsenic, benzene, copper, lead, mercury, phenols, zinc, chronic toxicity, total aromatic hydrocarbons, and total aqueous hydrocarbons. Not all of these pollutants are limited in each permit.

At first glance, these pollutants appear to be good candidates for trading. However, all of them are toxics and are subject to mixing zones. EPA's ocean discharge criteria specify that any discharges to offshore waters must comply with all applicable water quality standards within 100 meters of the outfall [40 CFR 125.121(c) and 125.123(d)]. Discharges to Cook Inlet are subject to site-specific mixing zones, which range in size from 20 to 955 meters.

Section 303(d) of the CWA requires states to develop total maximum daily loads (TMDLs) for bodies of water that are not meeting water quality standards. TMDLs can be developed for free-flowing river or stream segments. However, for open oceans or wide and deep coastal areas like Cook Inlet, the concept of a TMDL is impractical. The total load of toxic pollutants cannot be calculated to any meaningful degree. In setting water quality-based limits for Gulf of Mexico or Cook Inlet dischargers, permit writers follow the national guidance provided in EPA (1991) or in state versions of this guidance. In general, the permit writer calculates a waste load allocation (WLA) by multiplying the water quality criteria by a dilution factor based on the mixing zone size. The WLA is converted to a long-term average value, then to average and maximum permit limits through a statistical procedure outlined in EPA (1991).

The magnitude of the water quality-based limits is directly related to the size of the mixing zone. If mixing zone size is kept low by regulatory constraints like the ocean discharge criteria, limits are likely to be relatively low. As a result, there is probably not much room for trading.

Most offshore dischargers are not located within 100 meters of one another. From the standpoint of water quality, the entire Gulf of Mexico or Cook Inlet is not impaired by excessive loading of the limited pollutants; rather, individual dischargers represent small islands of reduced water quality in a vast body of relatively pristine seawater. Generally, their mixing zones will not overlap, and functionally, they are not in the same water segment any longer for the sake of trading.

Pretreatment Trading - No exploration and production facilities discharge to POTWs, so pretreatment trading is not an option.

Intraplant Trading - Exploration and production facilities generally do not have water quality-based limits on the same pollutants at more than one outfall, so intraplant trading is not a likely option.

Nonpoint Source Trades - Pollutants from oil and gas operations will not normally be found in nearby nonpoint sources, so nonpoint source trading is not a likely option.

Opportunities for Effluent Trading in the Refining Segment

Point/Point Source Trading - Refineries are likely to have water quality-based limits that could be the basis for effluent trading. The potential exists for water quality-based limits for nontoxic pollutants. For example, limits could be placed on BOD to control dissolved oxygen or on ammonia to control nitrogen. If these pollutants are limited, trades could be made with other nearby POTWs or industrial sources. There are possible problems with trading either of these pollutants, however. Both BOD and ammonia are already limited on a technology basis by the ELGs. Trading could occur only if the permit contains water quality-based limits for BOD or ammonia that are stricter than the ELG limits for that pollutant.

Although BOD trading is theoretically possible, the only trading program that has attempted to trade BOD allowances is the Fox River program, under which only one BOD trade has occurred. Anderson (1995) suggests several reasons why the Fox River program has not been overly successful. First, the ELGs overestimated the cost of treatment upgrades so there was less economic incentive to trade. Second, the Wisconsin Department of Natural Resources designed the trading program with numerous barriers that served as disincentives to trading. Finally the trading program did not fully conform to the national policy of uniformity under the CWA, making standards set under the trading program potentially subject to legal challenge.

Other than the Boulder Creek example, described in Chapter 3, ammonia trading has never been tried. Ammonia has water quality impacts through two mechanisms, both as a nutrient and as a toxic pollutant. The toxic aspects of ammonia present problems for trading because water quality standards for toxics must be met at the edge of a mixing zone.

Trading for other toxics controlled through water quality-based limits faces the same difficulty. The previous section describes how trading is impractical for offshore dischargers, particularly because the open marine waters do not lend themselves to development of a TMDL. Refineries, on the other hand, are generally located on freshwater or estuarine water bodies for which TMDLs can be developed. When a TMDL is developed for a stream segment, each point source discharger within the segment that discharges the pollutant of concern will be given a waste load allocation for that pollutant. The waste load allocation will be protective of water quality standards. Potentially, a refinery and another nearby point source discharger could trade portions or all of their waste load allocations for a toxic pollutant as long as neither discharger ends up with a revised waste load allocation that allows exceedance of water quality standards outside of the designated mixing zone. The likelihood of such a trade being approved by both

parties and the permitting agency is dependent on the cost savings to both parties and the ability of the buyer to demonstrate that it can meet water quality standards after the trade.

