Measuring Benefits of Oil Spill Prevention: Methods and Approaches

U.S. Environmental Protection Agency
Office of Solid Waste and Emergency Response
Office of Emergency Management
Regulation and Policy Development Division

with assistance by
Abt Associates Inc.
EPA Contract No. 68-W-03-020

April 29, 2009

Introduction

- EPA develops regulations to protect human health and the environment.
- EPA conducts an economic analysis for economically significant regulations to estimate the costs and benefits.
- Economically significant regulations are those with annual economic impact of $100 million or more and meet other criteria.

In this presentation we focus on estimating BENEFITS.

Economic Analysis of Regulations

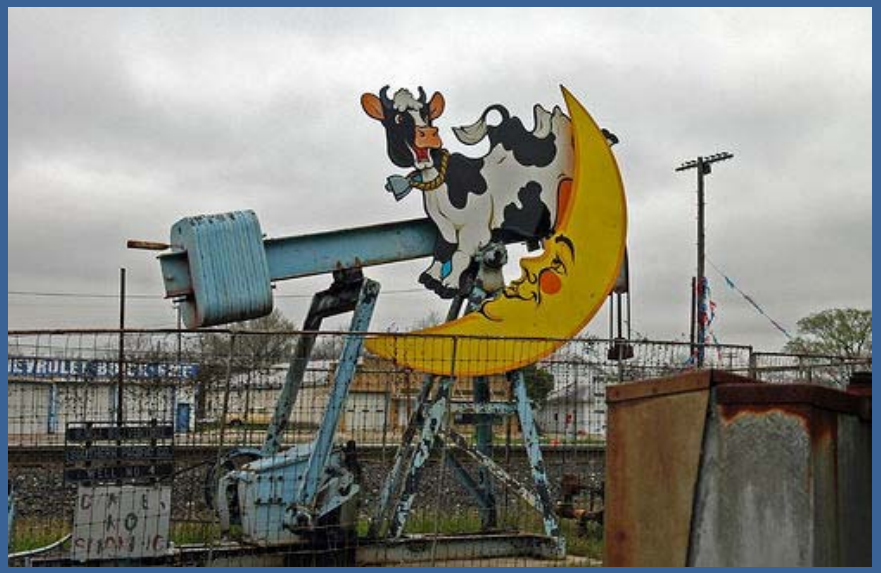
According to:

- Executive Order 12866 "Regulatory Planning and Review"*
- Office of Management and Budget (OMB) Circular A-4
- "Guidelines for Preparing Economic Analyses," USEPA, September 2000

* EO 12866 is currently under review at the request of the White House.

