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ABSTRACT OF THE DISSERTATION

Monitoring and Pollution Control:
A Stochastic Process Approach to Model Oil Spills

by

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In the first we analyze the behavior of a firm in an environment with pollution externalities and technological progress. We assume that firms may not purposely violate the pollution control regulations but nonetheless, generate some pollution due to negligence. Our model allows firms two possible actions: either increase the level of treated waste or pay an expected penalty if illegal pollution is detected. The results of the first chapter show that in a world with pollution externalities, technological progress does not guarantee increases in the welfare level. Most important for policy purposes, our analysis shows the trade-off between the policy instruments: penalties, taxes and treatment cost in a world where technological progress occurs and firms may violate the law.

In the second chapter we model the occurrence of an oil spill as a stochastic event. No shipowner or oil-carrying firm chooses the size of the spill. Characteristics of the ship, and the different types of ship's operating environment determine a stochastic process governing the time

patterns and size of spills. Both the time distribution of different types of oil spills, and the distribution of spill size are affected by pollution control instruments such as fines, by enforcement effort, and by the diligence of ship personnel. The stochastic model developed in the second chapter allows us to see how each step of the spilling process is affected by each policy measure and to compare the relative efficiency of different measures in reducing spills.

In the third chapter we estimate the parameters that govern oil spill frequency and size distribution. We model how these parameters depend on two pollution prevention measures: monitoring of transfer operations and assessment of penalties. We show that these measures reduce the frequency of oil spills. But we also show that the policy measures studied were almost irrelevant to the size of the spills.