There may be isolated instances where trading for toxics could work. In the first situation, a refinery's waste load allocation is calculated at a level lower than it would otherwise need to be due to the presence of significant concentrations of a pollutant in the ambient upstream water. Under these circumstances, the refinery could potentially trade with an upstream discharger to remove more of the pollutant than it needs to in order that the downstream discharger's waste load allocation could be increased somewhat.

A second situation where toxics trading might work would be analogous to the CAA offset policy. If a refining company wants to build a new refinery or expand an existing refinery on a water quality-limited stream, it would need to find a trading partner from among the existing dischargers in that stream segment that would agree to reduce its discharge of the pollutant. In both of these examples, the trade will be approved only if the buyer's revised waste load allocation is still protective of water quality standards.

In a study similar to this one, published over a decade ago, Davis (1983) concluded that some refineries might benefit from trading but that trading would require the involvement of other nonrefinery dischargers. He identified several potential receiving water bodies that might be good candidates for trading. He also concluded that if trading was to be viable, it would occur because it is in the interest of the nonrefinery sources. In the 13 years since that report was published, no reported trades involving refineries have occurred.

As water quality standards become increasingly stringent, particularly in areas covered under EPA's Great Lakes Water Quality Guidance (March 23, 1995; 60 FR 15366), there may be a stronger economic incentive for refineries to engage in trading.

Pretreatment Trading - Of all the energy industry segments evaluated in this report, only refineries are realistic candidates for pretreatment trading, since the other segments include few or no facilities that discharge to POTWs. Pretreatment trading for toxics is not constrained in the same manner as is point source trading for toxics; since the parameter of concern for a POTW with a pretreatment program is the total load of the toxic pollutant, not the individual loads or concentrations.

Anderson (1995) indicates that only a few POTWs receive effluent from more than one refinery, but that other industrial users of a POTW may discharge the same pollutants limited for refinery discharges. Anderson further suggests that since refineries have already made the investments needed to meet pretreatment standards, pretreatment trading will only be of interest to refiners if

- They can earn credits or receive payments by selling allowances to other industrial users; or

- Pretreatment standards are tightened or broadened to include additional pollutants.

Intraplant Trading - As discussed previously, only the iron and steel industry has a formal intraplant trading program that allows trading for technology-based limits. That trading program is built into the iron and steel industry ELGs. Over the past few years, EPA has revisited several industries with existing ELGs to determine the need to update them. The petroleum refining segment is one of the industries revisited by EPA. Kashmanian et al. (1995) reports that EPA officials estimate the feasibility of intraplant trading for the petroleum refining industry as small to medium, based on the number of refineries that have multiple outfalls and the likelihood that these outfalls discharge similar pollutants.

Davis (1983) suggests that the existing petroleum refining ELGs already promote informal intraplant trading. The ELGs calculate a single plant-wide limit for each regulated pollutant. The refinery can allocate its total loading to individual outfalls in whatever manner it chooses. Water quality-based limits could be applied to the facility as a whole or could be applied to individual outfalls. If the latter case is true, there may be some potential for intraplant trading of water quality-based limits.

Nonpoint Source Trading - Refineries could potentially trade with nonpoint sources of BOD, ammonia, or toxics in much the same manner as that described above for point/point source trades. In a point/nonpoint source trade, any allowances traded for by the refinery would come from nonpoint sources. One type of trade could result from the refinery paying for implementation of best management practices for controlling contaminated stormwater runoff from areas outside the refinery grounds, as long as the stormwater runoff contains the same pollutant that the refinery wanted to trade and is contributing to water quality impairment.

A second type of nonpoint source reduction project would involve remediating contaminated sediments in the stream segment adjacent to the refinery. Refineries are often located on heavily industrialized stream segments that have historically received large pollutant loads. It is not uncommon for the sediments in those segments to retain heavy loads of pollutants from an earlier era of less stringent pollution control. If those sediments are releasing pollutants back to the water column to the extent that they cause an impairment of water quality, sediment remediation might justify a trade.

