Topic Category: Planning for Compliance

Title of Paper: Planning for NPDES Permit Compliance to meet Changing Stream Standards at Los Alamos National Laboratory.

ABSTRACT

The Clean Water Act, as amended in 1987, increased statutory mechanisms for tightening discharge standards. The original 1972 Act made technology-based effluent limitations the nationwide minimum, or base-level treatment. The 1987 Amendments added Section 304(l) requiring that each State identify its waters where the application of technology-based effluent limitations has not resulted in the achievement or attainment of adequate water quality needed to protect the uses of the water that the State has designated.

In New Mexico, the application of water quality based effluent limitations in NPDES Permit has only recently begun, as the pre-1987 technology-based permits are expiring and permittees are attempting to renew their permits. Water quality standards and water quality-related effluent limitations can require levels of treatment considerable higher than those required by technology-related effluent limitations. The Clean Water Act does not set specific minimums for state standards, instead the regulations require that such standards specify and protect appropriate water uses (e.g., water supply, fisheries, wildlife, irrigation and recreation) and set specific numerical criteria where possible to attain these ends. The 1993 New Mexico Triennial Review of Water Quality Standards exemplified the stricter future for NPDES discharges with the Environment Department's proposed "Wildlife Habitat" use designation and the associated standards needed to protect this use.

The Clean Water Act expressly permits the Environmental Protection Agency (EPA) to treat tribal governments in the same fashion as states. Once a tribe has achieved state status as described in the regulations, they may develop water quality standards applicable to the designated uses of waters within the reservation boundary. These standards will also apply to those discharges located upstream from tribal waters where the discharge could impact the quality of water under the jurisdiction of the tribal government.

Los Alamos National Laboratory (LANL) has begun an aggressive program to meet the more stringent effluents limitations of the future. The Laboratory's current NPDES Permit allows discharge of effluent from approximately 130 separate outfalls into ephemeral streams. Similar quality outfalls are grouped into eight categories with each category having set effluent limits. LANL's near-future compliance strategy includes outfall elimination through the consolidation of outfalls of the same category, and the elimination of non-essential discharges. Also, LANL is planning the development of managed wetlands as a means to improve the local riparian habitat, and to contain effluent discharges within the Laboratory boundary. The longer-term strategy calls for reducing effluent discharges to zero. Zero discharge will be achieved through land application/irrigation and conservation through effluent re-use with evaporation of non-reusable discharges. One reuse program is currently underway, where sanitary wastewater effluent is recycled and used in a number of cooling water applications. Other reuse options may include recycling once-through cooling water through a number of process.

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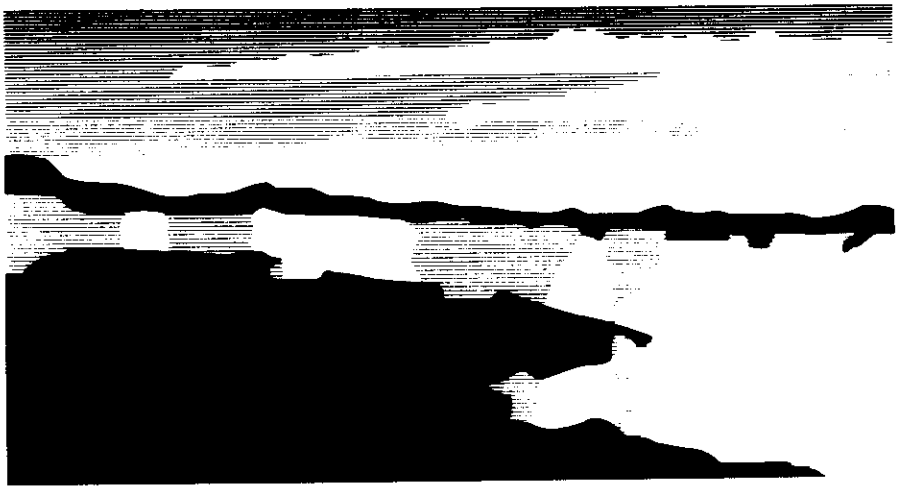

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** We prefer an oral presentation. **

Planning for NPDES Permit Compliance to Meet Changing Stream Standards at Los Alamos National Laboratory

Since 1990, Los Alamos National Laboratory (the Laboratory) has foreseen the future trend of Water Quality Standards in New Mexico through changing Conditions of State Certification of the Laboratory's NPDES Permit, and various proposed NMED and Indian Tribe water quality standards. These documents, whether in draft form or final form, strongly indicate the direction regulators are going in regard to Water Quality Standards. All indicators point to increasingly more stringent Water Quality Standards leading to increasingly more stringent effluent limits in National Pollution Discharge Elimination System (NPDES) Permits.