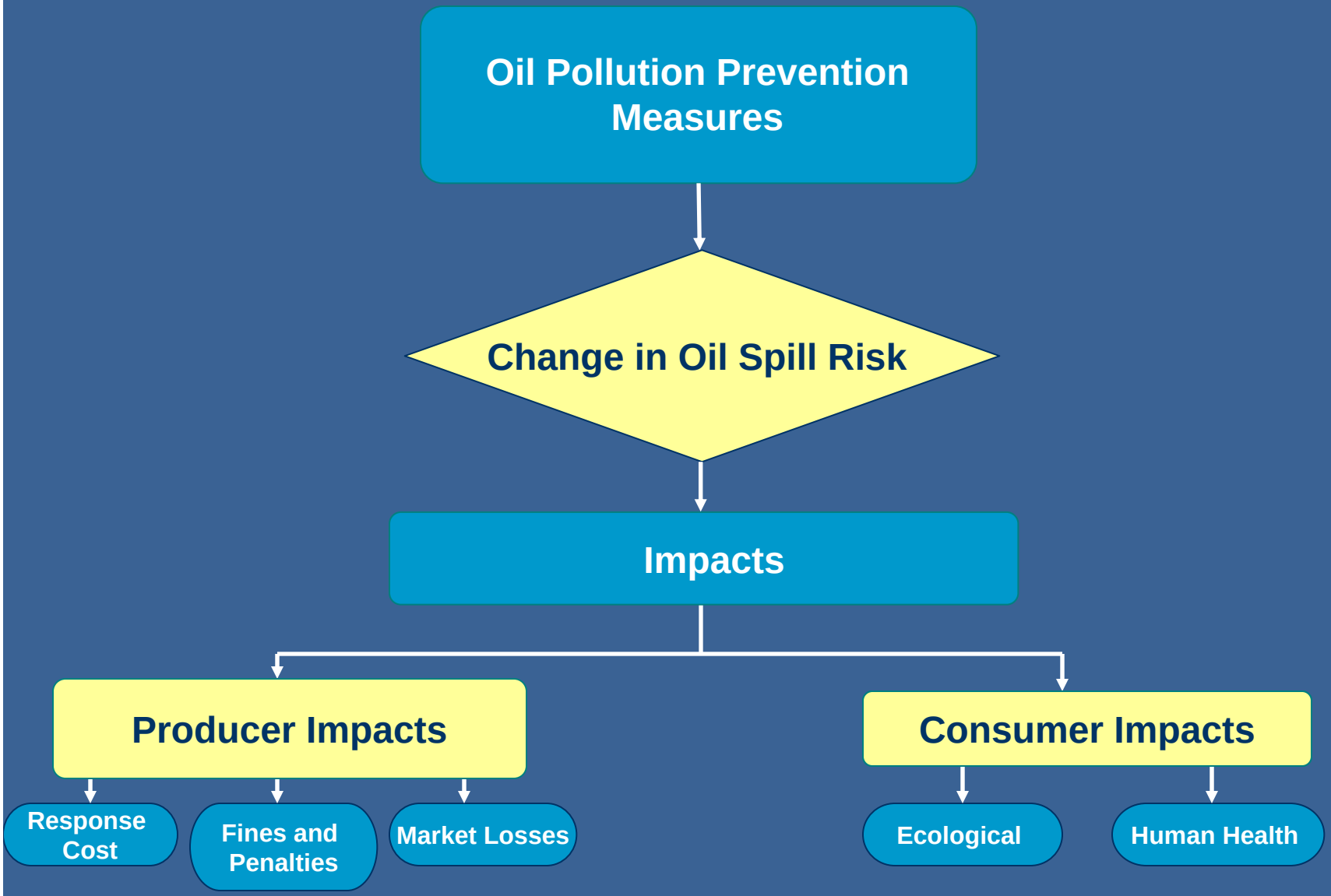
Objective

- Oil spill preparedness and prevention measures prevent oil spills!
- Regulated facilities may practice oil spill prevention measures in response to:
  - Clean Water Act
  - Oil Pollution Act
  - Federal SPCC regulations
  - State/Local regulations
  - Industry standards
  - Industry business practices
  - Insurance requirements



This paper considers the benefits of oil spill prevention measures required by the SPCC Program.

Measuring Benefits of Spill Prevention



Measuring Benefits

Benefits to Producers

=

Avoided response cost, fines and penalties and market losses.

Benefits to Consumers

=

Willingness-to-pay (WTP) to avoid human health, and market and non-market ecological impacts.

Measuring Benefits of Spill Prevention

Benefits to Producers

- Benefits to the producers is the avoided cost from an oil spill that includes response cost, fines and penalties and market losses.

- EPA used historical data on response costs*, fines and penalties to estimate the avoided cost.

* Data sources: PHMSA (Pipeline and Hazardous Material Safety Administration), POLREPS (EPA Pollution Reports), US Coast Guard data.

Measuring Benefits of Spill Prevention

Benefits to Consumers

- The measure of benefits to consumers from the avoided impact on resources is the willingness-to-pay (WTP) to prevent environmental damages from oil spills.
- Environment is a public good – the total benefits to consumers of a policy/regulation to protect the environment = sum of individual WTP.
- Data on WTP to prevent environmental damages from oil spills are limited to marine water bodies.
- Other models are available: Random utility models (RUM), Market models.