Davis (1983) postulates that point/nonpoint trading may not be appropriate for BOD or ammonia discharges from refineries because both pollutants are nonconservative (they break down in the water column and are not always present in the same mass). The water quality impact of a steady, continuous release from the refinery is different from a transient release of the same quantity of the pollutants through stormwater runoff during wet weather.

Opportunities for Effluent Trading in the Distribution and Marketing Segment

Point/Point Source Trading - Many tank farms are small and discharge only stormwater runoff from containment areas that may be contaminated through small leaks or spills of petroleum products. Small tank farms typically have relatively simple NPDES permits. Although there are no ELGs for this segment, permit writers may set technology-based limits on oil and grease. Larger tank farms may have more complicated permits with limits on toxics, particularly if wastes like tank bottoms are authorized for discharge. In such instances, there may be opportunities for trading in ways similar to those described above for refineries.

Retail petroleum outlets like service stations also discharge contaminated runoff, but generally, have not been required to obtain NPDES permits. Consequently, they are not candidates for trading.

Pretreatment Trading - Tank farms are normally direct dischargers. Therefore, no opportunity exists for pretreatment trading.

Intraplant Trading - Little information is available about the number of tank farms that have water quality-based limits at more than one outfall. If such facilities exist, they could potentially trade allowances between outfalls.

Nonpoint Source Trading - If tank farms have water quality-based limits in their permits, they could potentially trade with nearby point sources. The examples given for possible refinery nonpoint trades also apply here.

Other Oil and Gas Industry Trading Opportunities

Many oil and gas industry activities occur in areas that could disturb or destroy wetlands. In particular, exploration and production activities in the coastal and onshore subcategories and pipeline construction projects may be located in areas containing wetlands. Such activities may benefit from wetlands mitigation banks.

Chapter 6 - Feasibility of Trading for the Electric Power Industry

Introduction

The U.S. electric power industry consists of nearly 2,000 units generating about 570,000 megawatts of power. The largest waste stream at most power plants is the cooling water flow. About 44% of generating capacity is cooled by once-through cooling water and about 50% is cooled by such closed-cycle systems as cooling towers, cooling lakes, and cooling ponds (EEI 1996). Most plants using once-through cooling systems discharge hundreds of millions to billions of gallons per day of cooling water after it passes through condensers. Closed-cycle cooling systems circulate heated water from the condensers to the cooling structure and then back to the condensers. Cooling tower systems discharge a blowdown stream to avoid buildup of natural water constituents that have been concentrated through evaporation. Because cooling ponds and lakes are large, open bodies of water, they do not operate with a blowdown.

The ELGs for the steam electric power industry (40 CFR 423) contain limits on chlorine in once-through cooling water and limits on chlorine, chromium, and zinc in cooling tower blowdown. Cooling tower additives containing priority pollutants other than chromium or zinc may not be discharged. The ELGs place limits on TSS, oil and grease, and pH for low volume wastes (a variety of types of power plants waste streams) and ash transport water. Chemical metal cleaning wastes are subject to limits on TSS, oil and grease, pH, copper, and iron. Coal pile runoff is subject to limits on TSS. The ELGs acknowledge that some of these waste streams may be combined for treatment and authorize the permit writer to combine the ELG allowances from different waste streams. Power plant waste streams contain metals and some organics that could be subject to water quality-based limits.

Opportunities for Effluent Trading

Point/Point Source Trading - Chapter 4 pointed out that few power plant permits to date have included water quality-based limits except for limits on temperature and chlorine (only those chlorine limits that are stricter than the ELG limits). Neither of these pollutants are good candidates for trading because they are nonconservative pollutants. Potential trading partners for temperature include other industries with large volumes of cooling water flows (e.g., the pulp and paper, iron and steel, and other primary metal processing industries), although typically their cooling water flows are one or more orders of magnitude smaller in volume than power plant cooling water flows. A potential trading partner for chlorine would be a sewage treatment plant.

In recent years, permit writers are placing greater emphasis on toxics and consequently, power plant permits are beginning to be issued with water quality-based limits for toxics. In once-through cooling systems, no pollutants are intentionally added to the cooling water, but incidental leaching of the condenser material, which often contains copper, can occur. Some permit writers are including water quality-based limits on copper or other metals in cooling

water flows. Because EPA's chronic water quality criteria for copper are very low, water quality-based limits for copper can be quite low. It is impractical to treat the huge volume of once-through cooling water to reduce copper concentrations. It is possible that a power plant could find another discharger that has copper in its discharge that would agree to remove more copper than it would otherwise be required to remove and trade with the power plant. This type of trading scenario could also be applied for other toxic pollutants subject to water quality-based limits.

