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REPORT TO THE PRESIDENT FROM THE NATIONAL COMMISSION ON THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING

HEARING

BEFORE THE

COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS UNITED STATES SENATE

ONE HUNDRED TWELFTH CONGRESS

FIRST SESSION

MARCH 16, 2011

Printed for the use of the Committee on Environment and Public Works

Available via the World Wide Web: http://www.fdsys.gpo.gov

U.S. GOVERNMENT PRINTING OFFICE
85–231PDF WASHINGTON : 2014

For sale by the Superintendent of Documents, U.S. Government Printing Office
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ONE HUNDRED TWELFTH CONGRESS
FIRST SESSION

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REPORT TO THE PRESIDENT FROM THE NATIONAL COMMISSION ON THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING

WEDNESDAY, MARCH 16, 2011

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The committee met, pursuant to notice, at 10:05 a.m. in room 406, Dirksen Senate Office Building, Hon. Barbara Boxer (chairman of the committee) presiding.

Present: Senators Boxer, Inhofe, Carper, Lautenberg, Cardin, Whitehouse, Vitter, Sessions and Alexander.

STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Senator BOXER. I would prefer to just chat, but we have to get busy. So, we are going to get busy. We are going to start.

I am going to waive my opening statement and simply say that we are so pleased that both of you are here because I have read a lot of your recommendations and they make a lot of sense.

As we look at what is happening right now in Japan, those feelings of being out of control come back when we think about the BP spill. Nobody felt it more than the two Senators from Louisiana. So, I am glad that Senator Vitter is on this committee as we look at ways to make sure that something like this does not happen again and if it does happen again, we have the systems in place to keep people whole without having to scramble like we did before.

So, I want to thank both of you. I will ask unanimous consent to put my statement in the record. Hearing no objection, I will do so.

I will ask everyone to keep their opening statement, if they make it, to 3 minutes.

Senator Inhofe.

[The prepared statement of Senator Boxer follows:]

STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Today, we will hear from the distinguished co-chairs of the Commission on the BP Deepwater Horizon Oil Spill and offshore drilling about their report to the President on the Deepwater Horizon disaster.

This committee has previously heard testimony about the heartbreaking economic and resource damages caused by this oil spill and the need to ensure that the people whose jobs and livelihoods are impacted are made whole again.

The Commission's report and its recommendations underscore the work that remains to be done to minimize the chance of another disaster like the one we witnessed last year. The report highlights the safety and environmental risks associated with offshore drilling and spotlights the systemic lapses that led to the tragic Deepwater Horizon spill.

The report lays out a comprehensive set of recommendations to improve the safety of offshore drilling, to hold oil companies accountable when things go wrong, and to protect jobs, coastal communities and the environment.

The Commissioners recommend that Congress take steps to restore the Gulf Coast, including dedicating a significant portion of Clean Water Act penalties to the restoration of the Gulf's damaged ecosystems. I support efforts to restore the Gulf Coast and look forward to working with colleagues on a proposal that promotes the restoration of economically and environmentally important ecosystems in the Gulf of Mexico.

The Commission's report also urges Congress to act to increase the outdated limits on liability in the Oil Pollution Act. Under current law, an oil company's liability for economic and natural resources damages from an oil spill disaster is only $75 million. This is astounding when total damages for the BP Deepwater Horizon spill could total in the tens of billions of dollars.

According to the Commission's report, current liability limits distort safety incentives for companies drilling offshore and fail to provide assurances to those impacted by a spill that all damages will be compensated.

Legislation introduced by Sen. Menendez, the Big Oil Bailout Prevention Unlimited Liability Act of 2011 (S. 214), has been referred to the EPW Committee for consideration. The bill would remove the current limits on liability to ensure taxpayers are not left on the hook for damages from oil spills.

The committee reported this legislation in the last Congress, and it is important that we once again take action to ensure those impacted by a spill due to no fault of their own are made whole.

Working collaboratively, I believe we can find ways to address oil company liability in a way that ensures businesses, particularly small and independent operators, are able to maintain their economic competitiveness.

For example, the Commission's report recommends the establishment of a mutual insurance pool that allows offshore operators to pool risk and share the liability for any damages associated with an oil spill.

Senators Landrieu and Begich have already begun developing such a proposal. I plan to continue working with them and other colleagues as we seek to address this issue.

The Commission report also includes important recommendations on improving oil spill research, reforming environmental review of offshore drilling, updating Federal oil spill response efforts, and better evaluating the use of dispersants.

Many of the Commission's recommendations were addressed in legislation reported by this committee in the last Congress. I am committed to working with my colleagues in the Senate to again move forward on legislation that holds oil companies accountable while protecting jobs, coastal communities and the environment.

I look forward to hearing from our witnesses today about the Commission's recommendations.

STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. All right, I will do the same thing. I do have a good statement though.

I just want to make this comment. Every time something happens, I remember in Prince William Sound, way up there after the accident 20 years ago, and a lot of people up there celebrating, we are going to parlay this into stopping drilling on ANWR and all that type of thing. I said, wait a minute. This is a transportation accident. If you stop our developing our own resources we are going to have to transport more of them and the incidence of that happening would be greater. But that did not make any difference.

The same thing, I thought, happened when we had this spill down here. There were a lot of people who were wanting to stop, and they did successfully do it, and the moratorium came off and

we still have not, we have only issued, I think, two deep water permits since then.

But I do want to take my remaining 2 minutes to, when I get the attention of my colleagues here, I have a bill I am going to be introducing today having to do with all the cumulative effects of all of these regulations. Now, we are talking about regulations like the EPA's Greenhouse Gas Rules, we know that would be between $300 and $400 billion annually, Boiler MACT, around 798,000 jobs, Utility MACT, $100 billion by 2015, the NAAQS, $90 billion.

So, what we have tried to do with the Environmental Protection Agency is to get the cumulative effect in terms of dollars and jobs of all these regulations, not just the ones I mentioned, but there are a total of three more, I believe, and so I am introducing that bill today that will set up a committee comprised of the Secretaries of Energy, Agriculture, Commerce, Defense, Labor, Small Business and others to perform this comprehensive assessment of the effects of the EPA rules on America.

So, what I am going to want to do is encourage as many of the members of the committee to get on as co-sponsors of this and I will be introducing it today.

I will yield back the remainder of my time.

[The prepared statement of Senator Inhofe follows:]

STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Thank you, Madam Chair, for scheduling today's hearing to discuss the findings and recommendations of the President's National Commission on the BP Deepwater Horizon Oil Spill.

I also want to welcome Chairman Reilly, and welcome Senator Graham back to the Senate; I appreciate their work on this important report. I think we all can agree that the commission did a terrific job arranging a massive volume of complex information, releasing it in readable form, and doing it under budget.

I support some of the commission's conclusions and recommendations, while I have problems with others. There are specific issues raised by the commission that fall under the jurisdiction of this committee, including reforms to the National Environmental Policy Act (NEPA) and to the Oil Pollution Act. I look forward to hearing from the co-chairs on these important issues.

The commission calls for greater, more effective safety regulations. I don't think we need more regulations, but they can certainly be more effective. And to be effective, regulations must not be an obstacle to increasing our domestic production. As Chairman Reilly himself recently put it, "We vitally need the resources of offshore oil and gas, that's where the future lies. This industry is a major contributor to our supplies and will become a significantly more important contributor in the future."

And what of our domestic supplies? According to the Congressional Research Service, America's combined recoverable natural gas, oil, and coal endowment is the largest on Earth. In fact, America's recoverable resources are far larger than those of Saudi Arabia, China, and Canada combined.

Despite this, the Obama administration has made a conscious policy choice to block domestic production. Consider the proposed rule by the new regulatory body in the Department of Interior overseeing offshore production. Here's what it said about the regulations it proposed late last year:

"The impact on domestic deepwater hydrocarbon production as a result of these regulations is expected to be negative. . .Currently there is sufficient spare capacity in OPEC to offset a decrease in GOM deepwater production that could occur as a result of this rule." [Emphasis added]

In other words, the Obama administration is admitting what is simply a matter of common sense: if we decrease production, we will increase our dependence on foreign oil.

This is the inevitable result of the Obama administration's cap-and-trade agenda. EPA is moving forward with regulations that will restrict, impede, and stop domestic energy production. Energy prices therefore will go up; as President Obama put it, "electricity prices will necessarily skyrocket."

This is the wrong approach. I agree with the commission that we should protect the workers who supply the energy we take for granted every day and protect the environment. But I also agree with the commission that we should produce our own resources, which are the largest in the world. In fact, we should increase that production. I hope that the Obama administration will agree, too.

Senator BOXER. Thank you.

Is Senator Cardin here? Senator Lautenberg?

Senator Lautenberg, hi. You are just in time for your, we only have 3-minute opening statements. We waived our statements because we have a pending vote at 10:30 a.m.

Senator LAUTENBERG. I get the hint, Madam Chairman.

Senator BOXER. But you have 3 minutes.

STATEMENT OF HON. FRANK R. LAUTENBERG, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator LAUTENBERG. Just very briefly. First, to old friends, a long time, I am sorry, we do not use the word old. Friends, I am happy to see you and thank you for the work that you have done with this Commission. I will be brief with my statement.

Just to say that today I would like to see us raise the question about the cost-benefit analysis for drilling off our coasts and whether or not, with our ravishing use of oil and our limited supply, whether that is a good course for the long term.

We know one thing. If oil is drilled, oil will be spilled. We saw it in the worst of terms in the Gulf of Mexico. We do not need to repeat that experience, in my view.

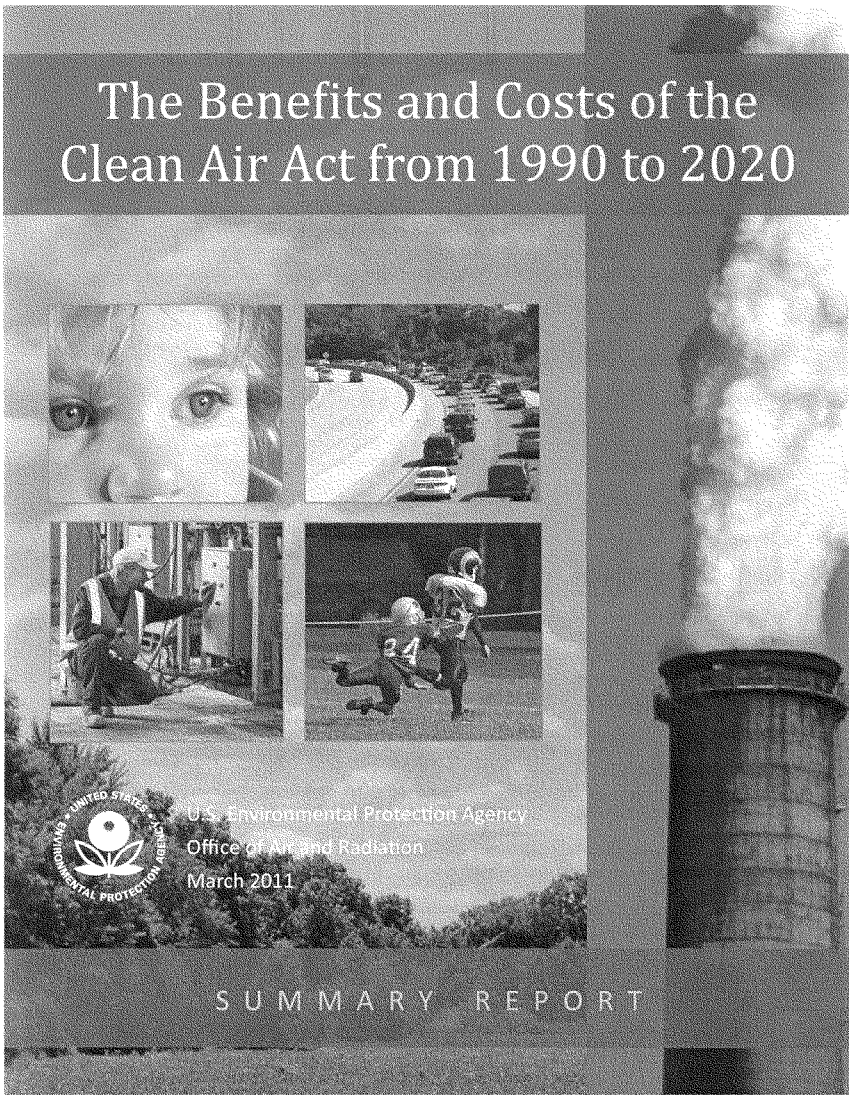
So, I once again thank you. Senator Graham, we still miss you, I can tell you that. Bill Reilly, we were together in Brazil some time ago and I enjoyed working with you as well.

Madam Chairman, thank you for holding this hearing and I ask unanimous consent that my full statement be on the record.

Senator BOXER. Without question.

I ask unanimous consent that I may place in the record a document called The Benefits and Costs of The Clean Air Act from 1990 to 2020. I think it is a good balance to my dear friend, his comments on the cost of regulation. This shows how many lives were saved in 2010, 160,000 infants saved, chronic bronchitis, et cetera. So, we are going to put that in the record and we will continue that debate at another time.

[The referenced document follows:]


The Benefits and Costs of the Clean Air Act from 1990 to 2020
U.S. Environmental Protection Agency
Office of Air and Radiation
March 2011
SUMMARY REPORT

Acknowledgements

The study was led by staff from the US Environmental Protection Agency Office of Air and Radiation, with support provided, under contract to EPA, by the organizations participating on the Study Team.

The full integrated report and this summary report were reviewed by the EPA Science Advisory Board's Advisory Council on Clean Air Compliance Analysis (hereafter the Council) and its three technical subcommittees. The individual detailed reports that focus on each of the key analytical components of the overall study were also reviewed by the Council and/or one or more relevant subcommittees.

The study was greatly improved by the ideas and expertise of the individuals and firms participating on the Study Team, and by the rigorous and thoughtful expert review by the external review panels. However, responsibility for the study's results, the analytical decisions leading to those results, the interpretations reported herein, and the recommendations made for future efforts, rests with the Environmental Protection Agency.

Study Team

US EPA Office of Air and Radiation
Industrial Economics, Incorporated
E.H. Pechan & Associates
ICF International
Research Triangle Institute
Stratus Consulting
Sonoma Technologies

Study Review Panels

Advisory Council on Clean Air Compliance Analysis
Air Quality Modeling Subcommittee
Health Effects Subcommittee
Ecological Effects Subcommittee

For further information

This document is an abridged version of a longer report which evaluates the benefits and costs of programs implemented pursuant to the 1990 Clean Air Act Amendments. The longer report in turn summarizes and integrates a series of technical reports documenting particular analytical tasks, such as estimation of compliance cost and projection of air quality changes. Data presented in this summary report are documented in the full integrated report and/or the supporting technical analyses.

Electronic copies of this summary report, the full integrated report, and all publicly available supporting technical documents can be downloaded at: *http://www.epa.gov/oar/sect812/prospective2.html*

Paper copies of this summary report can be obtained by submitting a request indicating the number of copies required to: *CAAA.Benefit-Cost-Study@epa.gov*

For information about the technical aspects of the study, contact Jim DeMocker, Senior Policy Analyst, Office of Air and Radiation, US EPA at *democker.jim@epa.gov*

For information about the peer review of the study, contact Stephanie Sanzone, Designated Federal Official for the Council at *sanzone.stephanie@epa.gov*

Summary of Findings and Recommendations

Findings

This study evaluates the benefits and costs of programs implemented pursuant to the 1990 Clean Air Act Amendments, relative to a hypothetical baseline which assumes control programs established under the 1970 Clean Air Act and 1977 Amendments stayed fixed at their 1990 levels of scope and stringency. The study applies the framework and principles of benefit-cost analysis to estimate significant beneficial and costly effects of these programs, express these effects where feasible and appropriate in dollar value terms to facilitate comparison of disparate effects, and then calculate the overall net economic benefits (benefits minus costs) of the changes in Clean Air Act-related programs resulting from the 1990 Amendments.

- Based on the scenarios analyzed in this study, ***the costs of public and private efforts to meet 1990 Clean Air Act Amendment requirements*** rise throughout the 1990 to 2020 period of the study, and ***are expected to reach an annual value of about $65 billion by 2020.***[1]

- ***Though costly, these efforts are projected to yield substantial air quality improvements*** which lead to significant reductions in air pollution-related premature death and illness, improved economic welfare of Americans, and better environmental conditions. ***The economic value of these improvements is estimated to reach almost $2 trillion for the year 2020***, a value which vastly exceeds the cost of efforts to comply with the requirements of the 1990 Clean Air Act Amendments.

