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STUDY TITLE: Improving Emission Estimates and Understanding of Pollutant Dispersal for Impact Analysis of Beach Nourishment and Coastal Restoration Projects

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PROJECT MANAGER(S): Till Stoeckenius

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BACKGROUND: The Outer Continental Shelf Lands Act, National Environmental Policy Act (NEPA), and Clean Air Act (CAA) require the Bureau of Ocean Energy Management (BOEM) to ensure that beach nourishment and coastal restoration projects do not cause or contribute to the deterioration of air quality. Estimating a proposed activity's emissions and evaluating the degree of dispersion of pollutants over the shallow inner continental shelf and coastal region are key elements of evaluating the potential effect of the proposed activities on air quality and determining appropriate mitigation. This study addresses the need for a standardized and technically defensible method for estimating criteria pollutant and GHG emissions associated with beach nourishment projects to ease the burden of preparing the required environmental reviews.

OBJECTIVES: (1) Development of a consistent, scientifically sound and defensible method for estimating air pollutant and greenhouse gas emissions from beach nourishment and coastal restoration projects involving dredging of sand and gravel from offshore borrow areas; (2) Development of a simple software tool that calculates beach nourishment project emission estimates given basic project parameters (amount of material to be placed, distance from borrow area, etc.); (3) Development of a

demonstration application of the emissions calculator tool and dispersion modeling to estimating the air quality impacts of a typical beach nourishment project.

DESCRIPTION: A method was developed and tested to calculate project emissions based on project design parameters, such as the amount of material to be placed on shore, location of the borrow area(s) and pump-out location(s) relative to the beach construction zone and specifications of the dredge vessel and other equipment to be used for the project. ENVIRON and Woods Hole Group reviewed historical dredging projects and consulted with dredging contractors to develop a method for translating these project design parameters into estimates of the amount of work (hp-hours) performed by the dredge vessels, support vessels and other project equipment. These activity estimates are in turn used to calculate engine emissions based on standard U.S. Environmental Protection Agency procedures and assumptions. A Microsoft ACCESS database program, the Dredge Project Emissions Calculator (DPEC), was developed to facilitate these calculations. DPEC stores all of the required information, provides a simple user interface for input of project design parameters, performs all of the necessary calculations and provides results via a suite of reports and a spreadsheet compatible data export.

To illustrate how the DPEC might be used in practice, a demonstration for a “typical” beach nourishment project (the Brevard South Reach project located along the east coast of Florida) was described. The DPEC was used to calculate emissions from the project. The AERMOD atmospheric dispersion model was used to evaluate the project impact on ambient air quality.

SIGNIFICANT CONCLUSIONS: Results from the demonstration application confirmed that the dredge vessel is the major source of emissions from the project, accounting for 91% of total NOx emissions with the remainder coming from auxiliary (support) vessels and on-shore construction equipment. Project total NOx emissions (39 tons) exceed the *de minimus* thresholds for severe and extreme ozone nonattainment areas only (such areas currently exist only in California and Houston, TX). These results suggest that dredging projects of this size would only require a detailed dispersion modeling analysis of their potential to cause violations of the NAAQS under the conformity rules if they were located offshore of a severe or extreme ozone nonattainment area.

Dispersion modeling results showed that peak short-term (1-hour) impacts occur when the dredge is located closest to shore and stationary, in other words during periods when the dredge is discharging its load. Emission totals and dispersion modeling results showed that the most significant concern from an air quality perspective for most beach nourishment and coastal restoration projects will be on possible violations of the 1-hour NO_2 standard. In non-attainment areas, it is not unreasonable to expect that NO_2 violations are possible from projects in which the dredge vessel operates close to

shore for significant periods of time and meteorological conditions are frequently unfavorable (i.e., light on-shore winds under limited vertical mixing). However, each situation is unique, and modeling procedures will vary from one project to the next depending on project design, location of activities and concerns raised by local residents and governments.

STUDY RESULTS: The DPEC software tool provides a standardized, scientifically sound and defensible approach to estimating emissions from planned future beach nourishment/coastal restoration projects. DPEC can provide reasonable emission estimates given only basic information about a proposed project. However, DPEC users can easily modify the calculations to include more refined project information when available.

Given the limited number of historical projects for which sufficient activity data was available for this study, it is recommended that data from additional projects relating project-level parameters to engine usage and fuel consumption be collected and used to update the DPEC. These additional data could be used to refine the DPEC and reduce uncertainties in calculated emissions. The historical projects with data suitable for analysis identified in this study only included projects involving hopper dredges. Additional data from projects involving other types of dredges, particularly those involving cutterhead (pipeline) dredges, are needed, especially if pipeline dredge projects become more common in the future. Several projects were constructed in 2012 using cutterhead dredges including Pinellas Co., FL and Pelican Island, LA. Data from these projects can provide the basis for extensions of the DPEC to allow for estimation of cutterhead dredge project emissions based on project parameters.

AERMOD evaluation studies suggest that peak concentration predictions tend to be reasonably accurate when emissions are accurately specified and meteorological conditions representative of the project area are used. However, AERMOD does not explicitly account for the differences in boundary layer dispersion parameters between the over water and over land portions of the modeling domain and this could lead to more significant errors in some cases. Further evaluation of AERMOD predictions and comparisons of AERMOD with other models such as CALPUFF in dredging project applications is needed. These studies should include further evaluations of the impact of alternative source parameterizations on predicted peak concentrations.

STUDY PRODUCT(S): ENVIRON International Corp. and Woods Hole Group, 2013. Improving Emission Estimates and Understanding of Pollutant Dispersal for Impact Analysis of Beach Nourishment and Coastal Restoration Projects. A final report for the U.S. Department of Interior, Bureau of Ocean Energy Management, Herndon, VA. Contract No. M10PC00088, Report No. 2013-123. 69 pp.

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Shah, T., C. Lindhjem and T. Stoeckenius, 2012 User's Manual for Dredging Projects Emission Calculator. A final report by ENVIRON International Corp. for the U.S. Department of Interior, Bureau of Ocean Energy Management, Herndon, VA. Contract No. M10PC00088, Report No. 2013-1128. 16 pp.

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