The previous chapter outlines some of the complicating factors of trading for toxics, particularly the need to ensure that neither trading partner ends up with a revised waste load allocation that allows exceedance of water quality standards outside of the designated mixing zone. As water quality standards become stricter over time, particularly in programs like the Great Lakes Water Quality Guidance, point source trading may play a useful role in meeting water quality-based limits.

Pretreatment Trading - Most power plants do not discharge industrial wastewater to POTWs. A few plants, located in urban areas, may discharge to POTWs. Pretreatment trading could possibly be used by such plants, although the opportunities appear to be limited.

Intraplant Trading - Over the past few years, EPA has revisited several industries with existing ELGs to determine the need to update them. The electric power industry is one of the industries revisited by EPA. Kashmanian et al. (1995) reports that the feasibility of intraplant trading for the electric power industry is unclear because of the types of discharges from power plants. Davis (1983) indicates that an intraplant bubble comparable to that used in the iron and steel industry offers few advantages for power plants.

Many power plants treat all industrial waste streams, other than cooling water flows, in a centralized treatment system. By combining waste streams for treatment, limits can be set using the building block approach described in Chapter 3. This accomplishes intraplant trading on a *de facto* basis.

Nonpoint Source Trading - Power plants could potentially trade with nonpoint sources for metals. The examples of nonpoint source trading partners given for refineries — control of off-site contaminated stormwater runoff and remediation of contaminated sediments — would also apply for power plants. Any trades for toxics must be structured to avoid exceedances of water quality standards outside of the power plant's mixing zone.

Other Electric Power Industry Trading Opportunities

Electric power industry facilities other than power plants may encounter the need to dredge or fill wetlands. Linear projects like power line corridors often pass through pockets of wetlands that must be temporarily or permanently filled. Such projects can be expedited through the use of wetlands mitigation banks.

VEPs have been instrumental in resolving complicated debates over fisheries impacts caused by cooling water intakes. One example with which the author is personally familiar involves the Chalk Point power plant located on the tidal Patuxent River in Maryland. To comply with state regulations implementing §316(b) of the CWA, Potomac Electric Power Company (PEPCO) conducted extensive studies of the impingement and entrainment of aquatic organisms through the plant's cooling water intake structure. The nonregulatory state power plant oversight agency [Maryland Department of Natural Resources (DNR)] conducted comparable studies to verify the utility's findings. Both sets of studies showed that eggs and larvae of the bay anchovy, a noncommercial species of fish, were being entrained and presumably destroyed. But for over a decade, the DNR and PEPCO developed widely different conclusions on the magnitude and impact of the entrainment loss.

In 1990, the DNR, the state NPDES agency (Maryland Department of the Environment - MDE), and PEPCO reached an agreement under which PEPCO would continue to operate aquaculture facilities to produce striped bass and yellow perch. PEPCO also agreed to remove instream barriers to migratory fish. The MDE agreed to issue an NPDES permit and the associated §316(b) cooling water intake variance for the Chalk Point plant. PEPCO's willingness to conduct the VEP was instrumental in ending the long-running debate over the magnitude of the fisheries impact. The VEP directly contributed to increased populations of commercially and recreationally desirable fish species.

In this example, both the state and the utility benefitted. The state was able to move on from a prolonged, expensive, and inconclusive series of studies and show some environmentally beneficial results. By offering to conduct the VEP, PEPCO avoided potential costs from (a) additional studies on cooling water intake impacts; (b) litigation, if the state proposed a permit requiring expensive cooling water system improvements; and (c) cooling water system improvements, if the state proposed such improvements and subsequent litigation was unsuccessful.

Another example of a recent VEP involves the Salem power plant, which sought to withdraw 3 billion gallons per day of water from the Delaware River for cooling. Regulatory agencies and environmental organizations were concerned that impingement and entrainment associated with the large intake could have potential future impacts on fisheries in the Delaware River estuary. In 1990, the New Jersey Department of Environmental Protection (NJDEP) released a draft permit that would have required cooling towers to be constructed at the Salem plant. Public Service Electric and Gas Co. (PSE&G), the owners of the Salem plant, prepared a comprehensive voluntary program to improve various aspects of fisheries in the estuary in lieu of constructing the cooling towers⁴. In 1994, NJDEP approved the program and issued an NPDES permit for the Salem plant. The program includes

⁴ Personal communication between Marcia Walton, Public Service Electric and Gas Co., Hancocks Bridge, NJ, and John Veil, Argonne National Laboratory, Washington, DC, on September 16, 1996.