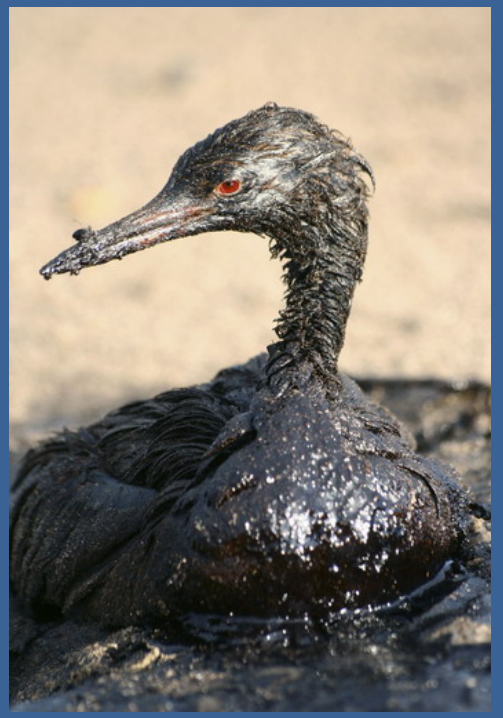
Ecological Damages

- Market Losses
  - Commercial fishing
  - Lost revenue from recreational site closures
  - Loss of oil
  - Water Intakes Shut Down (industrial or drinking water)
- Non-market Losses
  - Recreational impacts
  - Impact on wetlands and natural habitat
  - Impact on wildlife and natural resources

Ecological Damages: Non-market Impact

Key Steps

- Identify resources affected
- Estimate damages to aquatic and wild life
- Estimate damages to other natural resources including recreational sites



Challenges

- Resource valuation studies for freshwater spills
- Quantitative assessment of impacts

Ecological Impacts Quantified
in Natural Resource Damage Assessments

Chalk Point, MD: 140,000 gallons fuel oil spill, 2000:

- 76 acres of wetlands oiled
- 696 birds, 376 muskrats, 122 diamondback terrapins estimated dead
- Restoration projects:
  - Duck nesting habitat: $589,900
  - Tidal marsh, Washington Creek: $754,600

East Walker River, CA: 3,600 gallons fuel oil spill, 2000:

- 1 Virginia rail, 2 dippers, 1 mink, and 6 beavers collected dead
- 1 merganser, 1 heron, 1 bald eagle spotted alive and oiled
- Riparian habitat improvement project: $11,500

Ecological Damages: Recreational Impact

Alternative Approach to Estimating Recreational Impact

- Identify affected sites
- Estimate recreational days lost
- Develop an estimate of losses per recreation day based on availability of substitute sites and resource characteristics
- Calculate total recreational losses from the oil spill

Recreational Impacts Quantified
in Natural Resource Damage Assessments

Chalk Point, MD:

- ADA-Accessible Kayak/Boat Ramp: $95,485
- Boardwalk, trail, interpretive signs, benches, parking: $97,986
- Estimated lost recreational value: 125,000 trips / $453,500

East Walker River, CA:

- Riparian Enhancement: $12,500
- Outdoor Recreational Improvement: $347,300 (partly funded by USFS) – improve access w/ toilets, interpretive signs, fencing sensitive areas
- Estimated recreational fishing value damages: $232,540

Human Health Impact

Key Issues

- Workers exposure
  - Determining direct dermal exposure
  - Estimating inhalation exposure
- General public exposure
  - Estimating contamination of drinking water
  - Consumption of contaminated fish/shellfish
- Averting behavior
  - Estimating the expenditure on averting behavior

Leaking Oil Tank Responsible for Contaminating Local Water Supplies

Challenges

- Dose response function
- Affected population information

Total Costs of Restoration in Natural Resource Damage Assessments

Chalk Point (MD):

