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ESTABLISHING AN APPROPRIATE BASELINE FOR ASSESSING ENVIRONMENTAL IMPACTS

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ABSTRACT

An important consideration in assessing environmental impacts for the National Environmental Policy Act (NEPA) is to establish a baseline from which to evaluate potential changes associated with a proposed action. For some assessments, establishment of the baseline is straightforward because the proposed action is located in an undeveloped area which has been negligibly affected by human activity. For other assessments, however, the baseline may be more difficult to determine because the proposed action may occur in an area where human activities have affected the environment and, in essence, have established a new (and often changing) baseline. Frequently, appreciable degradation has occurred on the proposed site itself. For such cases, the question arises as to whether the unperturbed condition or the present condition is more appropriate to use as the baseline.

This paper argues that a proposed action in a previously disturbed area should not be assessed merely in relation to the new baseline. Rather, a more comprehensive evaluation should be given that compares potential environmental effects with both the unperturbed condition and the present condition and consequently presents a more balanced approach to the assessment. Furthermore, the sponsoring federal agency should take the opportunity offered by the proposed action to improve the environment by shifting the affected area back toward its natural unperturbed condition. Mitigation measures should be examined to achieve this goal. A NEPA case study is presented in the paper to support this viewpoint.

INTRODUCTION

A major component of NEPA analysis involves establishing a baseline for the affected environment from which to assess potential environmental impacts due to the proposed action and alternatives to the proposed action. The magnitude and severity of potential impacts are more easily quantified by comparison to a well-established baseline. The Council on Environmental Quality's NEPA regulations simply state that the assessment "shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives" (40 CFR 1502.15).

For some evaluations, the baseline is established easily because the proposed action is located in an undisturbed area which has not been exposed to appreciable human activity. For other assessments, however, the baseline may be more difficult to determine because the proposed action may occur in an area where human activities have affected the environment and consequently have created a new baseline that may continue to change with time. Substantial degradation may have occurred on the proposed site itself. For such cases, it is debatable as to whether the unperturbed condition or the present condition is more appropriate to use as the baseline.

Certainly there are valid arguments in favor of using the present condition. Perhaps the most logical argument is simply that the present condition—by intuitive definition—forms the proper baseline from which to assess impacts. This argument fits well with the definition of the no-action alternative, which frequently is stated as the alternative in which there would be no change from the existing conditions and activities, if any. As stated in the *Forty Most Asked Questions Concerning the Council on Environmental Quality's NEPA Regulations* (46 FR 18026-18038), the no-action alternative is interpreted to mean (1) "continuing with the present course of action" (e.g., continuing with an existing land management plan, while the proposed action is to update the plan), or that (2) "the proposed activity would not take place" (e.g., when the proposed action is to construct and operate a new facility). Under either interpretation, the no-action alternative would cause no changes to the "present condition" baseline and no changes to the existing level of impacts, if any. Intuitively, using the present condition as the baseline seems much more appealing than correlating the no-action alternative with an unperturbed baseline for which there may already be impacts associated with the no-action alternative.

Another related argument is that the site may have been disturbed for many years, perhaps longer than any worker's company service time (if the site is occupied by an operating facility) or even the lifetime of any nearby residents. Such a long period of time facilitates the perception that the site was always in the present condition. In addition, it may be the consensus of workers and residents that the advantages associated with an area affected by human activities outweigh the disturbance and other disadvantages. Such a consensus of people probably would favor using the present condition as the baseline. As an example, if an operating factory is located on the site, then the factory provides jobs and tax revenue for the community. In addition to the direct jobs, indirect jobs (such as sales positions at local stores) are a consequence of the factory's existence.

There are also compelling arguments for using the undisturbed condition as the baseline. Certainly, from the long-term perspective, the length of time in which the site has been disturbed by human activity is probably considerably less than the length of time in which it was previously undisturbed. So from the long-term view, it may be desirable to consider the more pristine environment as the baseline and the present condition as a recent deviation from the baseline.

Another argument involves the purpose of the baseline. Establishing a baseline is not so much a driver in the decisionmaking process as it is an assessment tool to understand fully the potential impacts of the proposed action and alternatives. For example, a proposed action may improve an existing environmental impact to one resource area such as air quality, but not affect an existing environmental impact to another resource area such as water quality. If the baseline is considered as the present condition, then the environmental tradeoff associated with improving air quality while not improving water quality may be masked because the existing water quality is considered as the baseline rather than the consequence of past and/or ongoing actions. However, if the baseline is the unperturbed condition, then the environmental impact to water quality is clearly seen and an analysis of the environmental tradeoffs is promoted.