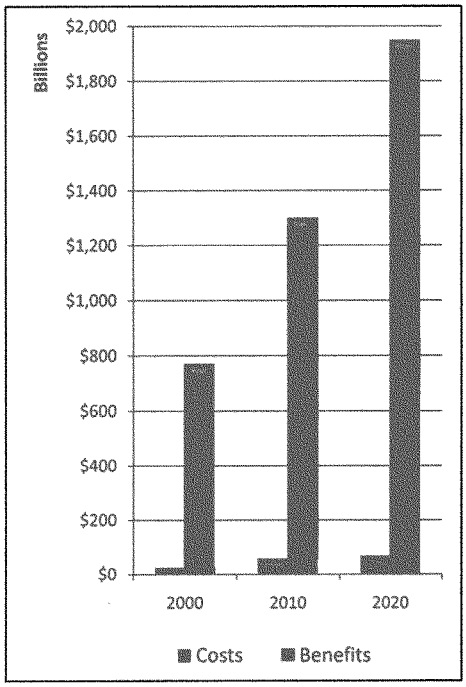


Exhibit 1. Primary Central Estimates of direct benefits and direct costs for the 2000, 2010, and 2020 study target years. (In billions of 2006 dollars). The graph shows the extent to which benefits exceed costs throughout the study period.

[1] Because of inflation, the value of a US dollar varies from year to year. In this study, dollars are defined according to the value they held in the year 2006.

- ***The extent to which estimated benefits exceed estimated costs*** and an in-depth analysis of uncertainties ***indicate that it is extremely unlikely the costs of 1990 Clean Air Act Amendment programs would exceed their benefits under any reasonable combination of alternative assumptions or methods identified during this study.*** Even if one were to adopt the extreme assumption that air pollution has no effect on premature mortality –or that avoiding such effects has no value—the benefits of reduced non-fatal health effects and visibility improvements alone are more than twice the total cost of compliance with 1990 Clean Air Act Amendment requirements.

- Economy-wide modeling was also conducted to estimate the effect of the 1990 Amendments on overall U.S. economic growth and the economic welfare of American households. ***When some of the beneficial economic effects of clean air programs were incorporated along with the costs of these programs, economy-wide modeling projected net overall improvements in economic growth and welfare.*** These improvements are projected to occur because cleaner air leads to better health and productivity for American workers as well as savings on medical expenses for air pollution-related health problems. The beneficial economic effects of these two improvements more than offset the costly effects across the economy of expenditures for pollution control.

- ***The most significant known human health effects from exposure to air pollution are associated with exposures to fine particles[2] and ground-level ozone pollution.*** Many of these effects could be quantified for this study; but other health effects of fine particles and ozone, health effects associated with other air pollutants, and most air pollution-related environmental effects could be quantified only partially, if at all. Future improvements in the scientific and economic information needed to quantify these effects would be expected to further increase the estimated benefits of clean air programs.

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[2] Particle pollution, also known as "particulate matter" or PM, is a term used to describe a broad class of extremely small solid particles and liquid droplets suspended in the air. Particle pollution can include one or more different chemical components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles. The size of particles has been linked to their potential for causing health problems since it is easier for smaller particles to bypass protective mechanisms in the nose and throat and enter deeply into the lungs. The number which sometimes follows the term PM refers to the aerodynamic diameter of particles expressed in units of microns (millionths of a meter); so PM2.5, for example, refers to a mixture of aerosol particles which are less than or equal to 2.5 microns. EPA classifies particle pollution into two main categories: (1) "inhalable coarse particles" such as those often seen near roadways and dusty industrial activities, which are larger than 2.5 microns but smaller than 10 microns, and (2) "fine particles" such as those found in smoke and haze, which are 2.5 microns and smaller. The terms PM2.5 and "fine particles" therefore refer to the same fraction of particle pollution.

Recommendations

The findings of this study have potentially significant implications for policy, programs, and research related to air pollution in the U.S. The recommendations presented below focus on research needs and the expansion and refinement of future studies.

- Clean Air Act programs address a wide variety of air pollutants beyond the fine particle and ozone pollution which emerged as the primary focus of this study's quantitative results. The data and modeling tools needed to estimate the health and environmental consequences of these other pollutants, however, are limited. ***There is an ongoing need for investment in research to improve the coverage of potentially important effects in benefit-cost studies of air pollution control programs.*** Additional research is also needed to reduce uncertainties in the estimates of effects already incorporated in benefit-cost studies, especially relatively significant effects such as those associated with fine particle- and ozone-related premature mortality and the economic value of avoiding those outcomes.

- Programs to reduce key Clean Air Act pollutants through national ambient concentration standards such as those for fine particles and ozone, programs to address air pollutants with more localized affects such as toxic compounds and heavy metals, and programs and policies which reduce emissions of greenhouse gases may impose various requirements on a given source of emissions. ***Future air pollution program assessments would be more useful to policymakers and the public if they were designed to provide insights on the combined effects of programs to address these different categories of air pollution.***

- Typical macroeconomic modeling tools and practices tend to focus on assessment of effects across the economy of compliance expenditures while ignoring the economy-wide benefits of cleaner air. ***Consideration should be given to improving macroeconomic modeling of major environmental programs so their benefits as well as their costs are reflected in projections of how these programs affect the overall economy and the economic welfare of American households.***

About this Report

This report is the third in a series of EPA studies which estimate and compare the benefits and costs of the Clean Air Act and related programs.

The first report was called the Retrospective Study, and was published in 1997. This first study estimated the benefits and costs through 1990 of programs implemented pursuant to the 1970 Clean Air Act and the 1977 Amendments, and included an analysis of the benefits and costs of phasing out leaded gasoline.

The second report was called the First Prospective Study. Published in 1999, it evaluated the incremental benefits and costs of the 1990 Clean Air Act Amendments and associated programs through the year 2010, relative to controls in place as of 1990. In addition to evaluating the effects on human health, the economy, and the environment of Titles I through V of the Amendments,[3] the First Prospective Study analyzed the benefits and costs of phasing out stratospheric ozone depleting chemicals such as chlorofluorocarbons (CFCs) under Title VI.

The current report is called the Second Prospective Study. This new study updates and expands the First Prospective Study by using new and better data and modeling tools. The new study also looks further out into the future by evaluating the costs and benefits of 1990 Clean Air Act Amendment programs through the year 2020.

CLEAN AIR ACT SEC. 312. ECONOMIC IMPACT ANALYSES (as amended, in part):
(a) The Administrator...shall conduct a comprehensive analysis of the impact of this Act on the public health, economy, and environment of the United States...
(b) In describing the benefits of a standard described in subsection (a), the Administrator shall consider all of the economic, public health, and environmental benefits of efforts to comply with such standard... The Administrator shall assess how benefits are measured in order to assure that damage to human health and the environment is more accurately measured and taken into account...
(c) [T]he Administrator shall consider the effects...on employment, productivity, cost of living, economic growth, and the overall economy of the United States.
(e) [T]he Administrator...shall appoint an Advisory Council on Clean Air Compliance Analysis of...recognized experts in the fields of the health and environmental effects of air pollution, economic analysis, environmental sciences, and such other fields that the Administrator determines to be appropriate.
(g) The Council shall-
(1) review the data to be used for any analysis required under this section and make recommendations to the Administrator on the use of such data;
(2) review the methodology used to analyze such data and make recommendations to the Administrator on the use of such methodology; and
(3) prior to the issuance of a report...review the findings of such report, and make recommendations to the Administrator concerning the validity and utility of such findings.

Exhibit 2. Clean Air Act Section 312 statutory language (abridged) as amended by Section 812 of the 1990 Amendments. The text of the law defines Congress' direction to EPA regarding the scope and review of these studies.

[3] The Clean Air Act is comprised of a number of statutory titles. Title I requires attainment of national air quality standards for designated pollutants such as ozone, Title II focuses on mobile source control programs, Title III addresses hazardous air pollutants, Title IV establishes programs to address acid deposition and related effects, Title V establishes permitting requirements, and Title VI focuses on protection of the stratospheric ozone layer.

The Second Prospective Study focuses on evaluating the significant changes made over the last decade in the implementation of Titles I through IV. Readers interested in benefit and cost information related to Title V (permits) and Title VI (stratospheric ozone protection) are referred to the First Prospective Study and subsequent EPA Regulatory Impact Analyses.

The effects of the 1990 Clean Air Act Amendments estimated herein reflect actions and partnerships across multiple levels of government, private organizations, households, and individuals. This combined effort involves federal standard setting and implementation, state and local programs to meet federal standards, and expenditures by private entities to achieve the requisite emissions reductions.

Goals and Objectives of the Study

During the legislative efforts leading up to enactment of the 1990 Clean Air Act Amendments, members of Congress working on the Act's reauthorization made it clear they wanted more and better information from EPA about the economic, health, and environmental effects of air pollution control programs. To ensure this improved information was available to support future policymaking, Congress added statutory language which required EPA to conduct periodic studies to evaluate the benefits and costs of the Clean Air Act itself. Enhanced credibility and continual improvement in data and methods were promoted by requiring that the design, implementation, and results of each study would be reviewed by a multidisciplinary panel of outside experts.

To meet Congress' goals for the third study in this series of Clean Air Act benefit-cost analyses, EPA defined a central objective and three supplementary objectives. Consistent with the central objectives defined for the two preceding studies, the current study was designed to estimate the direct[4] costs and direct benefits of the Clean Air Act as a whole, including the major federal, state, and local programs implemented to meet its requirements. The present study focuses on estimating the incremental effects of the 1990 Amendments in particular, and covers the period from 1990 –when these most recent Amendments were passed—through the year 2020.

A second, subsidiary objective of the study was to gauge the economy-wide effects of the 1990 Clean Air Act programs, including evaluation of the Act's effects on the overall growth of the U.S. economy and the economic well-being of American households.

[4] In this study, "direct" costs or benefits refer to first-order economic effects of pollution control programs. For example, the expenditure of funds to purchase, install, and operate pollution control equipment is considered a direct cost of a pollution control program. Similarly, the reduction in risk of a pollution-related health effect is a direct benefit of the reduction in emissions achieved by the use of that equipment. Indirect effects are those which emerge as consequences of the direct effect, such as the higher cost of producing steel if the direct cost to an electric utility of installing pollution control equipment leads to an increase in electricity prices paid by a steel plant. An example of an indirect benefit is the improvement in worker productivity achieved when the direct benefit of avoiding pollution-related illness helps workers avoid sick days. The present study focuses on evaluation of direct benefits and costs but also, to a limited extent, assesses indirect effects through economy-wide modeling.

EPA also sought, as a third objective, to be as comprehensive as possible –subject to practical limitations imposed by budget and information constraints—by considering a wide range of human health, human welfare (i.e., quality of life), and ecological effects. While some of these effects may contribute only minimally, if at all, to the quantitative estimates of benefits and costs generated for this study, looking at a broad range of effects was intended to ensure that (a) effects of concern to various stakeholders were included and (b) EPA and outside researchers could obtain additional insights about any deficiencies in the scope and quality of current information.

A fourth and final objective of the current study was to assess its limitations and uncertainties to identify opportunities for improving data and methods, and to explore the need for refining the scope and design of future air pollution benefit-cost studies. External peer review by the outside experts serving on the Council was a critical aspect of efforts to meet this objective, as well as the other objectives of this study.

Study Design

The current study is similar to the previous two in its fundamental design. To isolate the effects of Clean Air Act programs, the study configures and compares two alternative states of the world: one with the 1990 Clean Air Act Amendments, and one which assumes the 1990 Amendments were not passed.

In particular, the first scenario was built to reflect the actual history of post-1990 Clean Air Act implementation, including known programs already established, and future programs and control strategies anticipated in the later years of the study period. This scenario was called the "with 1990 Clean Air Act Amendments scenario," or *With-CAAA* case for short, and it represents a world of lower emissions but higher costs following enactment of the 1990 Clean Air Act Amendments. The *With-CAAA* case is represented by the lower line in Exhibit 3, which depicts a not-to-scale schematic illustrating the scenarios analyzed.

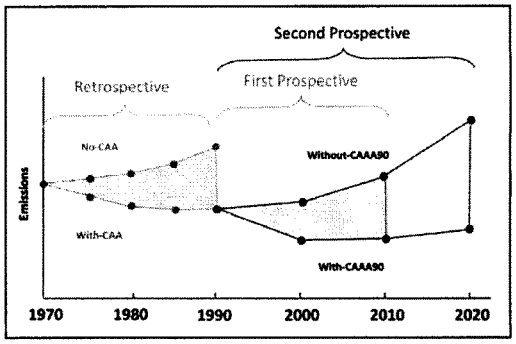

Exhibit 3. Second Prospective Study scenarios conceptual schematic. This exhibit is a schematic depiction of the scenarios to illustrate their timing and conceptual foundations. The differences in emissions between studies and between years are not to scale and should not be viewed as a comparison of emission reductions achieved between studies or between years.

The second, contrasting scenario reflects a hypothetical world which assumes federal Clean Air Act and related programs were frozen as of November 1990, the month the Amendments were signed into law. Therefore, 1990 serves as the "base year" of the analysis when the two

scenarios are initially set as equal but then begin to diverge. The counterfactual scenario was called the "without 1990 Clean Air Act Amendments scenario," or *Without-CAAA* case. The hypothetical *Without-CAAA* case is represented in Exhibit 3 by the upper 1990 to 2020 trend line showing the higher emissions which would result if standards stayed fixed but the economy and the population of the U.S. grew over the 1990 to 2020 period.

Once they were configured, the *With-CAAA* and *Without-CAAA* scenarios were processed through a series of economic and physical effects models, and their differences were estimated and compared. Specifically, each scenario was analyzed using a sequence of models to estimate what pollution control measures were (or might be) taken by government, private industry, and individuals; and what the effects of those measures might be in terms of economic and environmental change. The sequence of modeling steps followed to analyze the two scenarios is shown in Exhibit 4. Detailed descriptions of each analytical step –including the particular data, models, and methodologies used and their attendant uncertainties—are provided in the full integrated report and supporting technical documents.

One consequence of this sequential modeling approach is that the scenarios were defined early in the study. As such, this study reflects a particular snapshot in time with respect to known and anticipated control programs, especially those incorporated in the *With-CAAA* scenario. Several important programs, however, have been initiated or revised since the analytical scenarios were locked for the study in late 2005. For example, the *With-CAAA* scenario reflects the Clean Air Interstate Rule (CAIR) which had been recently promulgated when the scenarios were set, but this rule is now being replaced by a different rule designed to address the problem of long-range atmospheric transport of air pollution. Information about the estimated benefits and costs of recent rules is available in the relevant EPA Regulatory Impact Analyses.

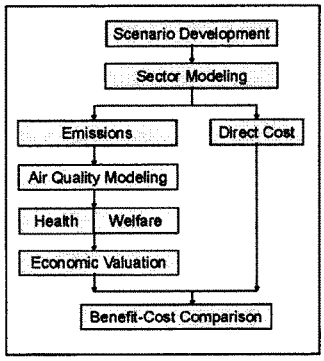

Exhibit 4. Analytical sequence of the Second Prospective Study. This flowchart shows the order of the major analytical steps followed to conduct the study.

To ensure high-quality, credible results, the study used the best available data and state-of-the-art modeling tools and methodologies. Most important, the design of the study, many of the intermediate methodological choices and findings, and the final results and their interpretation were all reviewed by the Council and its three technical subcommittees. The specialized expert review of the emissions and air quality, human health effects, and ecological effects study components by the three technical subcommittees complemented and supported the Council's broad expertise, which included substantial expertise in economics.