- Ecological restoration: $2,257,000
- Lost recreational value improvements: $453,498

Colonial Pipeline (VA):

- Civil penalties of $750,000 to U.S. and $750,000 to Virginia

East Walker River (CA):

- In-stream/riparian restoration: $140,000
- Recreational fishing/human use projects: $105,000
- Additional administration costs: $105,000

Measuring Avoided Spill Costs

Steps:

1. Estimate the frequency and volume of oil spills “before” and “after” preventive measures (number of spills each year, gallons per spill).
2. Estimate resulting change in the annual oil spill risk from spill prevention measures.
3. Estimate the average avoided cost of spill per gallon.
4. Total Benefits = ΣΣ (Change in Risk X Avoided Spill Cost)

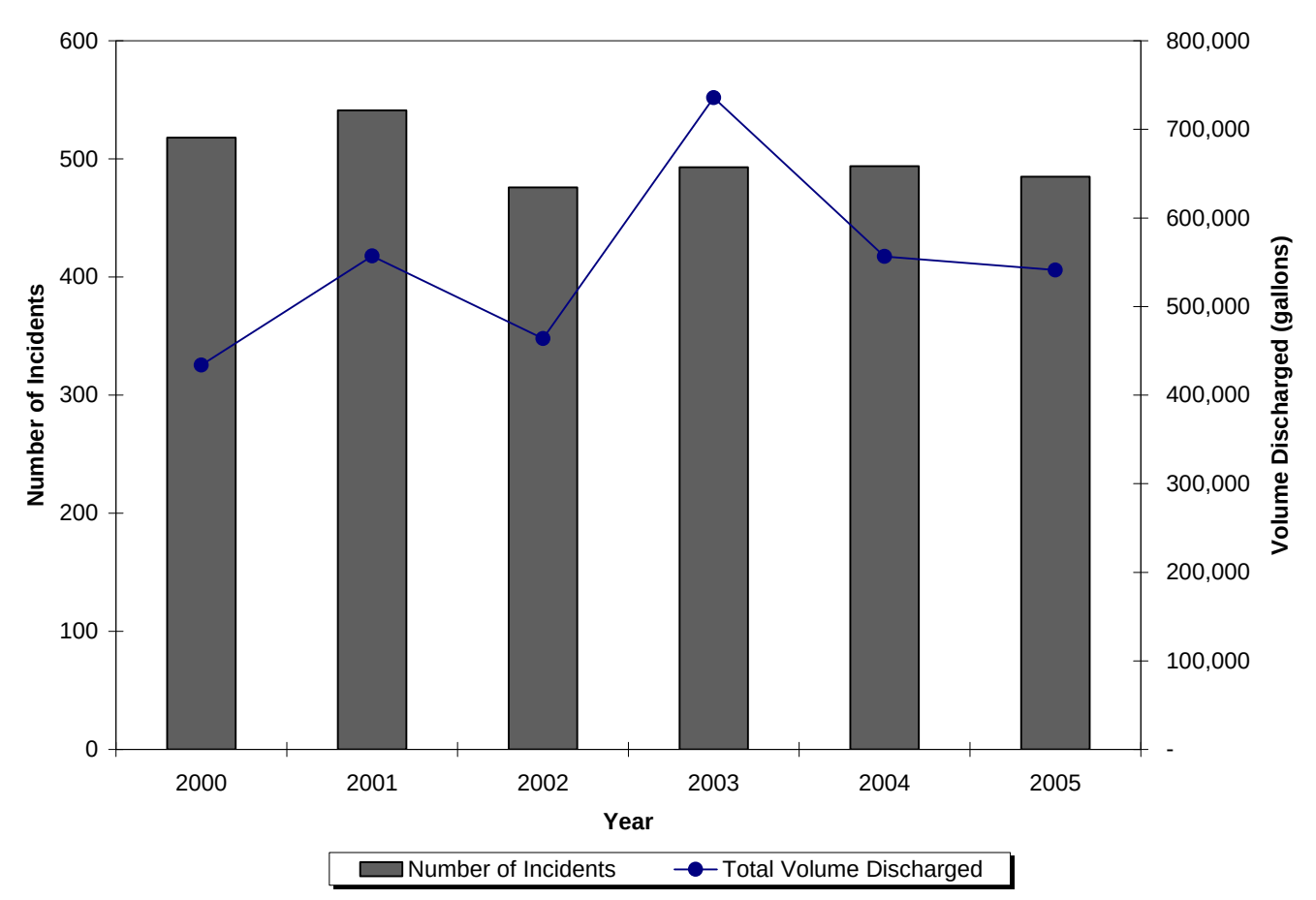
   Note: ΣΣ – total across facilities and oil spills

