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The Feasibility of Effluent Trading in the Oil and Gas Industry

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The Feasibility of Effluent Trading in the Oil and Gas Industry*

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ABSTRACT

In January 1996, the U.S. Environmental Protection Agency (EPA) released a policy statement endorsing wastewater effluent trading in watersheds, hoping to promote 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 paper evaluates the feasibility of effluent trading for facilities in the oil and gas industry. The evaluation leads to the conclusion that potential for effluent trading is very low in the exploration and production and distribution and marketing sectors; trading potential is moderate for the refining sector except for intraplant trades, for which the potential is high. Good potential also exists for other types of water-related trades that do not directly involve effluents (e.g., wetlands mitigation banking). The potential for effluent trading in the energy industries and in other sectors would be enhanced if Congress amended the Clean Water Act (CWA) to formally authorize such trading.

INTRODUCTION

Environmental release trading occurs when one pollutant source that is able to remove more of the pollutant than is required, trades the excess allowance of the pollutant to a second pollutant source, which then 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 waterborne pollutants have been undertaken. In January 1996, the

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U.S. Environmental Protection Agency (EPA) released a policy statement endorsing effluent trading in watersheds, hoping to promote additional interest in the subject. 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 (1).

TRADING UNDER THE CLEAN AIR ACT

Emissions trading has been allowed under the Clean Air Act (CAA) since the 1970s through a variety of mechanisms (2, 3, 4, and 5). 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 keeping pollutant emissions below its legal baseline level.

The 1990 CAA amendments established the Acid Rain Program to reduce emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x), the primary causes of acid rain, through an allowance trading program. Each covered source receives a specific number of allowances, each of which authorizes the source to emit one ton of SO_2 during a particular year. 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 either from other sources that have excess allowances or through EPA-sanctioned fixed sales or auctions. Sources that are able to reduce their actual SO_2 emissions below their allowances can sell the excess allowances or save them for future use. The NO_x reduction program is much more restrictive than the SO_2 reduction program.

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 promulgated as part of the effluent limitations guidelines (ELGs) for the iron and steel industry (40 CFR 420).

Appendix C to EPA's draft framework document (1) summarizes 26 existing or potential effluent or wetlands trading programs. Seven of these trades involve wetlands, 13 involve nutrients, and 7 involve some other pollutant or parameter.

Wetlands Trading

Wetlands trading programs, such as wetlands mitigation banks, make good sense in many situations. Although several bills have been introduced in Congress during the last few years that would formally sanction mitigation banking none has passed. Within a watershed, a mitigation bank could provide a large area of contiguous wetlands acreage that could be professionally managed, rather than having numerous small, isolated patches of wetlands less amenable to management. Such mitigation banks can be cost-effective for entities needing to drain or fill existing wetlands as part of a construction project.

Despite 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. Instead, 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, nutrient trading with partners can be allowed over greater distances within watersheds.

Several examples of nutrient trading programs have been well documented: Tar-Pamlico River Basin, North Carolina; Dillon Reservoir, Colorado; Cherry Creek Reservoir, Colorado; and Chatfield Basin, Colorado (2, 3, and 6). Although programs are in place or are planned for these watersheds, the level of trading to date has been low.

Trading for Other Pollutants

Although reference 1 describes a variety of other existing or hypothetical trading programs, very few actual trades have occurred 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. Also, trades for biochemical oxygen demand (BOD) have occurred in the Fox River Basin, Wisconsin (2 ,3, and 6) and in the Minnesota River Basin, Minnesota (7).

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". This means that, 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 adoption of revised bubble language on May 17, 1984 (49 FR 21028).

Other Types of Informal Water-Related Trades

Some of the formal trading programs either for effluents or for wetlands are described above. Other types of informal trading programs exist that are probably equally important in terms of costs savings and of practicing the principles of trading that are less well-publicized. These programs are described below.

Centralized Wastewater Treatment: Many large industrial facilities are governed by ELGs that have specific limits for several different processes. However, the facilities pipe all or most of their wastewater from different processes to a centralized treatment plant. Because 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 of the processes that contribute wastewater to the centralized treatment plant. The permits place pounds-per-day limits on each pollutant on the basis of 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. Hundreds of NPDES permits may 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.

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 by conducting 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 analogous to wetland mitigation banking, SEPs cannot be construed as trading.

Other Issues

One reason that water trading programs have not proliferated is that no language in the CWA establishes or authorizes 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.

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 oil and gas industry discharger. Nonpoint

source/nonpoint source trades are not considered in this paper because the facilities evaluated 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 discharging facility. 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 oil and gas industry 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.