- Remediation of more than 32 square miles of wetlands;
- Construction of fish passageways at dams in tributaries to the Delaware estuary;
- Enhancement of the existing biological monitoring program in the estuary;
- Installation of modern intake screens; and
- Investigation of technology that uses sound as a fish deterrent near cooling water intakes (BNA 1996b).

As in the PEPCO example, both the state and the utility benefitted from the VEP. The state was able to avoid expensive litigation and was able to show some environmentally beneficial results. Although the VEP is estimated to cost PSE&G in excess of \$100 million, it was far less expensive than construction of cooling towers, which are estimated at more than \$1 billion.

This report has focused on energy industry facilities as buyers of allowances, although conceivably energy industry facilities could also be sellers. The electric power industry is different from the other energy industries in that it is regulated by state Public Utility Commissions; however, this may change as the industry is presently undergoing deregulation. Some authors have postulated that utilities that engage in trading as sellers of allowances may have to rebate the proceeds to ratepayers, thereby reducing their incentive to trade at all (Bailey et al. 1993; Anderson 1995).

This report does not consider cross-media trades since EPA has not formally supported that possibility yet. If cross-media trading becomes available in the future, the NO_x emissions from power plants would represent a useful trading commodity for water-based nutrient trades (Bailey 1996).

Chapter 7 - Feasibility of Trading for the Coal Industry

Introduction

In the 1990s, coal is being mined in over half the states in this country. The primary waste stream from underground coal mines is groundwater, contaminated by contact with the coal and other underground formations, that seeps into the mine works. This water is pumped from the mine to the surface, where it is treated and discharged to nearby surface waters. Stormwater runoff that becomes contaminated by contact with such surface facilities as storage piles and coal transfer areas is also treated and discharged. The waste streams for surface coal mining are the same, but since the active working areas of surface mining sites are exposed to the weather, contaminated stormwater runoff from the mine and the surrounding yard and storage areas are the main waste streams. Groundwater that seeps into the working pit is also pumped out for treatment and discharge.

Coal preparation or processing plants may be located at the mine site or elsewhere in the mining region. At preparation plants, raw coal is cleaned and processed to separate the coal from impurities. It may be crushed to a smaller chunk size at the preparation plant. The waste streams from preparation plants are washing wastewater and stormwater contaminated by coal piles, transfer areas, and dust from the crushing operations. These waste streams are treated separately or are combined with mining wastewater for treatment and surface discharge.

EPA's ELGs for the coal mining industry contain limits for four subcategories: (a) coal preparation plants and coal preparation plant associated areas; (b) acid or ferruginous mine drainage; (c) alkaline mine drainage; (d) and post-mining areas. The ELGs require limits on iron, manganese, TSS, and pH for the first two of these subcategories. For the alkaline mine drainage subcategory, limits are required for iron, TSS, and pH. Under the post-mining areas subcategory, the ELGs require limits on iron, manganese, TSS, and pH for drainage from underground mines and limits on settleable solids and pH for reclaimed areas of surface mines.

In addition to the four subcategories, the ELGs offer two other important provisions. The first such provision is alternative limits that supersede the regular limits during storm events. The second provision states that if waste streams from one subcategory are commingled with those of another subcategory before treatment and discharge, the concentrations in the combined waste stream must meet the most stringent limits of any of the subcategories represented in the discharge.

Discharges from coal mines and preparation plants may contain metals other than iron and manganese, sulfate, and some organic chemicals.

Opportunities for Effluent Trading

Point/Point Source Trading - As noted in Chapter 4, one coal mining state, Maryland, rarely imposes water quality-based limits on mines. In the event that a coal facility does have water quality-based limits in its permit, trading may be possible. Most coal mines, at least in the Appalachian region, are located in rural and often mountainous areas that are not conducive to location of other large industrial facilities. Consequently, the primary available point-source trading partners for mines will be other mining facilities, either mines or preparation plants. If two coal mining operations in the same watershed have water quality-based limits for the same pollutant, they may be able to trade with one another, provided that the concentration of the traded pollutant at the edge of the buyer's mixing zone does not exceed state water quality standards.