Oil Spill Risk

- Change in frequency of oil spills before and after oil prevention measures
- Change in likelihood of the spills reaching navigable waters
- Change in the volume of the spills and the resulting change in economic losses and damage to human health, environment and ecological systems.

History of Oil Spills

Number of incidents and volume discharged by year 2000-2005



Source: Oil Production Issue Paper "Considerations for the Regulation of Onshore Oil Exploration and Production Facilities under the SPCC Regulation (40 CFR Part 112)."

Source of oil spill data: NRC.

Example Oil Response/Clean-Up Costs

Cost of cleaning up crude oil (DOT PHMSA)

$218 per gallon

Average size of a crude oil discharge from a production facility = 1,290 gallons (National Response Center)

Response Cost for an Average Discharge = $281,220

Per-Gallon Response Cost by Discharge Size

Type of Oil	Oil Spill Size								
	< 5 Gallons	5-30 Gallons	30-99 Gallons	100-499 Gallons	500-1,499 Gallons	1,500-10,000 Gallons	>10,000 Gallons	> 5 Gallons (Average)	Overall Average
Crude Oil	$19,631	$747	$750	$251	$218	$79	$40	$447	$1,114
Gasoline and other Fuels	$40,614	$723	$287	$140	$57	$41	$22	$244	$1,414
Average	$29,589	$737	$504	$192	$126	$56	$30	$341	$1,270

Source: Pipelines and Hazardous Materials Safety Administration, DOT

Fines and Penalties

Responsible party may also face administrative and judicial penalties for oil spills

- Class I Administrative Penalty: $11,000 ($16,000)-$37,500 per day.
- Class II Administrative Penalty: $11,000 ($16,000)-$177,500 per day.
- Penalties (gross negligence): $4,300 per barrel; minimum $130,000 ($140,000).
- Civil penalties can range from $1,000 per violation to hundreds of thousands of dollars per violation. On a volumetric basis, spill penalties can range from eleven hundred dollars to hundreds of millions of dollars.

Limitations

- Accounts for avoided cost *per unit* of oil spilled only, not total avoided costs resulting from SPCC.
- Limited spill data for estimating change in oil spill risk – which is needed to estimate total avoided costs.
- Limited spill data for estimating ecological and human health impact.
- Facilities use oil spill prevention measures for many reasons, not just Federal or State requirements.

Summary Findings

- Oil spills from transportation and non-transportation-related facilities create losses and damages to individuals, communities, and the overall U.S. economy.
- Response cost of an average size spill (1,290 gallons) in oil production sector -- $281,000.
- Between 2002-2006 average penalty per case ranged from $4,400 to $230,400 per case.
- These losses and damages are preventable.

Potential Future Work

- Conduct a consequence analysis to measure total benefits from specific spill scenarios.
- Conduct a survey of regulated facilities to collect data on oil spill history and spill risk.
- Conduct focus groups and discussions with trade associations of regulated industry and professional engineers to identify motivation for implementing spill prevention measures.

Questions or Comments?

George Denning
Economist
U.S. Environmental Protection Agency
(202) 564-2404
denning.george@epa.gov