Primary Results

Direct Cost

Compared to the baseline scenario without the 1990 Clean Air Act Amendments and related programs, the *With-CAAA* scenario adds controls across five major categories of emission sources. All significant emissions sources are assigned to one of these five major source categories. Two of these categories cover stationary point sources of emissions, two cover mobile sources, and the fifth category covers smaller sources dispersed over wide areas. The categories are:

1. **Electricity generating units** (e.g., coal-fired power plants)
2. **Non-utility industrial sources** (e.g., industrial boilers, cement kilns)
3. **Onroad vehicles and fuel** (e.g., cars, buses, trucks)
4. **Nonroad vehicles and fuel** (e.g., aircraft, construction equipment)
5. **Area sources** (e.g., wildfires, construction dust, dry cleaners)

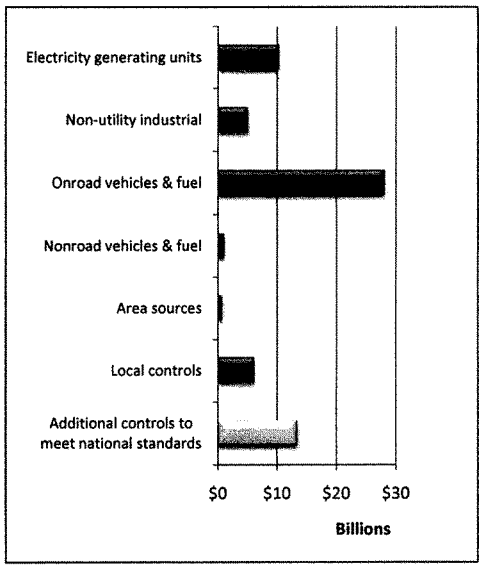

Exhibit 5. Year 2020 direct cost of compliance by source category. (In billions of year 2006 value dollars). The first five darker orange bars show how compliance costs compare for the five major categories of emissions source. Additional controls applied to these five source categories at the local level for the purposes of meeting air quality standards are shown by the sixth darker orange bar. The seventh, lighter orange bar also reflects additional local controls but these are shown separately because their costs are significantly more uncertain.

The costs incurred to reduce emissions from these sources under the 1990 Clean Air Act Amendments are estimated to rise steadily throughout the 1990 to 2020 study period. By 2020, the study target year when differences between the *With-CAAA* and *Without-CAAA* scenarios are at their greatest, additional annual compliance expenditures are estimated to be about $65 billion (in year 2006 value dollars).

As shown in Exhibit 5, these incremental costs of compliance did not fall evenly across the five major source categories. Almost half of the year 2020 direct costs are to meet requirements for onroad vehicles and the fuels used to operate them. About 40% of the $28 billion in onroad expenditures is to meet fuel composition requirements and the rest is incurred to meet tailpipe standards and implement vehicle inspection and maintenance programs.

Electric utilities account for the second largest area of expenditure, with costs in the year 2020 equal to a little over $10 billion. The programs leading to the bulk of these expenditures include the Title IV acid rain sulfur dioxide allowance trading program, the Clean Air Interstate Rule, programs targeted at reducing nitrogen oxide emissions (e.g., the NOx SIP Call), and controls required to meet the national ambient air quality standards for fine particles and ozone.

Implementation of federal and regional control programs to meet the national fine particle and ozone standards accounts for much of the cost incurred by the five major emissions source categories. However, for many local areas, emissions reductions achieved by these programs are not sufficient to reach attainment with national air quality standards. Under the Clean Air Act, these local areas are required to implement additional controls tailored to their particular needs and opportunities for the further emission reductions needed to improve air quality and attain the national standards. Expenditures for local controls which could be identified as both suitable for a given location and cost-effective to implement were estimated to reach about $6 billion by 2020.

By the year 2020, reaching the 8-hour National Ambient Air Quality Standard (NAAQS) for ozone in some locations appears to be a significant challenge. Some of these locations are assumed under the *With-CAAA* scenario to apply all controls identified as technologically feasible and cost-effective for their location yet still show modeled ozone concentrations higher than the 8-hour national standard. The *With-CAAA* scenario therefore assumes additional emissions reductions are achieved using "unidentified controls" of unknown cost and/or technological availability and applicability. Since the particular control strategies for each of these locations cannot currently be identified, their costs are highly uncertain. The *With-CAAA* scenario assumes that the additional emissions reductions achieved by unidentified controls will cost $15,000 per ton. The $15,000 per ton assumed value could turn out to be too high or too low depending on local circumstances and the prospects for near-term improvements in control technologies and cost, although there is some evidence that local areas would be reluctant to implement measures that cost more than $15,000 per ton. The total incremental cost of these additional local controls using unidentified technologies is estimated to be $13 billion. Given the relatively high level of uncertainty in this component of Clean Air Act program compliance costs, it is reported as a subtotal separate from the identified control measures subtotal of $52 billion.

Emissions Reductions

The controls applied across the major categories of emissions sources under the *With-CAAA* scenario achieve substantial reductions in emissions contributing to ambient concentrations of fine particles, ozone, and other air pollutants. As shown in Exhibit 5, the total costs of control from some sectors – such as electricity generating units and onroad vehicles and fuels—were high relative to other source categories, but these sources also achieved the greatest reductions in emissions. For example, onroad vehicles and fuel represent 46% of total control costs in 2020 but they also contribute 41% of the year 2020 reduction in total NO_X emissions. The full range of emissions reductions estimated under the *With-CAAA* case and the breakdown by source category are described in the full report, but the overall

reductions in pollutants which contribute most to changes in fine particles and ozone are highlighted in Exhibit 6.

In addition to directly-emitted fine particles,[5] three other pollutants designated for control under the Clean Air Act contribute to increases in ambient concentrations of fine particles through secondary formation and transport in the atmosphere.[6] For example, gaseous sulfur dioxide can be transformed in the atmosphere to particulate sulfates. Volatile organic compounds (VOCs) and nitrogen oxides are also key pollutants contributing to the formation of ground-level ozone.

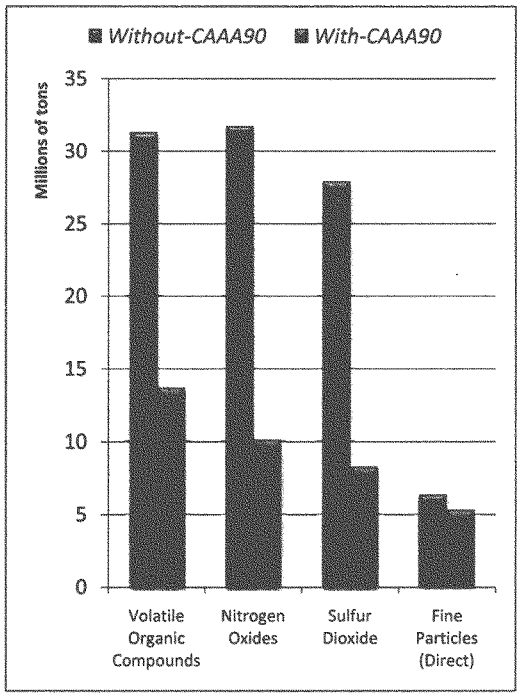

Exhibit 6. Year 2020 key pollutant emissions under the *With-CAAA* and *Without-CAAA* scenarios. (In millions of short tons). The difference in height between the orange and blue bars for each pollutant shows the estimated reduction in that pollutant achieved by 1990 Clean Air Act Amendment programs.

The estimated *With-CAAA* scenario emissions reductions depicted in Exhibit 6 are large because they reflect both absolute reductions relative to 1990 base year conditions and avoided increases in emissions which result under the *Without-CAAA* case when standards stay fixed at 1990 levels but economic activity increases from 1990 to 2020. Approximately 75 percent of the 2020 emissions reductions are attributable to improvements relative to 1990, while the remaining 25 percent is attributable to avoiding increases in emissions that could result if Clean Air Act standards stay fixed while population and economic activity grow.

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[5] Fine particle pollution already in a solid or liquid aerosol state at the point of emission from a tailpipe or construction site is commonly referred to as "directly emitted fine particles," or sometimes "primary particles." In contrast, fine particles which form in the atmosphere later from gaseous precursors, such as sulfur dioxide, are referred to as "secondary fine particles."

[6] In recent years the importance of ammonia in secondary formation of fine particle air pollution has become clearer. However, unlike the other pollutants shown in Exhibit 6, ammonia is not currently a designated air pollutant under the Clean Air Act, and there are no explicitly assumed differences in control requirements for ammonia between the *With-CAAA* and *Without-CAAA* scenarios.

Most of the reduction in volatile organic compounds is achieved by controls on evaporative emissions from area sources such as household solvents, controls on vehicle and nonroad engine tailpipe and evaporative emissions, and controls on non-utility industrial sources.

For nitrogen oxide emissions, all five major source categories achieve emissions reductions under the *With-CAAA* scenario; but the most substantial contributions to lower emissions are attributable to tailpipe standards for onroad vehicles and reductions achieved by utilities subject to cap-and-trade programs and/or the Clean Air Interstate Rule. Requirements related to the national standards for fine particles also reduce nitrogen oxides emissions.

Electricity generating units such as coal-fired power plants are the source category which achieves the most significant reductions in sulfur dioxide emissions, accounting for about 75 percent of the total reduction projected in 2020. Cap-and-trade programs, the Clean Air Interstate Rule, and other control programs implemented pursuant to the national fine particle standards account for most of the estimated difference in sulfur dioxide emissions between the *With-CAAA* and *Without-CAAA* scenarios.

About 40 percent of the year 2020 reduction in directly-emitted fine particles is achieved by controls on area sources such as construction dust and residential woodstoves. Reductions from utilities and from nonroad and onroad sources also contribute toward meeting the requirements of the national ambient air quality standards for fine particles.

Air Quality Improvements

The substantial reductions in emissions which contribute to ambient concentrations of ozone and fine particles lead to significant differences in modeled air quality conditions under the *With-CAAA* and *Without-CAAA* scenarios. Air quality modeling results for all pollutants and all target years analyzed in this study are available in the full report, though the estimated change in fine particle concentrations is highlighted here because reductions in exposure to this pollutant are responsible for the vast majority of benefits which could be evaluated in economic terms for this study.

Exhibit 7 shows that reductions in fine particle concentrations by 2020 are large and widespread, as demonstrated by the pervasive blue colors indicating improvement in air quality. The most significant reductions occur in California and the Eastern U.S., especially the Ohio Valley region, primarily due to sulfur reductions from electric utilities and industrial facilities combined with mobile source reductions concentrated around heavily-populated metropolitan areas. Because these areas had relatively high fine particle concentrations in the 1990 base year, the modeling results imply that 1990 Clean Air Act Amendment programs were effective in targeting high emissions sources in and around locations where improvements in air quality would benefit the greatest number of people. There are a few locations in the West where fine particle concentrations are estimated to be slightly higher in 2020 under the *With-CAAA* scenario due to localized effects related to electrical generating unit dispatch or fuel choice. These localized disbenefits, shown by the isolated spots of orange color in Exhibit 7, are negligible

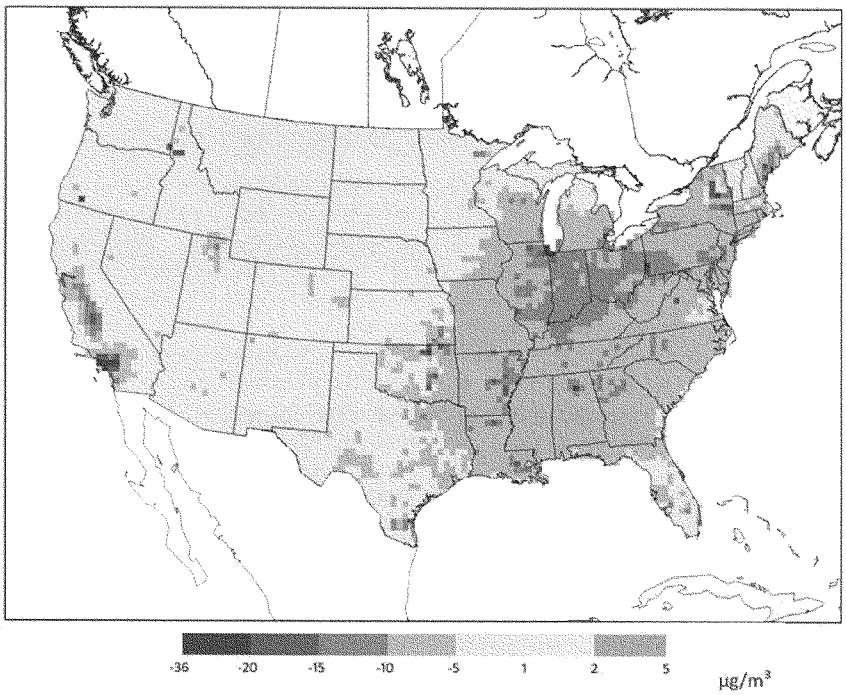

Exhibit 7. Difference in annual average fine particle (PM2.5) concentrations between the *With-CAAA* and *Without-CAAA* scenarios: *With-CAAA* minus *Without-CAAA* for 2020. (In micrograms per cubic meter). The map shows the change in concentrations of fine particles in the atmosphere achieved by 1990 Clean Air Act Amendment programs. The darker the blue color, the greater the improvement in air quality. The few spots of orange on the map are isolated locations where the air quality model projected slightly higher fine particle concentrations under the *With-CAAA* scenario than under the *Without-CAAA* scenario.

compared to the large and widespread overall reductions in fine particle pollution under the *With-CAAA* case.

Ozone concentrations are also significantly lower overall under the *With-CAAA* scenario relative to the *Without-CAAA* scenario. As shown by maps provided in the full report, the patterns of air quality improvements for ozone are similar to those observed for fine particles with widespread regional improvements across the East and improvements in the West occurring predominantly in areas influenced by Southern California population centers.

Health Improvements

The steady improvements in air quality estimated under the *With-CAAA* case from 1990 to 2020 period lead to increasing health and environmental benefits over the entire study period. By 2020, the differences in air quality and human health outcomes between the *With-CAAA* and *Without-CAAA* scenarios are considerable.

Fine Particle and Ozone Pollution

The largest reductions in fine particle concentrations are achieved in areas with relatively poor air quality and/or high population density (see Exhibit 7). This result is due in large part to the effective design of federal, state, and local programs aimed at meeting ambient air quality standards in ways which maximize public health improvements. The effectiveness of these programs in achieving well- targeted reductions in exposure means that the differences in health outcomes between the *With-CAAA* and *Without-CAAA* scenarios are substantial, even dramatic.

For example, as early as 2000, annual average exposures[7] to

Health Effect Reductions (PM2.5 & Ozone Only)	Pollutant(s)	Year 2010	Year 2020
PM2.5 Adult Mortality	PM	160,000	230,000
PM2.5 Infant Mortality	PM	230	280
Ozone Mortality	Ozone	4,300	7,100
Chronic Bronchitis	PM	54,000	75,000
Acute Bronchitis	PM	130,000	180,000
Acute Myocardial Infarction	PM	130,000	200,000
Asthma Exacerbation	PM	1,700,000	2,400,000
Hospital Admissions	PM, Ozone	86,000	135,000
Emergency Room Visits	PM, Ozone	86,000	120,000
Restricted Activity Days	PM, Ozone	84,000,000	110,000,000
School Loss Days	Ozone	3,200,000	5,400,000
Lost Work Days	PM	13,000,000	17,000,000

Exhibit 8. Differences in key health effects outcomes associated with fine particles (PM2.5) and ozone between the *With-CAAA* and *Without-CAAA* scenarios for the 2010 and 2020 study target years. (In number of cases avoided, rounded to 2 significant digits). The table shows the reductions in risk of various air pollution-related health effects achieved by 1990 Clean Air Act Amendment programs, with each risk change expressed as the equivalent number of incidences avoided across the exposed population.

[7] "Average exposure" in this case refers to "population-weighted annual average exposure," which is calculated by dividing the total population exposure over the course of a year by the total number of people in the exposed population. This measure provides a helpful summary indicator of overall exposures and exposure changes, in this case across all people living in the 48 states; though people living in particular locations may experience much higher or much lower exposures or exposure changes than people in other locations. To illustrate, consider a population of three people where two people experience a change in exposure from 30 to 10 micrograms per cubic meter ($\mu g/m^3$), and a third person's exposure change is from 25 to 20 $\mu g/m^3$. The change in population-weighted average exposure would be (20+20+5) divided by 3 = 15 $\mu g/m^3$. While the 15 $\mu g/m^3$ change provides a

fine particles among the U.S. population are lower by an average of 5 micrograms per cubic meter under the *With-CAAA* scenario. By 2020, the average exposure difference between the scenarios increases to an estimated 9 micrograms per cubic meter, all as a result of programs related to the 1990 Clean Air Act Amendments. This 9 microgram per cubic meter reduction is tantamount to cutting exposures almost in half, because the population average exposure for 2020 under the *Without-CAAA* scenario is slightly higher than 19 micrograms per cubic meter.[8]

The large reduction in risk of premature mortality associated with fine particles is the most significant outcome among those listed in Exhibit 8. Ozone health studies also indicate there is a separate, additive contribution to reduced premature mortality risk from this pollutant beyond the premature mortality effect associated with fine particle exposures. This study's estimates for these incidence reductions are based on a strong and extensive foundation of peer-reviewed epidemiological literature. The methodologies used to apply these epidemiological studies to the estimation of reduction in population risks from fine particle and ozone exposure have also been extensively peer-reviewed.