Pretreatment Trading - Few, if any, coal mining or preparation facilities discharge to POTWs. Therefore, pretreatment trading is not a likely option.

Intraplant Trading - The concept of intraplant trading for technology-based limits is already built into the coal industry ELGs. The ELGs allow waste streams from mining activities, preparation plants, and post-mining areas to be combined before discharge, with the final limits based on the most stringent set of limits for any of the included waste streams. Davis (1983) postulates that this language could even be used to allow interplant trades. However, since the limits for the various subcategories under the coal industry ELGs are so similar, little would be gained from this form of intraplant trading.

Nonpoint Source Trading - There may be some valuable opportunities for point/nonpoint trading in the coal industry. Coal has been mined in the eastern United States for several centuries, but for most of that time, coal mining practices have not been kind to the environment. Throughout much of the Appalachian mining region, streams are suffering water quality impairment from the effects of nonpoint source drainage from old abandoned underground or surface mines.

The Surface Mining Control and Reclamation Act of 1977 (SMCRA) brought firm controls over active surface coal mining and established an abandoned mine lands (AML) reclamation program funded by a fee on each ton of coal mined. The AML fund does not and will not contain sufficient resources to reclaim all AMLs.

Remining — mining again at a previously mined site with environmental problems — has the potential to eliminate or mitigate those water quality problems at many AMLs while recovering additional coal resources. In a remining job, an operator goes into an old mine site that had been abandoned years ago and recovers additional coal reserves from the mine. In the process, the operator eliminates or reduces the amount of uncontrolled acid mine drainage from the abandoned mine.

Remining holds a great deal of potential for coal operators, but even more promise as a means to clean up abandoned mines at no cost to the public. Unfortunately, there are several barriers to wider use of remining (Veil 1993). One of the most important barriers to remining is the permit-blocking language of SMCRA §510(c) that prohibits issuance of a surface mining permit to an operator if any job under its control is in violation of any permit required for the job. If an operator begins remining a site, and encounters water quality conditions that it cannot treat either technologically or economically, it is in violation of its NPDES permit and therefore the CWA. This triggers section 510(c) which permanently blocks the operator or any other company in which it has control from obtaining any future mining permits. If the violation of the NPDES permit is caused by an unanticipated event or condition, however, the blocking provisions do not go into effect.

A second important barrier is caused by §301(p) of the CWA, which allows a modification to technology-based permit limits for coal remining jobs but does not permit any exceedance of state water quality standards. Most sites with pre-existing discharges have a low pH. States have pH standards that are generally in the range of 6.0-9.0 or 6.5-8.5. §301(p) would allow relaxation of the ELG-based pH limit but would prohibit relaxation of a water quality-based limit for pH. It may be very difficult and expensive for an operator to treat pre-existing discharges to meet the state standards. If relief is not available from the pH requirements, the operator may not be willing to undertake the remining project.

One method of dealing with this issue is to develop site-specific or stream segment-specific water quality standards. Another method relies on a provision contained in most state water quality standards. This provision allows the standard to be made less restrictive if the water quality of a stream segment is naturally of lower quality in that segment. In some coal producing regions, the water quality has been degraded for many years due to past mining activities, and the state is able to make the argument that the degraded conditions are the "natural" conditions.

Coal remining can be implemented as a conventional point/nonpoint source trade or can be made attractive to operators using other types of incentives. One way in which coal remining could be implemented as a point source/nonpoint effluent trade is outlined in the following example. An abandoned mine is releasing nonpoint source acid mine drainage to a stream, causing the pH to be 3.0. No aquatic life can survive in the stream. An operator applies to remine the site. Normally a coal mining discharge would have to fall within a pH range of 6.0-9.0 and may be made more restrictive to meet the state water quality standard range of 6.5-8.5. The operator is uncertain about the hydrology of the abandoned site and fears that it may not be possible to economically meet a pH of 6.0. The operator negotiates a trade with the permit writer to receive an alternate pH range of 5.0-9.0. After excavating the old mine, the operator finds that it can only raise the pH of the discharge from the remined site to 5.3, resulting in an instream pH of 5.1. The discharge would have violated the normal pH limit, but complies with the alternate "traded" pH limit. The stream pH is raised from 3.0 to 5.1 and some aquatic life is able to survive. In this type of trade, the environment receives net

improvement and the operator is given less stringent permit conditions that are economically achievable.