Because all of the arguments presented above contain valid considerations, the best option for NEPA assessments in previously disturbed areas is to compare potential environmental effects with both the unperturbed condition and the present condition. This comprehensive approach instills more balance in the evaluations because it considers the potential effects from different perspectives. Of course, if the level of environmental impacts would not be affected by the different baselines, then there is no need to spend considerable effort describing both baselines. A NEPA case study is presented below to illustrate the suggested approach.

NEPA CASE STUDY

The example given in this paper is taken from an environmental assessment that was prepared to partially satisfy a federal agency's NEPA requirements for a proposed project in which a novel combustion technology would be demonstrated at an existing coal-fired power plant. Although the names of the participating agencies and private-sector companies and the location of the proposed site are intentionally withheld because some of the information may be considered sensitive, enough information is given for this example to serve as a useful case study. For the proposed project, a new coal combustor, ceramic heat exchanger, gas turbine, and heat recovery steam generator would replace two existing coal-fired boilers. The gas turbine would be integrated with an existing steam turbine to increase the amount of electricity generated. The cost of the proposed project would be shared equally by the federal agency and the electric utility. The federal agency's decision as addressed by the NEPA process was whether to fund the project.

The purpose of the project was to demonstrate that the novel coal-fired technology would be a viable candidate to meet future energy needs and would be an energy-efficient technology capable of reducing emissions of sulfur dioxide, oxides of nitrogen, and particulate matter to less than Clean Air Act standards required by the year 2000 and beyond. The project would fill the need for a full utility-size demonstration of the technology, and data generated from the project would allow private industry to assess the technology's potential for commercial power generation. Although the risk associated with advancing the technology from the existing pilot stage to full commercialization was too high for the private sector to assume in the absence of strong economic incentives or legal requirements, if the technology were demonstrated as part of the cost-shared program, the risk could be reduced and the private sector would have data upon which to make an informed decision as to the commercial readiness of the technology.

Construction and operation of the existing power plant, which was built in the 1940s, has altered most of the 100-acre site. Ash disposal has consumed about 40 acres, while the plant building, substation, coal pile, and an archaeological research site occupy most of the remainder of the site. Approximately 50 workers are employed at the power plant. Land use immediately adjacent to the site is predominantly commercial with a few residences, while most of the land within three miles of the site is forested. The proposed project would occupy one acre on the site which was previously disturbed during construction of the existing power plant.

The primary change in impacts resulting from the project is associated with air emissions from the facility. As a consequence of the pollution control incorporated into the technology, annual sulfur dioxide emissions at the power plant would decrease by about 40%, annual emissions of nitrogen oxides would be reduced by about 15%, and annual particulate emissions would decrease by about 30%. Air dispersion modeling confirmed that maximum downwind concentrations of sulfur dioxide, nitrogen oxides, and particulate matter in the ambient air would correspondingly be less upon operation of the proposed project. Because of an additional 70,000 tons of coal consumed per year to generate more electricity at the plant as part of the project, annual carbon dioxide emissions would increase by about 35%. Carbon dioxide is not considered a pollutant per se, but is a greenhouse gas that contributes to global warming. For air pollutants, the proposed project would reduce emissions, move the baseline from its present condition back toward the undisturbed condition, and mitigate existing impacts. For this case, a brief discussion of the level and history of air emissions at the site is sufficient to establish the baseline.

In contrast, the establishment of a baseline for water discharge is more difficult. Presently, water is withdrawn from an adjacent river and is heated while passing through the power plant because it is used to condense process steam back to water in the turbine condensers. The heated water is then returned to the river. The total flow entering the condensers is 59,000 gallons per minute. The proposed project would not affect this short-term flow of condenser cooling water or the heat discharge rate to the river. However, the annual operating time of the power plant is expected to increase by about 30% because the project would make the plant more efficient and desirable to operate at the maximum extent possible. The existing heat rejection rate is within the National Pollutant Discharge Elimination System (NPDES) permit limit. The NPDES heat rejection rate was established based on calculations allowing a maximum river water temperature of 87°F downstream of the discharge of heated water and a maximum increase in river water temperature of 5°F. In compliance with state regulations, the NPDES limit was formulated using a low river flow of 260,000 gallons per minute (this is the low flow averaged over a 7-day period that is expected to occur once every 10 years on average).

The existing thermal plume from the power plant extends from the condenser outlet into a shallow outfall channel and flows around both sides of a small island adjacent to the nearby bank of the river. For the environmental assessment, an analysis was performed using a steady-flow energy balance that accounts for the heat that the proposed project would reject to the river (the same heat rejection rate as the existing facility). Like the calculation for the NPDES permit, a low river flow of 260,000 gallons per minute was used; however, unlike the calculation for the permit, this calculation accounted for the presence of islands in the river, which limit the mixing of the heated discharge. The analysis indicated that water temperatures would occasionally exceed 87°F and could reach a maximum of 91°F in the main channel at and immediately downstream of the small island. Rapid cooling occurs after the flow in the main channel intercepts the plume at and beyond the small island. These elevated temperatures would occur less than 10% of the time because the river flow exceeds 710,000 gallons per minute approximately 90% of the time, the discharge from a nearby dam up the river is relatively cool (because water exits near the bottom of the reservoir), and the climate is also relatively cool.