In addition to reductions in incidences of premature mortality,[9] reductions in exposure to fine particles and ozone are also estimated to achieve major reductions in serious diseases such as chronic bronchitis and acute myocardial infarction, as well as fewer hospital admissions, emergency room visits, lost work days, and lost school days.

Hazardous Air Pollutants

Controls on emissions of hazardous air pollutants, including heavy metals and toxic gases, are known to reduce adverse health effects, though data and tools to quantify the full extent of the reductions in health risks from these pollutants are limited. A case study assessing the effects of the 1990 Clean Air Act Amendments in reducing benzene emissions and exposures in the Houston area was conducted as part of this study. The study found a significant cancer-reducing benefit overall in the region, but also found that 1990 Clean Air Act Amendment programs led to the most substantial reductions in those areas with the highest baseline cancer risks. These results are described in detail in the full report and in a separate technical report documenting the Houston benzene case study.

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useful measure of the shift in overall population exposure, it may obscure the fact that the third individual experienced a significantly smaller improvement and is left with a significantly higher residual exposure.

[8] For perspective, this level of population-wide annual average fine particle exposure is about the same as that experienced by people living in Los Angeles in the year 2000. (See Text Box 4-1 of the full report.)

[9] The term "incidence" is not intended to represent premature mortality of a particular known individual, but rather small reductions in risk experienced by many people that sum to an aggregate change in population risk numerically equivalent to one avoided premature mortality.

Other Clean Air Act Pollutants

Reductions in ambient concentrations of other Clean Air Act pollutants such as carbon monoxide also confer health benefits, though many of these benefits are difficult to quantify for various reasons. For example, in the case of carbon monoxide, available health studies are not well suited to isolating the incremental contribution of carbon monoxide reductions to improved health when significant reductions in other pollutants, such as fine particles, are modeled at the same time. Furthermore, health effects of some pollutants can be quantified in physical terms but economic studies supporting valuation of the changes in physical outcomes are unavailable. Whether the limits on quantification of these other criteria pollutant[10] effects emerge at the physical effect or economic valuation step, the result is that these effects are not reflected in the primary estimates of health improvements presented in this report.

Other Benefits to People and the Environment

Beyond the direct health benefits of Clean Air Act programs, a variety of other improvements to human well-being and ecological health are assessed in this study. Efforts to evaluate these other "non-health" effects were motivated by the study's goal of providing insights on the full range of outcomes which may affect people and the environment, including those which might either be important to particular stakeholders or warrant further research to support more or better quantitative treatment in future studies.

The first step in this study's assessment of non-health effects was a literature survey to identify ecological effects of Clean Air Act-related pollution reductions at various levels of biological organization (e.g., ecosystem, community, individual, cellular). The range of potentially relevant effects found in this literature review is described in the full report and supporting technical documents. Based on the results of this broad assessment, the analysis was then narrowed to focus on those ecological and human health effects for which economic valuation information was available and could be applied. This narrowing of focus served the principal goal of the study,

Quantified Human Welfare and Ecological Effects	Pollutant(s)
Visibility in residential areas (metropolitan areas)	PM, Ozone
Visibility in recreational areas (large parks in three regions)	PM, Ozone
Commercial timber (commercially important tree species)	PM, Ozone
Agriculture (commercially important crops)	Ozone
Recreational fishing (Adirondacks)	Acid Deposition
Materials damage (a few acid-sensitive materials)	Sulfur Oxides

Exhibit 9. Ecological and welfare effects included in primary estimates of benefits. For each effect in the table, the limited geographic range or the subset of effects included in the primary results is listed in parentheses.

[10] There are six Clean Air Act "criteria pollutants" for which national ambient air quality standards are established: particulate matter, ozone, carbon monoxide, sulfur dioxide, nitrogen oxides, and lead (Pb).

which was to evaluate the various health, economic, and environmental effects of the Clean Air Act using comparable measures of value. In the end, only a very limited number of non-health effects could be included in the primary estimate of benefits, and these quantified and monetized ecological and welfare effects are listed in Exhibit 9.

In addition to limitations in the range of effects included in the primary results, several of the included effects were subject to limitations in geographic coverage or the number of commodities or ecosystems covered. The limited scope of quantified effects or limited geographic coverage for each effect is described in Exhibit 9. For example, available data and modeling tools supported assessment of the effects of changes in ozone exposure only for select, commercially important crops and tree species; and other effects such as changes in recreational fishing opportunities due to acidic deposition could only be addressed through case study examinations not suitable for extrapolation to other areas of the country. This study is therefore subject to the same persistent limitations in data and methods for evaluating potentially important ecological and human welfare outcomes which have impaired other benefit-cost studies of air pollution control programs. The consequence is ongoing uncertainty about the potential magnitude of these effects relative to the human health effects which can be more readily evaluated in terms of physical outcomes and changes in economic value.

Visibility

Based on measurable economic value, improvements in visibility emerged as one of the most significant non-health effects of better air quality under the *With-CAAA* scenario. A new methodology was applied to estimate the economic value of visibility improvements in metropolitan areas, and the effect of this new approach was to expand the number of locations where visibility improvements could be valued in economic terms. The significance of the results obtained using this new methodology highlights the importance of improved visibility for enhanced quality of life.

There are two types of visibility improvement benefits estimated in this study: recreational visibility and residential visibility. Recreational visibility benefits reflect the values people assign to reductions in obscuring haze and resulting improvements in scenic views at important U.S. recreational areas, such as the Grand Canyon and other federal "Class I" areas.[11] Residential visibility benefits capture the value people assign to improved visibility where they live.

The differences in air pollution-related visibility impairment under the *With-CAAA* and *Without-CAAA* scenarios used to estimate both recreational and residential visibility benefits are shown in Exhibit 10. While benefits are estimated for all target years of the study, Exhibit 10 contrasts the county-level visibility conditions under the *With-CAAA* case relative to the *Without-CAAA* case for the year 2020. Visibility impairment is measured in Deciviews, which is a rating scale aimed at measuring and then valuing perceptible changes in visibility. In Exhibit 10, the darker the color, the greater the impairment

[11] Under the Clean Air Act, a "Class I" area is one in which visibility is protected more stringently than under the national ambient air quality standards. Class I areas include national parks, wilderness areas, monuments, and other areas of special national and cultural significance.

in visibility; so the lighter orange areas in the lower *With-CAAA* map indicate improved visibility resulting from 1990 Clean Air Act Amendment programs.

Previously established methods were used to estimate visibility improvements at federal Class I areas across the U.S. Because of limitations in the applicability of available economic valuation studies, however, the primary estimate of benefits presented herein includes only 86 parks and recreational areas in California, the Southeast, and the Southwest. The total value of visibility improvements at these 86 Class I areas is estimated to reach $19 billion by the year 2020.

Applying the new methodology supporting expanded coverage of U.S. metropolitan areas, residential visibility benefits are estimated to reach $49 billion in 2020, a number which is significant but consistent with the substantial improvements in visibility across major population centers. The $67 billion combined total for residential and recreational visibility benefits in the year 2020 slightly exceeds the entire $65 billion estimated cost of 1990 Clean Air Act compliance for that year.

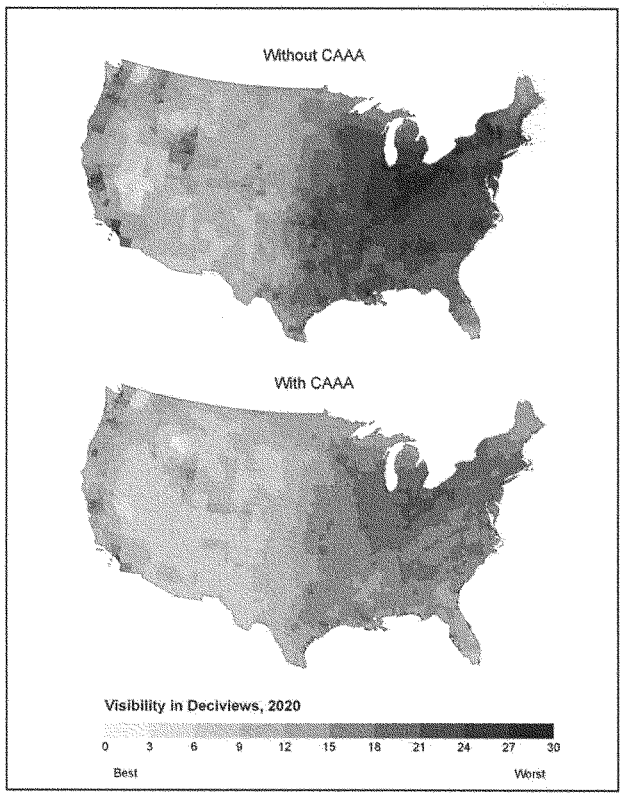

Exhibit 10. Visibility conditions at the county level under the *With-CAAA* and *Without-CAAA* scenarios for 2020. (In Deciviews). The maps show visibility conditions under each scenario with lighter colors indicating better visibility.

Comparison of Direct Costs and Direct Benefits

The final step in the benefit-cost analysis conducted for this study was to express the various health, welfare, and environmental benefits of 1990 Clean Air Act Amendment programs in dollar values so the benefits could be compared to the dollar-based estimates of control costs. As illustrated in Exhibit 11, comparison of the central estimates for benefit and costs supports a conclusion that programs related to the 1990 Clean Air Act Amendments are expected to yield benefits which vastly exceed their costs.

EPA is confident that this finding of positive net benefits of 1990 Clean Air Act Amendment programs is robust for several reasons. First, the benefits of improved morbidity and improved visibility alone are more than twice the estimated cost of compliance with 1990 Clean Air Act Amendment requirements; so even if one chose to ignore the substantial reductions in mortality risk achieved by these programs or assigned them a value of zero, benefits would still be projected to exceed costs. Second, many beneficial outcomes involving human health or environmental improvement could not be expressed in terms of economic values because the scientific and economic studies to support such valuations remain inadequate or unavailable. If methods were available to quantify these omitted effects, the estimate of net benefits would further increase. Some components of cost are also subject to uncertainty or omission, but cost uncertainties are comparatively minor in number and significance relative to uncertainties on the benefit side of the ledger. Finally, the in-depth assessment of key uncertainties described in the full report indicates that the chances are

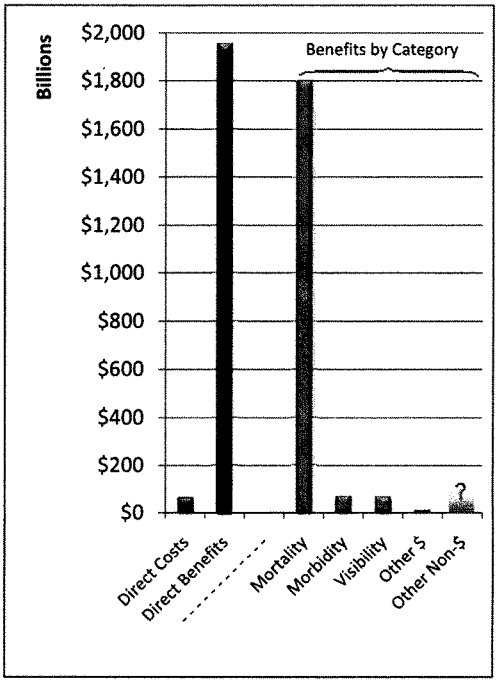

Exhibit 11. Year 2020 Primary Central Estimates of direct costs and direct benefits with breakdown of benefits by effect category. (In billions of year 2006 dollars). The two leftmost bars show the extent to which total benefits exceed total costs, and the bars to the right provide the breakdown of benefits by category of effect. The third bar shows the extent to which mortality reduction benefits exceed all other effects, including total costs. The Other Non-$ bar to the right is intended to emphasize the extensive benefit endpoints which could not be monetized, and the question mark indicates the potential value of these effects is unknown.

extremely small that uncertainties in the analysis could lead to a scenario in which costs exceed benefits.

Those who nevertheless find that uncertainties and other limitations of benefit-cost analysis render these results less than satisfactory for obtaining policy insights may prefer to use other paradigms for measuring, comparing, and evaluating the outcomes projected by this study. For example, it is possible to avoid assigning uncertain dollar-based values to changes in risk of premature mortality and, instead, compare the costs of Clean Air Act programs with the projected number of avoided incidences of premature mortality or illness. The full report for this study and the supporting technical documents provide details about the estimated benefits achieved in terms of physical outcomes as well as the estimated economic value of those outcomes, and these detailed results can be used to support alternative assessments of value.

One example of an alternative paradigm for assessing and comparing the value of premature mortality risk reductions achieved by the 1990 Clean Air Act Amendment programs is to divide compliance costs for a given year by the number of incidences of avoided premature mortality

Estimating and Valuing Reductions in Risk of Premature Mortality

Exposure to some forms of air pollution increase a person's chances of experiencing an illness they would not otherwise have experienced, or dying earlier than would otherwise have been expected. For the fine particle pollution which dominates the outcome of this benefit-cost study, changes in health risk differ among individuals based on factors such as age and initial health status. For example, individuals who have already experienced stroke or heart disease may experience a different loss in future life expectancy due to increased exposure to fine particle pollution than others in the population might experience. This variability in risk from a given change in pollution exposure means that different individuals experience different shifts in their "survival curve" which, in the air pollution context, represents the expectations an individual may have for additional years of life as different ages are reached. This variability among different segments of the population complicates efforts to estimate the overall change in risk experienced by the population as a whole following implementation of programs such as those associated with the Clean Air Act.

Moreover, a further complication arises in the context of benefit-cost analyses aimed at gauging the value to society of the reductions in premature mortality risks achieved by these programs. In addition to variability in how different individuals' survival curves shift when fine particle pollution is reduced, different individuals may also assign different values to a given shift in their survival curve. The extents to which people may assign different economic values to mortality risk reductions based on age, initial health status, or the source or nature of the risk (e.g., voluntary versus involuntary, sudden versus protracted) are significant uncertainties.

In the absence of sufficient scientific and economic data and tools for capturing the variability within the population in both the reduction in risk and the value individuals assign to such risk reduction, the estimates for both the population-wide risk change and the overall value to society of the aggregate risk change are uncertain. While the methods used for this study are state-of-the-art and consistent with other recent analyses, the key uncertainties which nevertheless persist in estimating the magnitude and value of changes in mortality risk due to air pollution are discussed and evaluated in detail in this study's full report and in the technical reports on health effects and on uncertainty which accompany this study.

projected to result from that year's emissions reductions. The result of this calculation for *With-CAAA* emission reductions achieved in the year 2020 is about $280,000 per avoided incidence of premature mortality. This and similar calculations, however, must be interpreted cautiously because cost-effectiveness comparisons typically divide costs by an effectiveness measure for a single beneficial outcome. Using the current example, comparing costs only to reductions in incidences of premature mortality may result in a failure to account for other potentially important benefits such as improved ecosystem protection.

While this study provides data supporting various approaches for evaluating Clean Air Act program outcomes, a central objective of the study was to estimate the net economic benefit (i.e., quantified direct benefits minus quantified direct cost) of differences between the *With-CAAA* and *Without-CAAA* scenarios. The separate totals for benefits and costs were reported earlier based on rounding to two significant digits to avoid creating an undue impression of precision in the estimates. The specific outcomes for the year 2020 are direct costs of $65 billion and direct benefits of $2,000 billion (i.e., $2 trillion). Prior to rounding to two significant digits for reporting purposes, the benefit estimate is $1,951 billion. Subtracting the $65 billion in direct costs from $1,951 billion in direct benefits results in a net benefit estimate of $1,886 billion, which resolves to a two significant digit estimate of $1,900 billion (in year 2006 value dollars).