The Clean Water Act (originally legislated as the Federal Water Pollution Control Act of 1972) as amended in 1987 (33 U.S.C.A. 1251-1387), increased statutory mechanisms for tightening discharge standards and effluent limits applied to the NPDES Permits. NPDES Permits are required for all discharges of "pollutants" into navigatable waters of the United States as established in the CWA. The CWA generally applies to navigatable waters, broadly defined as "waters of the United States". Waters of the United States is defined to encompass most surface waters, including navigable waters, and their tributaries (including ephemeral tributaries), interstate waters, and intrastate waters that can affect interstate or foreign commerce (See 33 U.S.C.A. 1362(7) and 40 C.F.R. 122.2). The original Act provided for technology-based effluent limitations as the nation-wide basis for NPDES Permits limits. As the term "technology-based" implies, effluent limitations were established based on the best water treatment technology available at permit issuance.

The 1987 Amendments added Section 304(l) requiring each State to identify waters where the application of technology-based effluent limitations has not resulted in the achievement or attainment of adequate water quality needed to protect the uses of the water that the States had

designated under Section 303. Section 304(l) then requires that where non-attainment results from point source discharges of toxic pollutants, the State must determine which point sources are responsible and develop individual control strategies for each of these point sources to bring the water body into compliance with water quality standards. Section 303(c)(3)(B) requires the States to adopt numerical water quality standards for toxic pollutants, where possible. Section 302 authorizes EPA directly to establish effluent criteria more stringent than the applicable technology limits where necessary for the attainment or maintenance in a specific water body of water quality standards, based on protection of the various uses: "...public water supplies, agriculture, and industrial uses, and the protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water..."

These amendments of 1987 allow the State of New Mexico, qualified Indian Tribes and the EPA to impose considerably stricter effluent limits on an NPDES permittees than technology-based limits. This is especially true where a water body traditionally has poor water quality due to hydrogeology but with stringent water quality standards. Sections 301(b)1(c) and 302 provide the basic mechanisms to establish water quality standards. Though the procedures are quite complex under the regulations in 40 CFR 131, including public hearings and ultimate EPA approval of State water quality standards, there are few guidelines and no specific minimums for a State to follow in setting water quality standards. The language only directs the State to set standards and numerical criteria to protect appropriate water uses. And since water quality standards may not be violated through NPDES discharges, the State and the EPA must then set effluent limits in NPDES Permits which will not cause or contribute to standards violation. Where water quality standards are not met even without the addition of pollutants, then potentially, the CWA requires no (zero) discharge, unless extraordinary treatment technologies are used without regard to cost or environmental consequences.

In New Mexico, the application of Water Quality-based effluent limitations in NPDES Permits has only recently begun, as the pre-1987 "technology-based" permits are expiring and permittees are attempting to renew their permits. Water quality standards and water quality-related effluent limitations can require level of treatment considerably higher than those required by technology-based effluents.

The Act and the regulations give explicit direction for the procedures required to remove a use, however, little objective guidance is given to States or Indian Tribes on how to designate uses of waterbodies. The minimum requirements for water quality standards submission are found in 40 CFR 131.6. A State or Tribe need only base use designations of a specific water body consistent with the designations stated in CWA Section 101(a)(2) and 303(c)(2). A designated use need not be existing or even attainable (defined as attainable if the use can be achieved by the imposition of effluent limits required under Sections 303 and 306 of the Act). Under these vague directions, a State or a Tribe may designate uses of water bodies for water quality standards purposes which are not based on historic uses.

Furthermore, States are quite restricted in removing any use once the use is designated. In 40 CFR 131.10(g) the criteria for qualification of use removal is explained, which leaves complete discretion to the State. The removal process is extensive and expensive, thus further reducing the incentive for a State to remove uses designated which may virtually be impossible to achieve. The regulations explicitly state that "[a] State is not required to conduct a use attainability analysis ... whenever designating uses...." 40 CRF 131.10(k).

And though the regulations at 40 CFR 131.11 require that a State must base water quality criteria on "...sound scientific rationale..." no specific requirements are mentioned. The EPA has review authority over changes to stream standards made by a State, but the EPA usually defers to the State agency on the issue of the scientific rationale the State used to develop its criteria.