Although few oil and gas 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. For permits developed after that time, greater emphasis is placed on toxics. Reference 8 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 with permits issued in the 1980s.

Type of Pollutants Traded

For trading of pollutant allowances to occur, the pollutant must be subject to a water quality-based limit, meaning 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 effluent trading programs have involved nutrient trading. Other than petroleum refineries, facilities in the oil and gas industry do not discharge large quantities of nutrients and consequently are not candidates for nutrient trading. Although refineries could potentially engage in nutrient trades, the only type of pollutant realistically suitable for trading in the industry is toxics.

Toxics trading presents unique problems. The water quality impacts from nutrients are not specific to a place or a time, but instead 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. This situation limits the opportunities for toxics trading.

Trading Partners

To trade effluent allowances, a company must find a trading partner within the same watershed that also discharges the pollutant for which a trade is desired and that is willing to engage in a trade. Reference 1 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.

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 industry, 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 then accept wastewater from other nearby companies, trading with the same industry may not work.

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

EFFLUENT TRADING OPPORTUNITIES IN THE OIL AND GAS INDUSTRY

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. Reference 2 discusses in detail the feasibility of effluent trading for the oil and gas industry; the key points are summarized below.

Exploration and Production Segment

The two major waste streams associated with the exploration and production segment are drilling wastes and produced water. With the exception of offshore facilities and very small onshore facilities, EPA's ELGs dictate zero discharge of drilling wastes and produced water. The current round of permits for offshore locations includes water quality-based limits for several toxic pollutants.

Mixing zones are used in calculating limits for toxics. 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)]. 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.

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 streams 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 divided into five subcategories -- topping, cracking, petrochemical, lube, and integrated. For all five subcategories, limits 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). Refinery wastewater includes other organics and metals and cyanide in addition to the pollutants limited by the ELGs.

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 were limited, trades could be made with other nearby POTWs or industrial sources. Problems are possible 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.

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.

As part of the permitting process, permitting agencies are required to develop a total maximum daily load (TMDL) of a pollutant that a stream segment can tolerate without exceeding water quality standards. When a TMDL is developed, each point source discharger of that pollutant within the segment 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 ended up with a revised waste load allocation that allowed 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 depend on the cost savings to both parties and the ability of the buyer to demonstrate that it could meet water quality standards after the trade.

Isolated instances may occur when trading for toxics could work. In the first situation, a refinery's waste load allocation of a pollutant is set at a level lower than it would otherwise need to be because of the presence of significant concentrations of that 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 correspondingly increased.

A second situation where toxics trading might work could be when a refining company wanted to build a new refinery or expand an existing refinery on a water quality-limited stream. Before getting permission to start, the company 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 would be approved only if the buyer's revised waste load allocation was still protective of water quality standards.

Refineries that discharge to POTWs may be able to take advantage of pretreatment trading. Pretreatment trading for toxics is not constrained in the same manner as is point source trading for toxics, because 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.

The existing petroleum refining ELGs already promote a form of intraplant trading. The ELGs calculate a single plantwide limit for each regulated pollutant. The refinery can allocate its total loading to individual outfalls in whatever manner it chooses.

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's 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 such stream 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.

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). EPA has not developed ELGs for tank farms. 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 no ELGs are established 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 such as tank bottoms are authorized for discharge. In such instances, opportunities may exist for trading in ways similar to those described above for refineries.

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

Other Oil and Gas Industry Trading Opportunities

Many oil and gas industry activities occur in areas wetlands could be disturbed or destroyed. 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.

CONCLUSIONS

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 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. 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 of trading for toxic pollutants.

For the oil and gas industry, effluent trading appears to have limited potential for the exploration and development and distribution and marketing segments. However, some potential may exist for point source/point source trades for toxics in the petroleum refining segment, provided that (1) suitable trading partners are available, (2) 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 (3) resulting limits will not cause violations of state water quality standards outside of designated mixing zones. This same potential may apply to other industrial categories that attempt to set up trades for toxic pollutants.

The only oil and gas industry sector with any potential for pretreatment trading is the petroleum refining sector. 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 the petroleum refining ELGs, under which a single, plantwide set of discharge limits is established. The operators can meet those limits through any combination of individual or centralized treatment processes.

Nonpoint source trading has a moderate potential for refineries, assuming that the three conditions described above – suitable trading partners, large cost savings, and ability to meet water quality standards – can be met.

Good potential exists for other types of water-related trades that do not directly involve effluents. Wetland mitigation banking can save time and costs for projects that need to dredge or fill existing wetlands. Banks would be valuable for the exploration and production segment and for the construction of pipe line and power line corridors.

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

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