Comparison of First Prospective Study and Second Prospective Study benefit estimates for the year 2010.

The previous study in this series of reports, the First Prospective Study, was published in 1999. Since then, significant improvements have been made in air pollution-related benefit-cost analysis data and methods, especially those associated with fine particles and ground-level ozone pollutants which are the focus of the present study. Insights about the significance of these methodological changes can be gained by comparing the results of the current study with those of the previous study for the year 2010, a key target year common to both analyses.

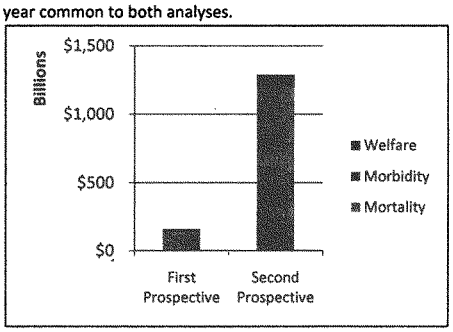

Exhibit 12. Comparison of 2010 Benefits from First and Second Prospective Studies. (In billions of year 2006 dollars)

As shown in Exhibit 12, benefits estimates for all three main categories of effect are significantly higher for the current study. There are several reasons these differences are so significant. Some of the difference results from the addition of several new and important control programs implemented since 1999, including the Clean Air Interstate Rule and major programs to reduce onroad and nonroad emissions. Welfare and morbidity effects are also higher because of the addition of new endpoints, such as improvements in residential visibility and reductions in acute myocardial infarctions. Air quality models have also been significantly improved since 1999, allowing analysis of fine particle species such as secondary organic aerosols which had been omitted in the First Prospective Study. The most influential change, however, appears to result from updates over the last decade in the epidemiological studies which provide estimates of changes in population risk of premature mortality associated with exposure to fine particles.

Avoiding incidences of premature mortality, especially those associated with exposure to fine particles, contributes the vast majority of the direct benefits of 1990 Clean Air Act programs measured in dollar value terms, as shown in Exhibit 11. There are two principal reasons mortality effects dominate the estimated differences in value between the *With-CAAA* and *Without-CAAA* cases. First, the differences in air quality, human exposure, and resulting risk of premature mortality between the two scenarios are substantial. Second, these changes in risk of premature mortality are estimated to have significant economic value, as measured by studies that assess what people are willing to pay to reduce such risks.

The methods used in this study for valuing reductions in risk of premature mortality are consistent with the methods used in the two prior studies in this series, with prevailing default values described in longstanding EPA economic guidelines, and with recent EPA Regulatory Impact Analyses. In addition to being consistent with current EPA policy and longstanding EPA practice, the valuation estimates used are close to estimates emerging in recent literature. Nevertheless, assigning appropriate value to premature mortality risk reductions achieved through air pollution control remains a significant challenge as described in the text box entitled *Estimating and Valuing Reductions in Risk of Premature Mortality* and in this study's full report and supporting technical documents.

Other categories of benefits presented in Exhibit 11 include total morbidity effects, visibility improvements, other welfare and ecological effects which could be expressed in terms of dollar values, and other welfare and ecological effects which were not quantified and monetized in the primary estimates of benefits for this study. This last category of benefits is presented as a question mark in Exhibit 11 to emphasize that the potential contribution to total benefits of these unquantified effects is simply unknown, but could conceivably be substantial.

Economy-Wide Effects

The main results of this study are the direct benefits of 1990 Clean Air Act programs relative to the direct costs of those programs. However, some public policy programs have such significant economic effects that they can influence the levels and patterns of activity across the larger economy, and it can be important to assess these broader economic consequences. The differences between the *With-CAAA* and *Without-CAAA* scenarios modeled in this study were expected to manifest these types of large, "spillover" effects on important sectors of the economy due, for example, to the potential effects of higher electricity prices under the *With-CAAA* case on sectors which are major consumers of electricity. Therefore, a macroeconomic model of the overall economy was configured and run to estimate how the size and structure of the economy might be different under the two scenarios analyzed. In addition to estimating changes in overall growth of the economy as measured by Gross Domestic Product (GDP),

the macroeconomic model provided estimates of the change in "equivalent variation (EV)"[12] a measure of the economic welfare of individuals or households.

Two macroeconomic model runs were conducted. The first model run evaluated the effect on the overall economy of just the additional cost of air pollution controls under the *With-CAAA* case relative to the *Without-CAAA* case. The second model run incorporated these higher compliance costs but also added in some of the beneficial effects of cleaner air under the *With-CAAA* case; specifically, improvements in labor force participation and productivity, and savings on costs of treating air pollution-related illnesses.

While the key outcomes of changes in overall economic growth and in household economic welfare are presented in this summary report, the full set of modeling results, including the changes in output from each of the economic sectors covered by the macroeconomic model, are presented in the full report and supporting technical document.

Macroeconomic Model Run A: Compliance Costs Only

The first macroeconomic model run followed the customary practice of altering only cost-side effects, in this case the effects of diverting significant resources toward air pollution control and away from other potential economic uses of those resources. In particular, the macroeconomic model was configured to assess the effects of larger investments in air pollution control under the *With-CAAA* scenario on prices and quantities of goods and services produced and consumed by different sectors, including households and various categories of industrial activity.

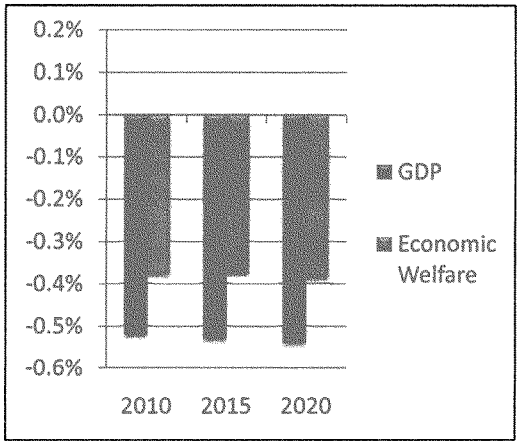

Exhibit 13. Differences in "Cost Only" model projections of GDP and economic welfare between the *With-CAAA* and *Without-CAAA* scenarios. For the set of economy-wide model runs which excluded beneficial effects of clean air, the orange bars indicate that economic growth as measured by Gross Domestic Product is lower throughout the study period. The blue bars indicate that the measure of economic welfare generated by the economy-wide model is also lower through the end of the study's reference period.

[12] "Equivalent variation" is an economic term for the amount of money someone would pay to avoid a change in prices or other market conditions which affect their economic well-being. In the present context, it provides a measure of the total value that people participating in the formal economy would assign to changes in markets for goods and services, including their own labor, associated with implementation of the 1990 Clean Air Act Amendments. Important limitations in this measure of welfare are described in the text box entitled *Measuring "Economic Welfare."*

The key overall results of the "Cost Only" run are shown in Exhibit 13. These key effects include both changes in overall 2010 to 2020 economic growth resulting from the investments made in Clean Air Act programs between 1990 and 2020, and the effect of changes in growth and sector-specific activity on the economic welfare of households. The results for the "Cost Only" run show that economic growth is about 0.54% lower in the year 2020 under the *With-CAAA* scenario than under the *Without-CAAA* scenario, mostly due to the effects of higher energy costs on various sectors of the economy. The macroeconomic model's measure of household economic welfare in 2020 is lower under the *With-CAAA* scenario by about 0.39%. The household welfare change is smaller than the reduction in GDP due to adjustments made by households which offset the adverse effect of reductions in household consumption of goods and services. The dollar equivalent of this 0.39% reduction in household economic welfare is about $75 billion.

The implication of the "Cost Only" macroeconomic modeling is that 1990 Clean Air Act programs both shrank the economy relative to what it would have been without these programs, and caused the average household to incur a small decrease in economic well-being, though there are important limitations in the macroeconomic model's measure of household economic welfare. (See the text box entitled *Defining "Economic Welfare."*)

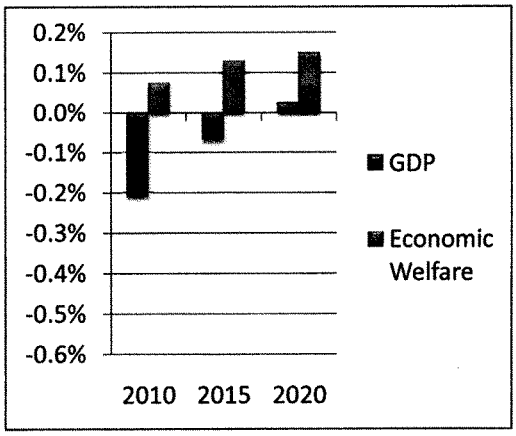

Exhibit 14. Differences in "Labor Force-Adjusted" model projections of GDP and economic welfare between the *With-CAAA* and *Without-CAAA* scenarios. A comparison of this chart with the preceding one (Exhibit 13) shows the significant changes in economy-wide modeling which occurred when just two of the beneficial effects of clean air were incorporated. Economic growth as depicted by the orange bars is initially lower but by the end of the study period 1990 Clean Air Act Amendment programs lead to higher overall growth in the economy. The blue bars indicate growing improvement in the measure of household economic welfare, a result which occurs because of the two beneficial effects of cleaner air and the fact that welfare is not determined by economic growth alone. Including more of the beneficial effects of cleaner air would likely result in even greater improvements in economic growth and household economic welfare.

However, in reality, effective air pollution control programs do not simply impose costs on the economy. They also improve air quality, which in turn affects the health and productivity of workers, reduces household medical expenditures for air pollution-related health problems, and protects the quality of the environment on which economic activity and growth depend.

Macroeconomic Model Run B: Adding Labor Force Improvements and Avoided Medical Costs

This study, for the first time, attempts to capture the broader economic effect of at least some of the benefits along with all of the estimated direct costs of 1990 Clean Air Act Amendment

programs. This was accomplished by adjusting the macroeconomic model's inputs and configuration to reflect some of the reductions in lost work days resulting from health improvements modeled in the health effect analysis. In addition to these labor productivity improvements achieved by reducing lost work days, the "Labor Force-Adjusted" model runs were configured to include the savings in medical expenditures implied by improved health outcomes projected under the *With-CAAA* scenario.

Exhibit 14 shows the results for the "Labor Force-Adjusted" macroeconomic modeling of the *With-CAAA* and *Without-CAAA* scenarios, and the results are very different from those obtained from the "Cost Only" model runs. By capturing some of the benefit-side effects, GDP eventually improves overall, and the measure of household economic welfare change is positive throughout the modeled period. Compared to the 0.54% reduction in GDP for the year 2020 under the "Cost Only" run, GDP is higher by 0.02%. Household economic welfare is also higher, reflecting a 2020 welfare improvement of 0.15% rather than a 0.39% reduction under the "Cost Only" method. The 0.15% welfare improvement for households under the "Labor Force-Adjusted" method is equivalent to about $29 billion for the year 2020. This estimate of welfare improvement is much smaller than that estimated in the main benefit-cost calculations because it excludes almost all of the value of mortality risk reduction, most of which cannot yet be incorporated in the type of economy-wide model used here.

Measuring "Economic Welfare"

The formal, measured economy –as represented in this study's economy-wide model–captures many aspects of the welfare of households, such as wages earned and the cost of goods and services. However economic models do not capture everything which affects people's welfare. For example, economic models do not capture the full costs of adverse health effects from air pollution. They may capture what people spend for preventive measures or medical costs, but they don't effectively capture the value people assign to avoiding the pain and suffering, inconvenience, or many other costs of being afflicted. Therefore, economic welfare as measured in a model of the overall economy provides only a limited measure of the changes which affect quality of life. For this reason, the principal focus of the present study is to estimate the direct benefits of air quality improvements using more complete, "willingness to pay" measures of economic value and comparing those direct benefits to the direct costs of regulatory compliance. Both measures of welfare change, however, provide potentially useful insights about the economic and welfare consequences of Clean Air Act programs.

Uncertainties

Benefit-cost studies of environmental programs are often highly complex, involve limited or uncertain scientific and economic data, and rely on models and other tools to simulate real world processes such as the atmospheric dispersion, transformation, and transport of air pollutants. Furthermore, external factors and conditions –such as rates of technology change or shifts in geographic patterns of economic activity—may also influence estimates of the benefits and costs of air pollution control programs. To meet the analytical challenges posed by these complexities and uncertainties, this study applied the best

available data and modeling tools, and used an extensive three-step approach to identify uncertainties and assess how they might influence the study's results.

For each major analytical step, beginning with development of emissions inventories and continuing through economic valuation of effects, potentially significant sources of uncertainty in the benefit and cost estimates were identified. Each "source of potential error" was evaluated to assess the direction and potential magnitude of its influence on the study's results. For some factors, alternative data or models were available which could be used to measure uncertainty in quantitative terms. Using quantitative methods where they were available –and analyst judgment where they were not—sources of potential error were classified as major or minor depending on whether reasonable shifts in their value could change the study's overall estimate of net benefits by more or less than five percent.

On the cost side, a number of uncertainties were identified, including cost components which are known to exist but could not be quantified, and cost components which were included but involve uncertain factors. As an example of an omitted effect, this study does not attempt to quantify the effect of clean air programs on the quality or features of affected products, such as the surface adhesion properties of paint reformulated to reduce emissions of volatile organic compounds. On the other hand, potential beneficial effects of product reformulation or redesign were also excluded. Staying with the example of paint reformulation, the study also omits the benefit of reducing indoor exposures to volatile organic compounds which are toxic.

Among the cost components which could be quantified, key uncertainties include the costs incurred by areas projected to need emissions reductions beyond those achievable by known cost-effective control measures, the effects on compliance cost of increasing industry experience with a given technology (i.e., "learning effects") as well as the effects of more fundamental technology change, and estimates of the percentage of vehicles failing to meet vehicle inspection and maintenance (I&M) requirements. In the end, however, none of the identified uncertainties on the cost side were classified as major. This is because total benefits exceed total costs by such a large margin that even doubling the total cost estimate would change the study's estimate of net benefits by less than five percent.

The list of effects on the benefit side which were only partially quantified, or entirely omitted, is far more extensive. Uncounted benefits include most hazardous air pollutant effects and virtually all effects of Clean Air Act programs on ecosystems, including ecosystems services which improve human welfare and quality of life, such as enhanced recreational experiences resulting from healthier forests. A variety of known or suspected human health effects associated with fine particle, ozone, or other Clean Air Act criteria pollutants were also excluded from this study's quantitative results due to limitations in health effects data, economic valuation information, or both.

There were also many more uncertainties identified for quantified benefits than for quantified costs. The complete list of uncertainties identified on the benefit side is available in the full report, but the three which emerged as the most significant were related to the estimated change in premature mortality risk resulting from fine particle exposure, the choice of model for estimating the timing of

premature mortality risk changes following a change in fine particle exposure,[13] and the estimated economic value of reducing premature mortality risk from air pollution. All three of these factors, along with eleven others associated with benefits estimation, were found to meet the study's criterion for defining a major uncertainty.

In the third step of the three-step uncertainty analysis, the effects of several of the most important quantifiable uncertainties were assessed using simulation modeling techniques. The results provide useful insights about which uncertain factors are most important and how the results of the study might be interpreted given the combined effect of these uncertainties. The detailed results of the simulation modeling and other uncertainty tests, along with discussion of the insights gained, are available in the full report and the supporting technical report on uncertainty analysis. In essence, the results suggest that it is extremely unlikely the costs of 1990 Clean Air Act Amendment programs would exceed their benefits under any reasonable combination of alternative assumptions or methods which could be identified. Even if one were to adopt the extreme assumption that fine particle and ozone pollution have no effect on premature mortality risk –or that such risk reductions occur but they have no value— the benefits of reduced non-fatal health effects and improved visibility alone add up to $137 billion for the year 2020, an amount which is more than twice the estimated $65 billion cost to comply with all 1990 Clean Air Act Amendment requirements in that year.

Conclusions

The objectives of this study included estimation of the incremental direct benefits and costs of the 1990 Clean Air Act Amendments, evaluation of economy-wide effects, assessment of a broad range of effects with potential significance for stakeholders and researchers, and consideration of the implications of study limitations and uncertainties for research and the design of future studies. Considering these objectives and the results obtained, EPA reaches the following conclusions.