The proposed project would not affect the temperature of the plume or the plume's areal extent. The maximum thermal tolerance for most fish species found in the vicinity of the power plant ranges from 85 to 88°F. The temperatures in the outfall channel and the narrow channel between the small island and the adjacent bank occasionally exceed the thermal tolerance for many of these species. Because of the small size of the channels, use by fish is expected to be minimal compared with the main channel of the river. Mobile species are expected to be capable of avoiding these areas of elevated temperatures. Because the thermal plume does not extend far into the main channel, those species preferring cold-water habitats can avoid the plume by staying in the unaffected portion of the main channel. Some species may actively seek the heated plume, especially during winter. Intolerant and relatively immobile fish or macroinvertebrates entering these channels could be trapped and killed in the thermal plume. However, a mussel survey found adults of four species of mussels residing in the outfall channel. No incidents to aquatic life (e.g., fish kills) have been reported as a consequence of the existing thermal plume in over 40 years of power plant operation.

No appreciable change is expected from increased annual exposure of the aquatic species to the thermal plume. Because the power plant would be operating more often during the year, there may be a beneficial impact resulting from the reduction in frequency of cold-water shock (during plant downtime) to species that have become accustomed to the heated plume. The host utility expressed willingness to comply with whatever heat rejection rate or temperature limits would be established after an upcoming reevaluation of its NPDES permit by the state regulatory agency.

In this case, it is difficult to decide whether to use the unperturbed condition or the present condition as the baseline for water resources, particularly with regard to the discharge of heated water. The power plant has been in operation for over 40 years. Thus, it is easy to perceive the existing discharge as part of the baseline. However, heated water is being added into the river as a consequence of anthropogenic activities which have changed the baseline from its undisturbed condition. For this case, the proposed project would improve the environmental impacts to air quality by decreasing air emissions, but would not affect water discharge, except by increasing annual operating time by about 30%, which was found to make little difference in impacts from existing operating conditions. If the baseline is considered as the present condition, then the environmental tradeoff associated with improving air quality while not altering water discharge may be obscured. However, if the unperturbed condition is included in establishing the baseline, then the environmental impacts associated with water discharge are clearly seen and can be compared with those of air quality with respect to environmental tradeoffs.

In evaluating environmental tradeoffs, potential mitigation measures often can be adopted. As stated in the *Forty Most Asked Questions Concerning the Council on Environmental Quality's NEPA Regulations* (46 FR 18026-18038), "mitigation measures must be considered even for impacts that by themselves would not be considered significant." In this case, the host utility examined the feasibility of installing and operating discharge diffusers which would spread the heated water more evenly across the width of the river. This mitigation measure was abandoned, however, because of concern by aquatic ecologists that there would be a negative impact to mobile aquatic species that now successfully avoid the thermal plume. The host utility also evaluated the feasibility of installing and operating mechanical draft cooling towers to recycle the cooling water rather than using once-through cooling water. This mitigation measure was dropped because of cost and potential impacts related to fogging along the river.

In summary, it is believed that the best option for establishing a baseline in this case is to explain the situation thoroughly, describing both the undisturbed and present conditions. This comprehensive approach provides full understanding for the public and decisionmaker when evaluating potential environmental impacts. Furthermore, mitigation measures were evaluated, which would have been overlooked if only the present conditions were used as the baseline.

CONCLUSIONS

An important consideration in assessing environmental impacts for NEPA is to establish a baseline from which to evaluate potential changes associated with a proposed action. For some assessments, establishment of the baseline is straightforward because the proposed action is located in an undeveloped area which has been negligibly affected by human activity. For other assessments, however, the baseline may be more difficult to determine because the proposed action may occur in an area where human activities have affected the environment and thus have established a new baseline. Frequently, appreciable degradation has occurred on the proposed site itself. For such cases, it is concluded that a proposed action in a previously disturbed area should not be assessed merely in relation to the new baseline. Rather, a more comprehensive evaluation should be given that compares potential environmental effects with both the unperturbed condition and the present condition and consequently presents a more balanced approach to the assessment. Furthermore, if possible, the sponsoring federal agency should take the opportunity offered by the proposed action to improve the environment by shifting the affected area back toward its natural unperturbed condition. Mitigation measures should be considered to achieve this goal.