Other Coal Industry Trading Opportunities

Another type of trade that could result from remining is not true effluent trading, but is more akin to a VEP. There are various incentives that can be offered to operators to encourage them to remine abandoned mines and improve water quality. Among the incentives considered by Veil (1993), a mining regulatory agency could

- Relax reclamation standards;
- Assist operators with collecting background water quality data to characterize a potential remining site;
- Reduce the frequency or duration of background monitoring requirements;
- Relax bonding requirements, including providing early bond release for remining sites; and
- Waive AML fees for each ton of coal mined from remining sites.

Like the other energy industries, the coal industry could benefit from wetlands mitigation banking where mining activities require filling or dredging of wetlands.

Chapter 8 - Conclusions

- EPA is enthusiastically promoting effluent trading as an economic incentive for CWA programs. Effluent trading may have great potential for POTWs or industry sectors that discharge nutrients, but even EPA expresses doubts over the potential for trading for toxic pollutants.
- EPA has administered emission trading programs in its air quality program for many years. Programs for offsets, bubbles, banking, and netting are supported by federal regulations, and the 1990 CAA amendments provide a statutory basis for trading programs to control ozone and acid rain. Different programs have had varying degrees of success, but few have come close to meeting EPA's expectations.
- In the water arena, neither the CWA nor the federal regulations have established formal effluent trading programs except for the intraplant bubbling allowed for the iron and steel industry. A few isolated programs have been developed at the state or local level and have had limited success.
- Effluent trading appears to have limited potential for the oil and gas industry's exploration and development and distribution and marketing segments.
- There may be some potential for point source/point source trades for toxics in the petroleum refining segment, for power plant cooling water, and at coal mines, provided that (a) suitable trading partners are available; (b) the costs to obtain allowances are sufficiently lower than the costs to meet limits through treatment or process changes, to induce the buyer to give up some control over its compliance destiny; and (c) resulting limits will not cause violations of state water quality standards outside of designated mixing zones.
- The only energy industry with any potential for pretreatment trading is the petroleum refining segment. Refineries could be either buyer or sellers depending on the conditions of the trade.
- Intraplant trading is already being informally used through the design of several energy industry ELGs. Under the petroleum refining ELGs, a single, plant-wide set of limits is established. The operators can meet those limits through any combination of individual or centralized treatment processes. The ELGS for the electric power and coal industries anticipate that individual waste streams may be combined before treatment and provide limited guidance on how to set limits under those circumstances.
- Nonpoint source trading has a moderate potential for refineries and power plants, assuming the three conditions described above — suitable trading partners, large cost savings, and ability to meet water quality standards — can be met. Nonpoint source

trading, in the form of re-mining abandoned mines that are causing water quality impairment, has great potential for the coal industry.

- There is good potential for other types of water-related trades that do not directly involve effluents. Examples of these types of trades include habitat trades allowed through wetlands mitigation banking and fisheries mitigation realized through VEPs. Wetlands mitigation banking can save time and costs for projects that need to dredge or fill existing wetlands. Banks would be valuable to the exploration and production segment, the coal industry, and for the construction of pipe line and power line corridors. Several electric power utilities, after offering to conduct VEPs, have been able to expeditiously conclude permit negotiations. Had the negotiations continued, the final permits could potentially have cost the utilities millions of dollars more in additional study costs or in requirements to construct expensive cooling system modifications.
- The potential for effluent trading in the energy industries and in other sectors would be enhanced if Congress amended the CWA to formally authorize trading.

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**APPENDIX A—EFFLUENT TRADING IN WATERSHEDS
POLICY STATEMENT**

EFFLUENT TRADING IN WATERSHEDS POLICY STATEMENT

Purpose

In response to President Clinton's *Reinventing Environmental Regulation* (March 1995), EPA strongly promotes the use of effluent trading to achieve water quality objectives and standards. This statement communicates EPA's policy on effluent trading in watersheds, discusses the benefits of trading, presents an explanation of several types of effluent trading, and outlines how EPA will be encouraging trading. This policy is Agency guidance only and does not establish or affect legal rights or obligations. It does not establish a binding norm and is not finally determinative of the issues addressed. Agency decisions in any particular case will be made by applying the law and regulations on the basis of specific facts when permits are issued.

Policy

EPA will actively support and promote effluent trading within watersheds to achieve water quality objectives, including water quality standards, to the extent authorized by the Clean Water Act and implementing regulations. EPA will work cooperatively with key stakeholders to find sensible, innovative ways to meet water quality standards quicker and at less overall cost than with traditional approaches alone. EPA will assure that effluent trades are implemented responsibly so that environmental progress is enhanced, not hindered.