1. ***The direct benefits of the 1990 Clean Air Act Amendments and associated programs significantly exceed their direct costs, which means economic welfare and quality of life for Americans were improved by passage of the 1990 Amendments and implementation of programs to meet their requirements.*** The wide margin by which benefits exceed costs combined with extensive uncertainty analysis suggest it is very unlikely this result would be reversed by any reasonable combination of alternative assumptions which could have been adopted in this study.

[13] "Cessation lag" is the technical term used to describe the delay between the change in air pollution exposure and the resulting change in health outcomes. Models for cessation lag which assume that a substantial proportion of the risk reduction occurs many years after the air quality improvement can lead to significantly lower estimates for the economic value of that improvement. Conversely, cessation lag models which assume most or all of the risk reduction occurs shortly after the air quality change can result in higher benefit estimates.

2. ***The broader economy is also improved overall by the 1990 Clean Air Act Amendments and related programs.*** While virtually all the costs of these programs could be incorporated, only two beneficial effects of cleaner air could be captured in the economy-wide model: improvements in worker productivity due to improved health, and savings on costs of medical care for some pollution-related health problems. Nevertheless, these two beneficial effects alone more than offset the economy-wide costs of investing in air pollution controls as both overall economic growth and the measurable economic welfare of American households are shown to be improved by the 1990 Clean Air Act Amendments.

3. ***Persistent uncertainties and limitations in available data and methods mean that some elements of cost and many human health, human welfare, and ecological effects cannot be fully and effectively captured in benefit-cost studies of air pollution control programs.*** The relatively comprehensive scope of the present study and its extensive uncertainty analysis highlight these deficiencies and demonstrate the need for ongoing investments in scientific and economic research to improve estimates of clean air program benefits and costs.

4. ***After designing, implementing, and evaluating the results of the current study, the Project Team identified several potential improvements worth considering for future analytical efforts.*** As described in the next section, future evaluation of Clean Air Act programs might be improved through scenarios analysis or an expanded analytical framework capable of evaluating criteria pollutant, hazardous air pollutant, and climate change pollutants in an integrated manner.

Looking Ahead

Beyond the intrinsic value of the present study with respect to its defined goals and objectives, there are at least two additional potential uses for this study. First, the methods or results of the study may contribute directly to other research. Second, the lessons learned from this study may provide insights which help improve the design of future studies and methods development efforts.

Additional direct uses for the present study

Energy externalities

The methods and results of the First Prospective Study were used by the National Academy of Sciences to support its analysis of energy externalities (see National Research Council, *Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use*, June 2010).[14] The current, Second Prospective Study could provide significantly improved information in support of future efforts to estimate the criteria pollutant-related externalities associated with energy production and use.

[14] Available at http://www.nap.edu/openbook.php?record_id=12794

Data, methods, and modeling tools

The Council and its technical subcommittees provided effective and rigorous evaluation of the data and methods used in the present study. EPA and other federal agencies, states and local agencies, and other researchers may find the methods developed and/or evaluated herein to be useful for their work. For example, the macroeconomic modeling techniques used to account for beneficial as well as costly effects of pollution control could be further refined and adapted to improve the modeling of economy-wide effects of other environmental programs.

Improving future studies

Redesigning analytical frameworks

Some of the limitations in the information this and other current studies provide to policymakers and the public can be addressed by redesigning the scope and frameworks for analysis to better capture important interactions among pollution control programs. It may be especially useful to explore building an analytical framework that evaluates criteria pollutant control programs in conjunction with programs to address climate change. An approach which focuses on analyzing broad scenarios, rather than small incremental differences in individual programs, may provide more useful insights into the ways such programs interact, capturing important effects of one program which influence the costs or effectiveness of other programs. For example, under a scenario involving unchecked greenhouse gas emissions it is reasonable to anticipate an atmosphere prone to more and worse extreme temperature days. An increase in extreme temperature days may lead to more code red[15] air quality alerts for ozone. Ozone air quality alerts may in turn lead to a reduction in outdoor activity, which may lead to greater use of indoor air conditioning. As people increase their use of air conditioners, the resulting increase in demand for electricity may lead to higher fine particle emissions from electricity generating units. A scenarios analysis approach might also support more realistic modeling of other external trends and conditions which influence a program's cost and prospects for success. Examples of factors which could be treated in a more realistic and consistent manner include patterns of economic growth, rates of technological development, patterns and intensity of fuel use, changes in atmospheric conditions, and population behavioral responses to air pollution and to measures taken to control it.

Value of Information analysis

Formal Value of Information (VOI) analysis has rarely been applied in evaluations of air pollution control programs. VOI principles are sometimes followed informally in the design and implementation of studies, as they were for the present study. However, more formal exercises aimed at assessing the policy and analytical implications of uncertainties in key variables could help guide priority-setting for research, analytical design, and efforts to improve data and methods.

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[15] Code red days are those classified under the Air Quality Index (AQI) as "unhealthy." For ozone code red days EPA recommends that sensitive groups avoid, and everyone else should limit, prolonged or heavy outdoor exertion. For more information about the AQI, go to http://www.epa.gov/airnow/aqi_brochure_08-09.pdf.

Ex ante versus *ex post* evaluations of data and modeling tools

Data and modeling tools could also be improved by more extensive evaluation of the validity of existing data and the performance of current models. Though not all data and modeling tools can be evaluated in this manner, formal data and model validation exercises based on comparisons of *ex ante* projections and *ex post* outcomes (e.g., comparing projections from current air quality models against air quality monitoring data) could improve the accuracy and reliability of future air pollution program benefit-cost studies.

Improved sharing of data and methods development

Sharing of data among researchers usually leads to significant improvements in the quality and usefulness of information. Formal collaborations among researchers to develop improved analytical methods could also significantly improve the quality of air pollution program benefit-cost analysis. For example, the Council panel which reviewed the initial analytical blueprint for the present study recommended the Agency consider organizing "Learning Laboratories" focused on addressing particularly important analytical challenges through a public-private collaborative process aimed at developing and vetting new methods and assumptions. The current Council panel also proposes more extensive release to the public of underlying data for use and improvement by other researchers. Both initiatives could lead to significant improvements in air pollution program evaluations.

Beyond the existing Clean Air Act

The statutory language defining the parameters for the present study limited its scope to evaluation of the effects of the existing Clean Air Act. However, since the Clean Air Act was last amended in 1990, the science and economics of air pollution control have progressed significantly. For example, much has been learned in recent years about the role ammonia plays in formation of the secondary particles which dominate this study's estimates of direct benefits. Future air pollution control program evaluations could be expanded to consider pollutants not currently addressed by Clean Air Act programs so the potential value of addressing such pollutants is clarified for policymakers and the public.

Cheaper, faster, better

Benefit-cost analyses of air pollution control programs are enormously complicated exercises, usually requiring operation of a long chain of highly complex models with numerous, large data sets. The substantial time and resource costs of the modeling systems used in the present study precluded the multiple model system runs that could provide policy-useful results disaggregated by pollutant, program element, and/or location. EPA continues to engage in and support model development efforts aimed at reducing the time and resources required to evaluate air pollution control program effects, while maintaining the high standards for scientific and economic rigor expected of EPA analysis. Achieving further gains in data quality and model speed and performance, and improving linkages between models in the analytical sequence, will require significant ongoing investment in model development. However, the results of this study demonstrate that the effects of 1990 Clean Air Act programs on public

health, the environment, and the economy are considerable, so improving Agency capabilities to conduct such analyses would appear to be a sound investment.

Frequently Asked Questions

Can the results of this study be added to the Retrospective Study to get a full picture of the benefits and costs of clean air programs since the 1970 Act?

The Retrospective Study evaluates the benefits and costs of the 1970 Clean Air Act and its 1977 Amendments up through the year 1990. The current Second Prospective Study evaluates the incremental effect of the 1990 amendments, using a baseline which reflects continuation after 1990 of only those programs in place when the 1990 Amendments were passed (see Exhibit 3 above). The results of the two studies, therefore, are at least conceptually additive. However, any attempt to add the benefits and costs estimated by these two studies would confront at least two significant challenges. First, the Retrospective Study used data and modeling tools significantly different from those applied in the current study. If the Retrospective Study were done again using current data and modeling tools, the resulting estimates of benefits and costs would be significantly different. Second, neither study provides information about the post-1990 effects of 1970 and 1977 Clean Air Act programs, except to the extent they are directly superseded by 1990 Amendment requirements and programs.

What about the benefits of reductions in hazardous air pollutants achieved by Title III? Are those counted?

The costs of complying with Title III Maximum Achievable Control Technology (MACT) standards for hazardous air pollutants are included in the primary estimates. These MACT standards achieved reductions in volatile organic compounds and other emissions beyond the reductions achieved by programs under other Clean Air Act titles. Therefore, while the incremental effects of Title III programs on criteria pollutant emissions are captured, the benefits of reductions in the direct toxic effects of hazardous air pollutants across the country are not captured. Pursuant to the study's goal to assess a broad range of potentially important effects, a case study evaluating both the costs and benefits of reduced exposures to benzene achieved by the 1990 Clean Air Act in the Houston area was conducted. A central purpose of the case study was to explore the specific data and model deficiencies which currently preclude effective quantification of hazardous air pollutant reduction benefits, perhaps providing insights to guide future research and development efforts. The benzene case study is available as a supporting technical document for the Second Prospective Study.

Isn't it likely other actions would have been taken at the federal, state, local or even private levels to address the problem of worsening air pollution if the 1990 Clean Air Act Amendments hadn't been enacted? So isn't the study giving too much credit to the Clean Air Act for all the air quality improvements since 1990?

The projected air quality conditions under the *Without-CAAA* scenario are significantly worse than projected under the *With-CAAA* case. As a result, it does seem likely actions would have been taken through other federal programs, state/local regulations, and/or voluntary private actions to protect air quality. The extent and character of the alternative actions which might have been pursued, however, are unknown. Such measures would have also imposed costs, perhaps similar to those estimated herein and attributed to the 1990 Clean Air Act Amendments. Since it is a matter of speculation what actions may have been taken in the absence of the 1990 Amendments, the present study is designed to show the difference between a world with and a world without all the federal, state, and local programs implemented after passage of the amendments. As such, this study is best interpreted as capturing the value of the full range of public and private actions taken to improve air quality to levels consistent with overarching federal law. Significant credit is due to EPA's state and local partners, and to private firms and individuals, for the air quality improvements and resulting net benefits estimated by this study.

Does this study predict what will happen in particular locations, especially whether a given county or state or air quality management district will or won't attain federal air quality standards in the future?

This study focuses on analyzing differences in air quality between one particular, assumed pathway for implementation of the Clean Air Act as amended in 1990 versus a hypothetical, counterfactual state of the world without the 1990 Amendments. As such, though the study applies several models which have high levels of spatial detail and are used for attainment demonstrations, the study focuses on estimating potential differences in air quality between two constructed scenarios over a period of decades and across the 48 contiguous states. It therefore does not provide the analyses of location-specific meteorological data, control measures, and consecutive year air quality change used to determine attainment with air quality standards. Nevertheless, the study does provide insights on the overall magnitude of 1990 Clean Air Act Amendments compliance costs and the substantial benefits achieved by the measures taken.

The significant benefits estimated for 1990 Clean Air Act Amendment-related programs can be traced to the large differences between actual air quality conditions reflected in the* With-CAAA *case and the much poorer air quality conditions projected under the counterfactual* Without-CAAA *case. Are those poor air quality conditions under the counterfactual scenario realistic?

While the *With-CAAA* air quality conditions are anchored to actual air quality monitor data, the air quality conditions under the hypothetical *Without-CAAA* scenario cannot be observed and therefore the credibility of those projected conditions is harder to establish. Comparisons to historical conditions can be helpful, but in this case such comparisons are confounded for the fine particle pollution which dominates this study's results because the particle size fractions monitored through the years changed. Nevertheless, data were available for a few time periods and locations where both fine ($PM_{2.5}$) and coarse particle fractions –PM_{10} and/or Total Suspended Particles (TSP)—were monitored. These data showed that projections for *Without-CAAA* air quality in three of the four U.S. cities examined were reasonably consistent with historical monitored air quality during the 1980 to 1990 period prior to

passage of the 1990 Clean Air Act Amendments, suggesting that *Without-CAAA* air quality conditions are severe but plausible. For example, despite a significant deterioration in Los Angeles air quality under the *Without-CAAA* scenario, the projected annual average PM2.5 concentration for 2020 of 35.5 micrograms per cubic meter is slightly less than Los Angeles' estimated 1980 annual average PM2.5 concentration of 38.5 micrograms per cubic meter. Details of these comparisons are available in the full report (see text box 4-1).

Some of EPA's previous analyses of particular rules included an assumption that there was no mortality-related benefit from reducing exposure to fine particle pollution once concentrations fell below some threshold level. Does this study apply a threshold assumption?

In a limited number of past analyses of individual rulemakings, EPA did impose an assumption that there was no further benefit to reducing fine particle exposures once concentrations to which people were exposed fell below 10 micrograms per cubic meter. However, based on a subsequent re-assessment of the scientific literature and consultation with the public and outside experts, EPA returned to the earlier practice of estimating benefits down to the lowest measured fine particle concentrations without imposing an assumed threshold. This is the same approach used in the first two reports in this series: the Retrospective Study and the First Prospective Study. EPA nevertheless believes there is a distinction which can be made between exposure changes which occur above versus below the fine particle concentrations measured in the health studies used to estimate benefits. Although a health study's lowest measured level (LML) is not viewed as a threshold, EPA's confidence in benefit estimates is higher for the portion of the risk change which occurs at or above the LML of a health study used to estimate benefits. For the fine particle-related premature mortality benefits presented herein, two health studies were applied. The LML of the Laden et al. (2006) study is 10 micrograms per cubic meter, and 91 percent of the mortality risk reduction benefit presented in this analysis occurs at or above this concentration. Similarly, the corresponding numbers for the Pope et al. (2002) study are 7.5 micrograms per cubic meter and 98 percent of the estimated mortality reduction benefit. Given that the vast majority of the present study's mortality risk reduction occurs at or above the LMLs of the underlying health studies, EPA's confidence in the estimates of the fine particle-related premature mortality benefits presented herein is particularly high.

The Second Prospective Study results are dominated by the benefits of reducing overall exposures to fine particles. But there are several different species of fine particles, including sulfates and nitrates, and there is some evidence they aren't all equally toxic. Why didn't the study evaluate the possibility that some species of fine particles are more toxic than others?

As a practical matter, the mix of particle species making up total fine particle mass does not change much between the *With-CAAA* and *Without-CAAA* scenarios. Therefore, the results presented herein would not be very sensitive to even strong assumptions about potential differences in the toxicity of particle species. Furthermore, scientific evidence establishing the potential differential toxicity of particle species is still considered by EPA to be insufficient to support effective analysis of the potential consequences if specific species of fine particles are found to manifest different degrees of toxicity. Available epidemiological studies supporting the association between fine particle exposure and health

effects such as premature mortality are based on aggregate measures of fine particle exposure. Assuming one particular species is more toxic requires adjustments to the known or presumed toxicity of all other particle species, including potentially critical interaction effects among them. Absent adjustments to maintain coherence, the set of differentiated, species-specific concentration-response functions developed for analytical purposes may be inconsistent with the underlying health studies. While notional species-specific risk coefficients might theoretically be constructed, EPA believes that unfounded and inconsistent species-specific risk functions would be highly uncertain and could be biased, leading to analytical results which may be significantly more misleading than informative. There is ongoing research on the issue of potential differential toxicity of fine particles and EPA looks forward to improvements in the scientific information available to address this question.

Is it plausible that clean air programs are responsible for yielding benefits equal in value to $6,000 per person, a figure which is about 6-7% of projected mean personal income in 2020?

It is true that this study's direct benefit results imply a very substantial gain in value to people living in the United States, especially from reductions in risk of fine particle-related premature mortality. The difference in health outcomes with and without 1990 Clean Air Act Amendment programs may be so great that the customary measures used to translate small, marginal changes in health outcomes to dollar values may misestimate the economic value of the non-marginal changes in health outcomes between the two scenarios analyzed. This issue warrants further consideration. Nevertheless, there is an important difference between the value people may assign to improved health and what it costs them to acquire it. It is not the case that Americans had to spend $6,000 per person per year for the cleaner air achieved by 1990 Clean Air Act Amendment programs. Instead, as shown by the direct cost results of this study, the costs to society of implementing these programs only reach about $190 per person by 2020, the study year when the incremental costs are highest. The $6,000 figure is a dollar-based value for the welfare improvement people enjoyed by avoiding the poor air quality conditions projected under the *Without-CAAA* scenario, and is not an estimate of what people actually had to pay for the improvements in health, welfare, and environmental conditions achieved by 1990 Clean Air Act Amendment programs.