One approach which has been generally recognized as a model in setting water quality standards based on "... sound scientific rational..." is the Great Lakes Initiative published in Volume 58, No. 72, April 16, 1993 Federal Register. This broad directive includes a new use category of Wildlife Criteria and guidance on determining if and where such a use exists. The Great Lakes Initiative clearly states that this is EPA's first attempt at implementing the new use category, and their criteria are open for review and comment, though not necessarily open for adoption by States at this time. In this guidance, the use of aquatic based numerical standards was regarded by the EPA as the incorrect process for development of Wildlife Criteria. The EPA based their proposed Wildlife Criteria on harm currently being done to the environs of the region. They sited specific chemicals of concern, as well as specific species of concern, those most vulnerable and in need of extra protection.

An early NMED approach in developing "Wildlife Habitat" by establishing stringent standards based on protection of aquatic invertebrate has forced many permittees throughout the State to consider "zero discharge" of NPDES effluents. The drinking water supply of many communities will not meet proposed standards for discharge to dry arroyos, even if no pollutants were picked up during usage (copper is one such naturally occurring constituent in drinking water common in New Mexico). What would pursuit of this approach accomplish with respect to the State of New Mexico as a whole? Zero-discharge will essentially dry up established wildlife watering areas and wetlands existing below NPDES outfalls throughout the State (Silver City, Raton, Gallup and Las Cruces to name a few). In our arid State, properly treated effluent discharges to ephemeral streams and dry arroyos should be considered valuable resources that increase riparian lands and species diversity.

Zero discharge is not without environmental costs. Besides the obvious of eliminating New Mexico's effluent dependent ecosystems, physical facilities and land must be acquired. Large

amounts of currently non-developed land will be required for either land application use, or evaporation lagoons, as well as increased storage capacities for many municipalities. One estimate of the cost of zero discharge includes approximately $300 million of capital cost incurred by New Mexico municipalities, along with a cost of approximately $100 million for the purchase of water rights (needed to offset the lack of return flow available with zero discharge) and an additional $8 million for operation and maintenance costs per year (averaging out to about an $11.00 per month increase in residential sewer service charges). The treatment options to obtain zero-discharge include only limited options for re-use (irrigation of limited areas), evaporation and land application (generally this option is seasonal in nature, and may be subject to groundwater regulation). And, as mentioned above, water rights issues must be considered. Where a municipality owns water rights, usually ownership of rights for consumptive use is offset to a degree by the requirement that the municipality guarantee a certain amount of return flow back into the water supply. Many municipalities rely on NPDES permitted discharges for this return flow. Obviously, if zero-discharge becomes a reality, return flow cannot guaranteed, and more water rights would then have to be acquired. The additional water rights for municipalities would probably come at the expense of agricultural uses. One estimate shows that the loss could be as much as 1.0 million AFY, conservatively, which translates to approximately 500,000 acres of currently irrigated land taken out of service. An increase in cost of sanitary sewer service for the average New Mexican where some environmental benefit would occur would be worthwhile, but real benefits must be realized in improvements to fisheries, wildlife and recreation.

This trend toward zero discharge suggests that the economic Law of Diminishing Returns must be recognized, understood and dealt with by regulators, as well as environmental advocates. The Law of Diminishing Returns is a part of a fundamental rule of economics and cost-benefit analysis. The economic rule states that "...in all situations, the optimal outcome is the alternative that produces the greatest net benefit." Once the equilibrium point is reached, where the

marginal benefit equals the marginal cost, the Law of Diminishing returns predicts the outcome. Eventually a point is reached where maximum benefit is attained, and thereafter, each incremental rise in cost produces an incremental decrease in benefits.

During the infancy of environmental regulation, this economic theorem was easily ignored, or overlooked, since the equilibrium point had not been reached (benefits achieved were always greater than or equal to cost expenditures). However, as the theorem predicts, where equilibrium is found, any minute step in cost cannot be economically justified since there is no corresponding gain in benefits, in fact, as cost continue to rise, benefits level off, then decrease. In other words, perceived benefits from strict effluent limits are lost due to the higher and higher cost required to achieve the limits. In environmental terms, not only are permittees expending capital without a corresponding benefit, environmental costs are occurring through, for example, increased energy production, loss of efficiency, waste generation or even an increase in pollution in a different media.

As effluent limits become increasingly strict, the choices of treatment diminish. It is a concern of many water quality experts and environmental advocates that the impact of zero discharge will have more significant and detrimental affect on the local environs, than does the quality of most effluent today.