Benefits

EPA's support of watershed-based trading is anchored to a strong commitment to achieve and maintain water quality standards. EPA believes that trading is an innovative way for community stakeholders (e.g., regulated sources, non-regulated sources, regulatory agencies and the public) to develop more "common sense" solutions to water quality problems in their watersheds. Effluent trading potentially offers a number of economic, environmental and social benefits:

Economic Benefits:

- Reduces costs for individual sources contributing to water quality problems.
- Allows dischargers to take advantage of economies of scale and treatment efficiencies that vary from source to source.
- Reduces overall cost of addressing water quality problems in the watershed.

Environmental Benefits:

- Achieves equal or greater reduction of pollution for the same or less cost.
- Creates an economic incentive for dischargers to go beyond minimum pollution reduction and also encourages pollution prevention and the use of innovative technologies.
- Can reduce cumulative pollutant loading, improve water quality, accommodate growth and prevent future environmental degradation.
- Can address the broader environmental goals within a trading area, e.g., ecosystem protection, ecological restoration, improved wildlife habitat, endangered species protection, etc.

Social Benefits:

- Encourages dialogue among stakeholders and fosters concerted and holistic solutions for watersheds with multiple sources of water quality impairment.

Explanation of Different Types of Effluent Trading

Trading supplements the current regulatory approach. It is a method to attain and/or maintain water quality standards, by allowing sources of pollution to achieve pollutant reductions through substituting a cost-effective and enforceable mix of controls on other sources of discharge. As the Agency improves its understanding of the opportunities afforded by watershed-based decision making, EPA will provide information for additional forms of trading.

To take advantage of trading, a point source must be in compliance, and remain in compliance, with applicable technology-based limits. Intra-plant trades must also have a technology-based floor, while the technology floor for pretreatment trading is determined by the categorical standards. EPA expects that most trades will be covered by Total Maximum Daily Loads (TMDL) or similar watershed-based analysis.¹

The items to be traded are the pollutant reductions or water quality improvements sought. Under trading, a source that can more cost-effectively achieve greater pollutant reduction than is otherwise required would be able to sell or barter the credits for its excess reduction to another source unable to reduce its own pollutants as cheaply. To ensure that water quality standards are met

¹ A TMDL provides the water quality analysis and planning process for determining the specific pollution reductions that are necessary to attain or maintain water quality standards. Under section 303 (d) of the CWA, States establish TMDLs for impaired waters. The TMDL process includes legal requirements for public participation and implementation through NPDES permits.

throughout a watershed, an equivalent or better water pollutant reduction would need to result from a trade. Below are proposed definitions for several different types of effluent trading approaches. These definitions are preliminary and do not reflect the full range of feasible trades:

Intra-Plant Trading:

A point source is allocated pollutant discharges among its outfalls in a cost-effective manner, provided that the combined permitted discharge with trading is no greater than the combined permitted discharge without trading in the watershed.

Pretreatment Trading:

An indirect industrial point source(s) that discharges to a publicly owned treatment works arranges, through the local control authority, for additional control by other indirect point sources beyond the minimum requirements in lieu of upgrading its own treatment for an equivalent level of reduction.

Point/Point Source Trading:

A point source(s) arranges for other point source(s) in a watershed to undertake greater than required control in lieu of upgrading its own treatment beyond the minimum technology-based treatment requirements in order to more cost-effectively achieve water quality standards.

Point/Nonpoint Source Trading:

A point source(s) arranges for control of nonpoint source discharge(s) in a watershed in lieu of upgrading its own treatment beyond the minimum technology-based treatment requirements in order to more cost-effectively achieve water quality standards.

Nonpoint/Nonpoint Source Trading:

A nonpoint source(s) arranges for more cost-effective control of other nonpoint sources in a watershed in lieu of installing or upgrading its own control.

How EPA Will Be Encouraging Trading

EPA is developing a framework for watershed-based effluent trading, as well as information exchange workshops, and limited technical assistance for trading projects in specific areas. Watershed-based trading will be implemented on a voluntary basis under existing Clean Water Act (CWA) authorities. There will be substantial public outreach effort to obtain stakeholders' recommendations and insights on draft portions of the framework prior to implementation.

Finally, while EPA believes that the potential of trading is largely untapped, the usefulness of