Why doesn't this study include the costs and benefits of climate change programs?

When EPA defined the scope of the study in 2001, there were no Clean Air Act standards in place which specifically address greenhouse gas emissions, nor were there any Agency plans at that time to set such standards in the future. Furthermore, the final specification of scenarios to be analyzed was made in 2005, two years before the 2007 Supreme Court ruling that greenhouse gases are pollutants covered by the Clean Air Act. Although not included within the scope of this study, EPA has conducted numerous other studies assessing the environmental and economic effects of proposed climate change programs. In the future, EPA expects to conduct and/or encourage studies which more effectively integrate evaluations of climate change policy options with evaluations of ongoing and future Clean Air Act programs.

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Senator INHOFE. I would agree that I support this.

Senator BOXER. Good.

Senator INHOFE. I have always been a supporter of the Clean Air Act. I see it has done wonderful things.

Senator BOXER. Good. Thank you very much.

Senator, I believe it is Vitter at this time. Alexander? Sorry.

Senator Alexander.

STATEMENT OF HON. LAMAR ALEXANDER, U.S. SENATOR FROM THE STATE OF TENNESSEE

Senator ALEXANDER. Thank you, Madam Chairman.

I want to welcome Bob Graham and Bill Reilly. I started with Bob as Governor. He was really one of the most effective and innovative Governors in our country when he served. Bill Reilly I served with in the Bush administration, and a great leader on environmental matters.

Last week, and I will keep my remarks brief, last week I bought a Nissan Leaf, so I am driving an all electric car back and forth to the office. But I figured out that even if we electrify half our cars and trucks, which I would like for us to do in this country, which is a very audacious and ambitious goal, we would still need about 10 or 11 million barrels of oil, of crude oil, a day. And 31 percent of our domestic oil comes from the Gulf.

We are all watching what is happening in Japan with nuclear power even though we have never had a death in connection with a commercial nuclear plant in the United States. We have not had one on any of our navy reactors, no one was hurt at Three Mile Island. We worry about nuclear power but it provides 70 percent of our clean electricity, no sulfur, nitrogen, mercury or carbon.

Coal, we have had many discussions about the use of coal, but that is 50 percent of our electricity. Natural gas, we are relieved that we have a new supply of natural gas which has less pollutants. But all of a sudden we are reminded that 25 percent of our domestically produced natural gas comes from off shore.

So in a country that uses about 25 percent of all the energy in the world, all of the energy sources we have have some cost to them. I look forward, greatly, to your recommendations about how we can continue to explore for oil and gas, because we are going to need it, and we are going to need to look off shore and in Federal lands in Alaska, in my opinion, but to do so in a safe way as we move toward using less oil and gas and natural gas in our country.

Thank you very much for your service and your work on this.

Senator BOXER. Thank you, Senator Alexander.

Senator Cardin.

STATEMENT OF HON. BENJAMIN L. CARDIN, U.S. SENATOR FROM THE STATE OF MARYLAND

Senator CARDIN. Thank you, Madam Chair.

I really want to thank our two Co-Chairs, very much, for your leadership on this. Senator Graham, it is nice to see you again and thank you for your leadership. Mr. Reilly, it is nice to have you before the committee and we thank you very much for your service. Your report I found to be excellent. I think it really will be used

as a judge for congressional action, both legislative and oversight. So we thank you.

I do want to acknowledge that we are proud that Dr. Don Boesch was part of your group from Maryland. He is one of our experts on the environment and he helps us a great deal on the Chesapeake Bay.

This is the largest environmental disaster in our Nation's history and there are a lot of things we need to take a look at as a result of this disaster. We have to take a look at the liability laws to make sure they are adequate. We certainly need to take a look at a regulatory system that failed.

But I want to concentrate on one issue and that is focus on the environmental damage and the ongoing assessment efforts and your recommendations related to independent scientific assessment of those damages.

The role of science in the aftermath of the Deepwater Horizon disaster is something which I think all of us need to be concerned. I say that because there was a troubling reliance on the responsible party for funding. Now, BP put major funding efforts into the cleanup, and that is certainly understandable, but they also were involved in the assessment of damage and there, of course, they have a self interest. So, I think it behooves all of us to make sure that we get objective review of the material and assessment so that we can take the appropriate action.

I do not know how that can be done unless we have some form of an independent source of funding to allow independent scientists to make those judgments to assist the Government in holding a responsible party for the damage that has been done. We need some type of a dedicated source of funding so that independent science work can be deployed without hesitation.

I hope that we will find ways in which we can address those issues. I think your recommendations really help us in that regard. The natural resource damage assessment provisions of the Oil Pollution Control Act require that the public be compensated for the injuries and the loss of public resources. We have a responsibility to make sure that, in fact, is done.

I think you have given us the foundation so that we can take the appropriate action here in Congress and I thank you very much for your public service.

[The prepared statement of Senator Cardin follows:]

STATEMENT OF HON. BENJAMIN L. CARDIN, U.S. SENATOR FROM THE STATE OF MARYLAND

Madame Chairman, let me begin by thanking our witnesses. Both Senator Graham and Administrator Reilly have already had distinguished careers. The fact that they responded to this call to duty is an example of selfless public service that deserves the nation's thanks. We are indebted to you both.

I also want to note the contribution of one of the other Commission members. Dr. Don Boesch is the President of the University of Maryland Center for Environmental Sciences and an eminent scientist in his own right. He has extraordinary experience as a scientist who has studied the Louisiana wetlands complex for decades. We are especially proud of the work that he does today as the Chesapeake Bay's preeminent scientist. I know that his contribution to the Commission was invaluable, and I want the record to note my personal thanks for the work of Dr. Boesch.

The Commission's report is thorough-going. It contains key findings about this extraordinary event that cost 11 people their lives and immediately disrupted the lives

of countless Americans. As you note, it was the largest environmental disaster in the Nation's history.

Your recommendations are thoughtful and I intend to pursue legislation that will implement many of them.

We have much to discuss, ranging from liability limits that are too low, a regulatory regime that failed to protect human lives as well as our public resources. You have detailed recommendations that include technology, research, management, oversight, emergency response and more. All of these are the proper purview of this hearing, but I want to focus my comments and questions on the environmental damages, the on-going assessment effort, and your recommendations related to independent, scientific assessments of those damages.

In short, I want to focus my remarks and later my questions on the role of science in the aftermath of the Deepwater Horizon disaster.

As the witnesses said in their Recommendations report, we need to deploy the full range of the nation's scientific capacity when disaster strikes. That means government scientists and engineers from multiple agencies and departments, academics, and both private sector and independent public scientists being fully engaged day one.

Getting this phalanx of expertise into the field quickly and in a well-coordinated fashion is essential. As you note in your report, the full range of that expertise was not fully engaged. Unnecessary restrictions were placed on scientists, who found many areas with restricted access. Oil spill rates were grossly underreported until reasonable access to the site was afforded to independent government and academic engineers.

Further, there was an inability to put sufficient financial resources into the recovery effort quickly enough. There was a troubling reliance on the responsible party for funding. BP put major funding into the effort. But cleanup and restoration activities are in the company's self interest. An independent analysis of the scope of damages is not, and yet the company exerted strong hold on those purse-strings.

In a hearing I held last year, the water and wildlife subcommittee heard compelling testimony from a number of scientists who were engaged in the Natural Resources Damage Assessment. The Federal Government had insufficient financial resources to put full teams into the field to gather both baseline and impact data.

We need a dedicated source of funding so that independent science work can be deployed without hesitation. One of the lessons of *Exxon Valdez* disaster, several witnesses said, was the need to collect better data in the immediate aftermath of such a catastrophic event and to keep such expertise in the field long enough to get a complete picture of the damages to our natural resources.

We also heard about the need to have independent scientists conduct these surveys. We were warned repeatedly that data gathered, analyzed and published by the responsible party would never be viewed as unbiased.

Your recommendations make this same point. There is a compelling need for fair and transparent analysis of the impacts on our natural resources. The Natural Resource Damage Assessment provisions of the Oil Pollution Control Act require that the public be compensated for injury to and lost use of public resources. These include essential habitats such as wetlands. They also include the loss of fish, turtles, and uncounted shorebirds such as the brown pelican. Plant life and the microorganisms that make up the basis of the food chain for all species also must be assessed.

You have done a remarkably thorough job of sorting through the chaos of the Nation's largest environmental disaster. Your independent, non-partisan analysis, impartial judgment and thoughtful recommendations are remarkable. We are grateful for your service, and I look forward to exploring some of these issues in greater detail during our question period.

Senator BOXER. Senator Vitter.

STATEMENT OF HON. DAVID VITTER, U.S. SENATOR FROM THE STATE OF LOUISIANA

Senator VITTER. Thank you, Madam Chair, and thanks to both of the Chairmen for their work. I would just like to briefly focus on two things.

First of all, to me, moving forward in Louisiana and on the Gulf, I think the single most important recommendation of your report is that we, in Congress, with the President, dedicate a significant portion of the fines related to this incident under the Clean Water

Act to restoration in the Gulf. I thank you for making that crystal clear recommendation.

The Administration supports that approach. But, of course, the devil is in the details in terms of what we dedicate those resources to and how it is spread geographically and among jurisdictions. The quicker and the fairer we can resolve that, the better. I would really encourage all of us to come together to move forward with dedicating a significant majority of the fines under the Clean Water Act to Gulf restoration.

Second, I would just like to point out that this incident in the Gulf is a continuing tragedy and a continuing crisis. Most of the continuation of it right now is on the economic side due, in my and many people's opinions, to an unwarranted continuing shutdown of the Gulf. I think it is unwarranted.

None of us argue with the need to learn from this disaster and adapt and change. We are doing that in major ways. Maybe the most obvious are the two major containment systems that have been developed to be on call to respond to any future incident, which hopefully we will not have. But we need to move on and restart the Gulf and put people back to work. That is the continuing crisis that we are facing, the economic devastation.

Finally, let me say with regard to both of those points, my colleague, Mary Landrieu, agrees wholeheartedly. She is a Democrat, I am a Republican, but we certainly agree on both of those points about Clean Water Act fines and about putting people back to work in a much more aggressive way immediately in the Gulf to help meet our Nation's immediate energy needs.

Thank you, Madam Chair.

Senator BOXER. Senator, I am looking forward to some legislation that would carry out what you are talking about because we do need that legislation. I just would ask you if you are working on such legislation with Senator Landrieu at this time.

Senator VITTER. Yes.

Senator BOXER. Good. So, as soon as that is ready, I think we ought to bring it here and I think we ought to get it done because I fully agree with that.

We welcome you again and we will have time before the vote starts to hear your full statements. So, Senator Graham, do you want to proceed? Or, whichever one of you.

STATEMENT OF HON. BOB GRAHAM, U.S. SENATOR (RETIRED), CO-CHAIR OF THE NATIONAL COMMISSION ON THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING

Senator GRAHAM. Thank you very much, Madam Chair.

I am very appreciative to join my long-time friend and colleague, Bill Reilly, in discussing some of the recommendations of our Commission on Offshore Oil. We believe very strongly that this goal should be, as Senator Alexander has said in other areas, to assure the American people that the way in which we are conducting this enterprise has the highest standards of safety of any place in the world. I am afraid that we cannot say that today.

With that, there may be the confidence of the American people that will allow this industry, which is a critical part of our oil and gas production, to proceed forward and continue to serve America.

The President created our Commission and asked it to determine the causes of the Deepwater Horizon disaster, evaluate the response, and advise the Nation about how future energy exploration could take place in a responsible manner. We spent the better part of 8 months organizing ourselves and then conducting a series of hearings, interviews, and expert review of the documents and literature in order to reach our conclusions. We made recommendations for the industry, for the executive branch, and for the Congress.

I am very gratified by the progress that has been made by the industry. As Senator Vitter commented, the industry is developing impressive new well containment technologies and there are new standards being established within the industry itself. The Interior Department is moving forward with internal reorganization that will allow it to have a higher level of oversight of the industry and greater public confidence in the manner in which the Government-industry relationship is being managed.

I would like to focus my remarks, Madam Chairman, on the issues that are within the jurisdiction of this committee and I will discuss three of those and Bill Reilly others.

The first is the Oil Pollution Act of 1990. This was legislation enacted after *Exxon Valdez* and it included the recommendation that there be a cap on liability of $75 million. We think this cap is a, obviously 20 years out of date. Just inflation itself would demand that it be reopened and examined.

We also think an even more important thing that has happened is that about the time that this law was passed, the industry moved from being a shallow water industry, that is drilling at 1,000 feet or less, to increasingly a deep water industry. In the next 20 years, almost all of the new offshore oil activities will be at depths of greater than 1,000 feet. That is not just a difference measured in feet or yards or meters. It is a significant difference in the risk and the potential adverse consequence of an untoward event.

So, we recommend that there be a reexamination of what would be the appropriate level of, the appropriateness of having any cap, and if there is to be a cap, what should be the considerations.

We think the basic policy considerations are, on the one hand, you do not want to create a situation where only the megafirms are in a financial position that they can be part of the exploration activity. For a variety of reasons, it is important to maintain a strong, independent sector within the oil and gas industry.

But, on the other hand, if the liability cap is too low and is not reflective of the real economic consequences, then the cost is not going to go away, but it is either going to be born by the innocent victim, that small fisherman in Louisiana who has lost the ability to provide his income, or other interests that will be adversely effected, or, as we have seen in other industries, it becomes the Federal Government's responsibility and, therefore, the taxpayers are picking up the costs.

We think the challenge to this committee is to strike that appropriate balance and we have made a number of recommendations as to how to do that.

The second issue is oil spill response. One of the best things that happened in this disaster was that it was a BP well. If this had occurred to a company that was less financially capable than BP, the disaster would have been multiple times more difficult and of greater pain to the American people.

We believe there are some important steps that can be taken that would increase the industry-wide ability to respond to an incident. First, that the Department of the Interior do as it has been doing, which is develop a more rigorous set of standards and requirements for industry response plans before a well is permitted, that is, before we proceed forward, we need to know that we have the capability to respond to an adverse event.

Second, that the EPA and the Coast Guard should more fully involve State and local governments as significant players in spill response planning. This is a familiar concept to this committee because it would adopt some of the principles of the Stafford Act, which relates to earthquakes, hurricanes and other natural disasters, to oil spills.

Third, that the Congress should provide an adequate and sustained funding for oil spill research as Senator Cardin has suggested. One of the shocking discoveries was that there was virtually no improvement in our ability to respond to an oil spill between *Exxon Valdez* in 1989 and this incident in 2010. In large part, that was a function of the fact that nobody had been investing in that research that would have improved our level of response, particularly for a deep water event.

Finally, the issue that Senator Vitter raised. We believe it is very important to see this as an opportunity to do something that has been long needed but has faltered largely on the lack of an adequate source to make it happen, and that is a major effort to restore one of America's treasures, which is the Gulf of Mexico. It has been a battered area, and that is particularly true in the Mississippi Delta area.

A combination of actions that had an economic purpose combined with nature has caused a serious deterioration of, and the basic quantity of the marshlands of, the Mississippi Delta. We believe that this is an opportunity by committing 80 percent of any civil fines or penalties that are collected under the Clean Water Act to this purpose to make a major step forward in the protection of our Gulf.

Madam Chairperson, I have exceeded my time already. I will thank you and call upon my colleague.

Senator BOXER. I would not have called on you to end except we do have a vote pending and what I want to do is get both of your testimony finished. So, we do have time. If the bell rings, keep on going. We certainly can stay for the full 5, 7 or 8 minutes of your statement.

Hon. Bill Reilly, we are very honored to have you here as well, along with Senator Graham.

STATEMENT OF WILLIAM REILLY, CO-CHAIR OF THE NATIONAL COMMISSION ON THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING

Mr. REILLY [Speaking off microphone]. Thank you, Chairman Boxer, Senator Inhofe——

Senator BOXER. Make sure you turn on your mic. There you go.

