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Project Summary

Pipeline Landfalls: A Handbook of Impact Management Techniques

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This project provides detailed information on the environmental impacts associated with outer continental shelf (OCS) pipelines. The report is designed to be used by scientists or engineers involved in offshore petroleum pipeline planning, including pipeline corridors and pipeline landfalls.

Available methods are presented for managing the environmental effects of pipeline installation at the landfall. Two basic techniques are available: (1) Choosing a site that has the fewest constraints to pipeline installation, and (2) using construction and restoration techniques that minimize the effects of installation-related activities at the chosen landfall.

The report provides an overview of factors that may be considered in evaluating potential pipeline landfall sites. Major technical and environmental constraints discussed include the physical, geological, and biological characteristics of suggested sites. Other factors influencing site selection—coastal topography adjacent to offshore development areas, economics, existing onshore infrastructure, and state and local coastal policy—are also presented.

Because other considerations may result in the final selection of landfall sites with less favorable natural characteristics, emphasis is placed on the site itself and site-specific methods of installation and restoration designed to minimize the potential effects of pipeline installation in both favorable and unfavorable coastal systems. Past experience indicates that environmentally acceptable landfall installation is possible under unfavorable conditions with the use of such methods.

Two approaches are considered: (1) Alteration of technical construction and restoration methods to fit the constraints present at a particular landfall, and (2) preinstallation planning by government and industry officials to insure that construction methods selected address both technical requirements and environmental concerns posed by the chosen landfall. Specific examples of North Sea and Gulf Coast installations are used to illustrate technical methods that have been applied successfully to minimize pipeline effects in a variety of coastal ecosystems.

This Project Summary was developed by EPA's Municipal Environmental Research Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Background

In 1977, the New England/New York Coastal Zone Task Force, a group affiliated with the New England River Basins Commission (NERBC) and made up of state coastal zone program managers, recommended that the U.S. Environmental Protection Agency (EPA)

initiate a research project on the environmental impacts of oil and gas pipeline construction and operation. The Task Force felt that should oil and/or gas be found on the region's outer continental shelf (OCS), they would need this type of information to make sound decisions regarding OCS pipeline routing. EPA, recognizing NERBC's continuing interest in OCS-related activities, responded with a formal request that NERBC undertake this project, entitled "OCS Pipeline Construction and Operations: Potential Environmental Problems and Recommendations for Mitigation of Impacts." Work was begun in January 1978.

Two final reports have been completed thus far. One report, "North Sea Pipelines: A Survey of Technology, Regulation and Use Conflicts in Oil and Gas Pipeline Operation," (EPA-600/7-80-023) was published in February 1980. In May 1980, a second report, "Choosing Offshore Pipeline Routes: Problems and Solutions" (EPA-600/7-80-114), was issued. This report is the final in this series, all of which were prepared by the staff of the New England River Basins Commission under the sponsorship of EPA's Municipal Environmental Research Laboratory in Cincinnati, Ohio.

Introduction

One of the major concerns associated with offshore oil and gas is the transportation of petroleum from platform to shore. Although pipelines are generally accepted as the safest method of oil and gas transportation, their possible effects on the locations chosen as pipeline routes are still uncertain. This project, sponsored by EPA, is designed to provide information on the environmental effects of OCS oil and gas pipelines to officials in frontier areas who may become involved in planning pipeline routes from offshore development areas to land. This document presents methods for minimizing the environmental effects of pipeline installation at the landfall.

The report focuses on two major methods of minimizing potential impacts: choosing a site that has the fewest constraints on pipeline installation, and using construction and restoration techniques that minimize the effects of installation-related activities at the chosen landfall. Criteria are described for choosing or evaluating the relative environmental acceptability of various landfall sites, site-specific methods of pipeline installation, and site restoration methods that have been successfully used to minimize effects in favorable and unfavorable coastal environments. Two types of site-specific techniques are considered: technical installation and restoration methods that specifically address the physical constraints of a particular site, and cooperative planning between government and industry to develop acceptable and effective regulations for a particular landfall. Specific examples of North Sea and U.S. installations are used to illustrate the effectiveness of these impact-mitigating methods.

Recommended Management Techniques

The following are suggested technical and planning methods that may be used to minimize the potential impacts of pipeline installation at a landfall. Although it is recognized that all these methods may not be usable in every instance, they should be considered in the evaluation of any proposed pipeline installation. In the final analysis, individual assessments of any landfall site will be necessary, and impact management methods and regulations must be developed based on the specific constraints of the site.