The following outlines the Laboratory's basic plan for NPDES Permit compliance to meet changing water quality standards.

Outfall Reduction

With the 43 square miles of land use, the Laboratory has developed as independent research facilities. For convenience and cost savings, effluent discharges of wastewater were basically

permitted from their origin, and each discharge kept distinct from others. The NPDES Permit currently contains approximately 130 separate and distinct outfalls, each with varying amounts of discharge, a few gallons per month, to thousands of gallons per day. And though each outfall is distinct in location, there are many of the same type. For example, the Laboratory currently has about 50 non-contact cooling water discharges (basically potable water of increased temperature) and about 30 treated cooling water discharges. The sheer number of outfalls have become expensive and difficult to manage, though the actual amount of volume per outfall is quite small. Almost 50% of all of the Laboratory's total discharge is treated sanitary effluent. Outfall reduction focuses on consolidation of like discharges, as a way to reduce the sheer number of outfalls that must be monitored. In some instances, the reduction in the number of outfalls will cause a reduction in the volume of effluent discharged, though emphasis on volume reduction can be achieved in other ways.

Effluent Reuse

Effluent reuse, besides reducing ultimate wastewater discharge, is a water conservation method. Treated sanitary effluent is used as make-up water for cooling towers and once-through cooling loops, or, as many municipalities today are doing, using effluent as an irrigation source for city-owned parks and other areas. The Laboratory currently reuses approximately 70% of treated sanitary effluent (about 375 AFY) for cooling water. Further reuse projects are being considered as well. Currently however, the water is eventually discharged under the Laboratory's NPDES Permit. Some reduction in effluent volume occurs, though the major benefit to reuse is conservation of water supply. Another consideration, especially for municipalities, is that the use of treated effluent for irrigation may require an NPDES Permit if the irrigation water or return flow enters a water course.

Managed Wetlands

Wetlands are nature's own water treatment system. At the Laboratory, and across New Mexico, many NPDES discharges create or add to existing riparian habitats. At the Laboratory, a number of effluent discharges create an effluent-dependent wetland areas, prior to eventual evaporation and transpiration. Wetland areas naturally improve the quality of the water flowing through the system. With some management, the natural treatment process can be increased and further refined. At the Laboratory, managed wetland areas are planned for a portion of NPDES effluent discharges, enhancing and improving wildlife habitats. Through a managed wetland system using existing wetland areas, and creating new wetlands, much of the present volume of effluent can be utilized for this purpose. However, this treatment method at the Laboratory will not satisfy zero discharge, since the wetland areas are considered waters of the State, and thus fall under the jurisdiction of the NPDES Permit Program.

Zero Discharge

If stream standards continue to follow current trends, then the final treatment option for the Laboratory becomes total evaporation to achieve zero discharge. All potentially dischargeable water will be collected in evaporation ponds on-site. The effluent will be evaporated, instead of discharged to dry canyons or wetland areas. To accomplish this, a large amount of land area will have to be utilized for the evaporation ponds, through the construction of a series of such ponds. At the Laboratory, with limited land suitable for pond construction, land acquisition and construction for evaporation will be quite expensive. Estimated capital cost are about $53 million while annual operation and maintenance costs have been estimated to be $900 thousand, in addition to operation of current treatment facilities.

Conclusion

In the realm of environmental protection, a consensus must be reached as to what costs our society is willing to endure. The costs of modern conveniences and ever-changing technological

improvements must be balanced with the impacts on the environment. Regulations promulgated without concern for achievablility will result in effluent limits which cannot be met without detriment to the environment, the very thing the regulations were meant to protect. Environmentally sound treatment technologies such as managed wetlands, will not be available as options in such a scenario. Other treatment options may be too costly for large-scale use in industry or for municipalities.

Constructed and managed wetlands as an effluent treatment method in this arid State produce significant environmental benefits by increasing riparian habitats. The zero discharge goal will omit such treatment technology and other options, thereby reducing a valuable resource that adds to the agricultural and recreational opportunities in New Mexico and provides valuable habitat for aquatic life and wildlife. Many of New Mexico's water-related environmental problems stem from as much as 89% to 98% of non-point discharges, as identified by the NMED in its biennial Report to Congress in 1990 and 1992 (required by Section 305(b) of the Clean Water Act). Regulators, environmental groups and the regulated community must cooperate in finding practical solutions to environmental problems. Solutions which actually achieve environmental benefits, without destroying natural resources, agricultural lands, and ecosystems that have become dependent on properly treated effluents.

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