Management Technique No. 1: Landfall Site Selection

Landfall site selection is based on consideration of a number of physical criteria, including the physical/geological structure of the area and adjacent ocean, and the ecological systems at and adjacent to the landfall that may be affected by pipeline installation. Based on these criteria, geologically less favorable landfalls would include those with eroding shorelines, steep slopes, rocky coastlines, or high-velocity, nearshore currents. Biologically sensitive areas include wetlands, barrier beaches and island, unstable sand dunes, and unique and/or rare or endangered species habitats. More preferable would be coastal areas that are gently sloping (less than 10% grade), with sandy or firm sediments and no fragile or unusual habitats.

Other criteria (such as coastal topography adjacent to offshore development areas, economics, existing onshore infrastructure, and state and local coastal policy) may, however, cause final selection of landfalls with less favorable characteristics. The remaining methods focus on technical and planning techniques for minimizing potential impacts at the chosen site.

Management Techniques No. 2. Technical Installation Methods

Installation impacts may be minimized by a number of methods that are appropriate for use in any coastal system. Although it is recognized that it may not always be possible to employ these techniques, they should be considered in planning any pipeline installation.

General Technical Methods—

General technical methods include:

- Scheduling to avoid key ecological seasons to minimize impacts on local plant and animal species;
- Minimizing the size of the area affected and, therefore, the extent of impact;
- Restoring the land/water interface area immediately to minimize risk to landward coastal systems (e.g., wetlands or dunes); and
- Restoring the entire affected area physically and ecologically to a condition as closely approximating the original as possible.

Certain coastal ecosystems require few additional methods to restore them to original condition after installation activites have been completed. These areas include flat or gently sloping beaches with no dunes and industrialized or commercially developed waterfront areas.

Specialized Technical Restoration—

The presence of other coastal features such as dunes, cobble beaches, rock cliffs, and wetlands may require the use of more specialized methods to assure more complete functional and aesthetic recovery. These specialized technical restoration methods include:

- *Dunes*—Artificial stabilization techniques (e.g., snow fences, gabions, or Christmas tree tops) may be considered to assure dune recovery, particularly in coastal areas prone to wind or wave erosion. Dunes may be naturally stabilized by replanting with native vegetation.
- *Cobble beaches*—Where blasting is necessary, non-native materials may be required for trench refilling and restoration of the beach form

and function. In this case, new fill should approximate the general size, shape, and distribution of original surface materials, if possible.

- *Rock cliffs*—As with cobble beaches, blasting for trench preparation will require refilling with non-native materials. In this case, however, it is likely that use of concrete would be necessary to restore functional integrity, making total aesthetic restoration impossible.
- *Wetlands*—As stated previously, wetlands may be the most difficult of all coastal ecosystems to restore to original functional or aesthetic conditions. Restoration programs would need to be designed on a case-by-case basis to address the key impacts expected in the affected wetland system.

Management Technique No. 3: Planning Methods

Increased government involvement in pipeline landfall siting and regulation will require coordination and interaction between the developer and public officials throughout project development. To encourage this cooperative planning and to facilitate development of acceptable and effective regulations for a particular installation, these planning methods may be considered:

- *Environmental assessment preparation*—Such preparation is an important means of identifying major potential impacts and information needs before construction.
- *Single-agency planning and permitting*—These procedures minimize the time necessary to obtain required permits and variances in original stipulations. They may also foster better communication between developers and regulators by clearly defining key participants in regulation development.
- *Ongoing consultation between developers and regulators*—Such communication fosters development of installation stipulations appropriate to the landfall's technical and environmental constraints and allows the flexibility to change original plans if necessary or desirable as construction proceeds.
- *Establishing restoration goals*—Goal-setting will focus restoration efforts on minimizing major identified potential effects, rather than on attempting a complete replication of original conditions—which is often impossible to achieve except over a long-term natural restoration cycle.
- *Long-term monitoring programs*—These programs would provide a method for ongoing assessment of restoration success and the opportunity to identify and remedy, if necessary, an initially unsuccessful restoration effort.

Conclusions

The major conclusion that may be drawn from these examples is that pipelines can generally be installed in most coastal systems with little evidence of environmental damage. The main exceptions are rock cliffs and wetlands. In the case of rock cliffs (where blasting is required), restoration with original materials is not possible; the concrete required to refill the trench may not be acceptable on ecological or aesthetic grounds. Because of their very loose sediment structure, wetlands (particularly those that are highly saturated) are probably the most difficult of all coastal ecosystems to restore to original aesthetic or functional condition. Only recently have large-scale restoration activities been attempted. Although insufficient time has elapsed to draw final conclusions, early results of these restoration attempts appear to be very encouraging.

The full report was submitted in fulfillment of Interagency Agreement EPA-78-D-X0063 by New England River Basins Commission under the sponsorship of the U.S. Environmental Protection Agency.

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The complete report, entitled "Pipeline Landfalls: A Handbook of Impact Management Techniques," (Order No. PB 81-242 950; Cost: $17.00, subject to change) will be available only from:
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5285 Port Royal Road
Springfield, VA 22161
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