Mr. REILLY. Thank you. Chairman Boxer, Senator Inhofe, members of the committee, I ask that my testimony, our testimony, be included in the record——

Senator BOXER. Without objection.

Mr. REILLY. It will be fairly brief. Senator Graham, with whom I have had the great pleasure to serve on this Commission, a statesman and a terrific collaborator, very important in the whole presentation, organization and approach of the Commission, I would just simply point that I believe this may be the first Commission in history, I think Congressman Waxman observed that it probably was and he considered it bad precedent that we came in well under budget, I think about two-thirds, I think, of the money allocated to us we spent, we also finished in about the shortest time ever allowed a Commission and that was 6 months.

I want to comment on a couple of things that are relevant to the committee, I think, and some that may go somewhat beyond your jurisdiction. Senator Graham has covered some of the key, the really salient points that are within this committee's jurisdiction.

I want to say, first of all, that as someone, the only member of our Commission who had significant industry experience, a longtime member of the Board of ConocoPhillips, I want to say that this is a very vital industry and an extremely important enterprise.

We do, as Senator Alexander said, get about 30 percent of our oil, domestic oil, from the Gulf. We are getting it increasingly from deep water. We will get even more of it from deep water going forward for the simple reason that that is where it is. That is where the serious reserves of hydrocarbons now lie in the United States waters with the single exception of those that are offshore in Alaska.

The first point I would like to make is that the report is a hopeful report. It is essentially an optimistic report. We believe that this enterprise poses significant risks and the deeper you go the higher the risk. But it is a manageable enterprise.

There are many high risk industries that have learned to manage their risks, the chemical industry after Bo Pahl with responsible care, the nuclear industry in the United States, as Senator Alexander mentioned, after Three Mile Island, and this industry has had its wake-up call. It is a sophisticated industry and largely a responsible industry. We believe that it will learn from this experience and the indications that they are going to establish an institute modeled on some of those that have characterized other high risk industries is very encouraging in that respect.

The experience of the *Exxon Valdez*, over which I had significant responsibilities, led me to believe that the things that we provided for in the Oil Pollution Act would have provided a substantially improved response capability, technology, the skimmers, the booms, the dispersants, and the rest. The truth is that we did not see any improvement significantly in the Gulf. That can be addressed. It

should be addressed with concentrated research that is fostered. There was research provided for, research funds, in the early years after 1989. But that money diminished over time as memories faded. We strongly encourage attention to response capability and technology going forward.

Second, the interagency coordination process really needs to be fixed. The Interior Department has been in the habit of accepting comments, advice to its proposals from whomever. If the Coast Guard or NOAA should make comments, those are treated along with any ordinary citizen's or inexpert observer. That needs to be changed.

The Commission makes a number of recommendations about the improvement in the way in which the National Environmental Policy Act works to engage other agencies and particularly expert agencies. We recommend that the role particularly of NOAA and the Coast Guard, who really, oddly, have not been heavily involved or consulted in deliberations respecting leasing decisions, be substantially upgraded.

I think going forward one of the major questions that will preoccupy us in this field is what to do about the offshore Arctic. The Arctic poses a different set of risks. It is shallow water, largely, but has its own threats of terrible fog, very severe hurricane-type forces, darkness over much of the year, ice and ice scouring that goes all the way down to the 140 foot depth that wells are likely to be drilled in the Chukchi Sea. Those are all going to need special attention, along with the very important species in the Arctic, some of which are endangered, many of which are priceless and highly important.

As we go forward, our Commission, which dealt with this issue, it was probably the most divisive or difficult issue that we confronted, we do recommend that there be no moratorium on offshore drilling in the Arctic. We recommend also that baseline science be developed with respect to those species and other impacts that are likely to be encountered. We recommend that much greater attention be given to the prevention capabilities of those who are allowed to drill exploratory wells, and to containment should there be a disaster.

Finally, we recommend that the issue of dispersants, which have not previously been tested seriously in the Arctic, that be given a high priority by the Environmental Protection Agency. As a former EPA Administrator, I fully understand why there has been significant reluctance to deposit oil into waters, particularly, perhaps, fragile ones. But that needs to be done so that we can have the conversation about dispersants and determine their appropriateness and effectiveness before an event requires their use, which was not true in the Gulf.

Finally, let me just say that this is a global industry and these are global problems. We know that Mexico intends to drill within the next 2 years in deep water in the Gulf in their sovereign jurisdiction. We know also that Cuba is planning, possibly as soon as next year, to begin 16 wells, some of them 50 miles off the coast of Key West. In the Arctic, also, we will have to have some kind of understanding with the other Arctic powers, Russia, Canada, Denmark and the like, with respect to how they proceed.

There is every reason to give a high priority to getting the best practices accepted in regulations and recognized by the international oil and gas developing community of nations.

Thank you, Madam Chairman.

[The prepared statement of Senator Graham and Mr. Reilly follows:]

STATEMENT OF HON. BOB GRAHAM, U.S. SENATOR (RETIRED) AND HON. WILLIAM REILLY, NATIONAL COMMISSION ON THE BP "DEEPWATER HORIZON" OIL SPILL AND OFFSHORE DRILLING

I. INTRODUCTION

Chairman Boxer, Ranking Member Inhofe, and members of the committee, thank you for the opportunity to testify today on behalf of the National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling.

The explosion that tore through the *Deepwater Horizon* drilling rig last April 20, as the rig's crew completed drilling the exploratory Macondo well deep under the waters of the Gulf of Mexico, began a human, economic, and environmental disaster.

Eleven crew members died, and others were seriously injured, as fire engulfed and ultimately destroyed the rig. And, although the Nation would not know the full scope of the disaster for weeks, the first of more than four million barrels of oil began gushing uncontrolled into the Gulf—threatening livelihoods, the health of Gulf coast residents and of those responding to the spill, precious habitats, and even a unique way of life. A treasured American landscape, already battered and degraded from years of mismanagement, faced yet another blow as the oil spread and washed ashore. Five years after Hurricane Katrina, the Nation was again transfixed, seemingly helpless, as this new tragedy unfolded in the Gulf. The costs from this one industrial accident are not yet fully counted, but it is already clear that the impacts on the region's natural systems and people were enormous, and that economic losses total tens of billions of dollars.

On May 22, 2010, President Barack Obama announced the creation of the National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling (the "Commission"): an independent, nonpartisan entity, directed to provide thorough analysis and impartial judgment. The President charged the Commission to determine the causes of the disaster, and to improve the country's ability to respond to spills, and to recommend reforms to make offshore energy production safer. And the President said we were to follow the facts wherever they led.

This Commission report (the "Report"), which we ask be made part of the hearing record in its entirety, is the result of an intense 6-month effort to fulfill the President's charge. As a result of our investigation, we conclude:

- The explosive loss of the Macondo well could have been prevented.
- The immediate causes of the Macondo well blowout can be traced to a series of identifiable mistakes made by BP, Halliburton, and Transocean that reveal such systematic failures in risk management that they place in doubt the safety culture of the entire industry.
- Deepwater energy exploration and production, particularly at the frontiers of experience, involve risks for which neither industry nor government has been adequately prepared, but for which they can and must be prepared in the future.
- To assure human safety and environmental protection, regulatory oversight of leasing, energy exploration, and production require reforms even beyond those significant reforms already initiated since the *Deepwater Horizon* disaster. Fundamental reform will be needed in both the structure of those in charge of regulatory oversight and their internal decisionmaking process to ensure their political autonomy, technical expertise, and their full consideration of environmental protection concerns.
- Because regulatory oversight alone will not be sufficient to ensure adequate safety, the oil and gas industry will need to take its own, unilateral steps to increase dramatically safety throughout the industry, including self-policing mechanisms that supplement governmental enforcement.
- The technology, laws and regulations, and practices for containing, responding to, and cleaning up spills lag behind the real risks associated with deepwater drilling into large, high-pressure reservoirs of oil and gas located far offshore and thousands of feet below the ocean's surface. Government must close the existing gap and industry must support rather than resist that effort.
- Scientific understanding of environmental conditions in sensitive environments in deep Gulf waters, along the region's coastal habitats, and in areas proposed for

more drilling, such as the Arctic, is inadequate. The same is true of the human and natural impacts of oil spills.

We reach these conclusions, and make necessary recommendations, in a constructive spirit: we aim to promote changes that will make American offshore energy exploration and production far safer, today and in the future.

II. THE ROOT CAUSES OF THE EXPLOSION

The Commission examined in great detail what went wrong on the rig itself. Our investigative staff uncovered a wealth of specific information that greatly enhances our understanding of the factors that led to the explosion. There are recurring themes of missed warning signals, failure to share information, and a general lack of appreciation for the risks involved. In the view of the Commission, these findings highlight the importance of organizational culture and a consistent commitment to safety by industry, from the highest management levels on down.

To summarize, the Macondo blowout happened because a number of separate risk factors, oversights, and outright mistakes combined to overwhelm the safeguards—promised by both government and by private industry—to prevent just such an event from happening. But most of the mistakes and oversights at Macondo can be traced back to a single overarching failure—a failure of management by BP, Halliburton and Transocean. Set out below are what Commission investigative staff determined were "key facts."

Key Facts: The investigation team identified several key human errors, engineering mistakes and management failures including:

- A flawed design for the cement slurry used to seal the bottom of the well, which was developed without adequate engineering review or operator supervision;
- A "negative pressure test," conducted to evaluate the cement seal at the bottom of the well, identified a cementing failure but was incorrectly judged a success because of insufficiently rigorous test procedures and inadequate training of key personnel;
- Flawed procedures for securing the well that called for unnecessarily removing drilling mud from the wellbore. If left in place, that drilling mud would have helped prevent hydrocarbons from entering the well and causing the blowout;
- Apparent inattention to key initial signals of the impending blowout; and
- An ineffective response to the blowout once it began, including but not limited to a failure of the rig's blowout preventer to close off the well.

Key Findings: The "key facts" led investigators to make the following "key findings":

- Errors and misjudgments by at least three companies—BP, Halliburton and Transocean—contributed to the disaster.
- Management failures included:
  - Inadequate training of key personnel.
  - Inadequate management of numerous late-stage well design decisions.
  - Poor communication within and between the companies involved.
  - Inadequate risk evaluation and risk mitigation measures.
- The disaster could have been prevented. Notably, workers on the rig incorrectly interpreted clear warning signs of a hydrocarbon influx during the negative pressure test. If recognized, those warning signs would have allowed them to shut in the well before the blowout began.
- Government regulations did not address several key causes of the blowout, and regulators lacked the resources or technical expertise to address others.
- Whether purposeful or not, many of the risk-enhancing decisions that BP, Halliburton, and Transocean made saved those companies significant time (and money).

The Commission's investigation concludes that these failures were preventable. Errors and misjudgments by at least three companies—BP, Halliburton and Transocean—contributed to the disaster, and Federal regulations did not address many of the key issues.

III. REGULATORY OVERSIGHT AND THE NEED FOR REFORM

Regulatory Oversight

While our testimony will primarily focus on those areas that fall within the committee's jurisdiction, it is important to briefly discuss the lapses in regulatory oversight that contributed to this disaster, and the Commission's recommendations in this area.

The responsibilities assigned to the Minerals Management Services (MMS) in an effort to regulate the offshore oil and gas industry have created conflicts of interest and have been subject to pressure from political and industry interests. MMS was

not only responsible for offshore leasing and resource management; it also collected and disbursed revenues from offshore leasing, conducted environmental reviews, reviewed plans and issued permits, conducted audits and inspections, and enforced safety and environmental regulations.

Over the course of many years, political pressure generated by a demand for lease revenues and industry pressure to expand access and expedite permit approvals and other regulatory processes often combined to push MMS to elevate revenue and permitting goals over safety and environmental goals. These problems were compounded by an outdated organizational structure, a chronic shortage of resources, a lack of sufficient technological expertise, and the inherent difficulty of coordinating effectively with all of the other government agencies that have had statutory responsibility for some aspect of offshore oil and gas activities.

To remedy this conflict of interest, the Commission recommends that the roles and responsibilities of the former MMS should be separated into three entities with clearly defined statutory authorities. One entity would be responsible for offshore safety and environmental enforcement; another would perform functions related to leasing and environmental science; and the third would manage natural resource revenues. The safety and environment enforcement authority or entity, in particular, should have primary statutory responsibility for overseeing the structural and operational integrity of all offshore energy-related facilities and activities, including both oil and gas offshore drilling and renewable energy facilities.

Since the Commission issued its final report on January 11th, Secretary of the Interior Ken Salazar has already announced changes in the organization within Interior that reflect many of the Commission's recommendations.

Regulation to Better Manage Risk

The Commission also recommends a more comprehensive overhaul of both the leasing program and the regulatory policies and institutions used to oversee the safety and environmental protection of offshore activities. The goals must be to reduce and manage risk more effectively, using strategies that can keep pace with a technologically complex and rapidly evolving industry, particularly in high-risk and frontier areas, and to secure the resources needed to execute the leasing function and provide adequate regulatory oversight.

BOEMRE currently relies heavily on prescriptive regulations incorporating a number of industry technical standards. Prescriptive regulations must be the basis of an effective regulatory system, but given the many variables in deepwater drilling, prescriptive rules can never cover all cases. The Federal agency responsible for offshore activity must have a regulatory approach that integrates more sophisticated risk assessment and risk management practices into its oversight of energy developers operating offshore. The focus should shift from prescriptive regulations covering only the operator to a foundation of augmented prescriptive regulations, including those relating to well design and integrity, supplemented by a proactive, risk-based performance approach that is specific to individual facilities (production platforms and drilling rigs), operations, and environments. Both the operator and the drilling rig owners would have a legal duty to assess and manage the risks of a specific activity by engaging all contractors and subcontractors in a coordinated safety management system.

IV. ENVIRONMENTAL REVIEW

As part of its inquiry into the existing regulatory structure for offshore drilling, the Commission reviewed existing mechanisms for protecting the environment. In its work on this question, the Commission focused on two issues: (1) the application of National Environmental Policy Act (NEPA) requirements to the offshore leasing process and (2) the need for better science and greater interagency consultation to improve decisionmaking related to management of offshore resources.

NEPA

Based on the Commission's review of leasing and permitting processes in the Gulf of Mexico before the *Deepwater Horizon* incident, the Commission concluded that the breakdown of the environmental review process for OCS activities was systemic and that Interior's historical approach to the application of NEPA requirements for offshore oil and gas activities needs significant revision. In particular, the application of tiering, use of categorical exclusions, the practice of area-wide leasing, and failure to develop formal NEPA guidance all contributed to this breakdown. The Commission recommends that the Council on Environmental Quality and the Department of the Interior revise and strengthen the NEPA policies, practices, and procedures to improve the level of environmental analysis, transparency, and con-

sistency at all stages of the OCS planning, leasing, exploration, and development process.

Improved Interagency Consultation and Environmental Science

Under OCSLA, it is up to the Secretary of the Interior to choose the proper balance between environmental protection and resource development. In making leasing decisions, the Secretary is required to solicit and consider suggestions from any interested agency, but he or she is not required to respond to the comments or accord them any particular weight. Similar issues arise at the individual lease sale stage and at the development and production plan stage. As a result, NOAA—the nation's ocean agency with the most expertise in marine science and the management of living marine resources—effectively has the same limited role as the general public in the decisions on selecting where and when to lease portions of the OCS. The Commission recommends a more robust and formal interagency consultation process in which NOAA, in particular, is provided a heightened role, but ultimate decisionmaking authority is retained at DOI. The Commission further recommends the creation of an Office of Environmental Science, led by a Chief Environmental Scientist, with specified responsibilities in conducting all NEPA reviews, coordinating other environmental reviews, and whose expert judgment on environmental protection concerns would be accorded significant weight in leasing decisionmaking.

V. REFORMING INDUSTRY SAFETY PRACTICES

Changing Business As Usual

Without effective government oversight, the offshore oil and gas industry will not adequately reduce the risk of accidents, nor prepare effectively to respond in emergencies. However, government oversight alone cannot reduce those risks to the fullest extent possible. Government oversight must be accompanied by the oil and gas industry's internal reinvention: sweeping reforms that accomplish no less than a fundamental transformation of its safety culture.

Just as the nuclear power industry created the Institute of Nuclear Power Operations (INPO), the nation's oil and gas industry needs now to embrace the potential for an industry safety institute to supplement government oversight of industry operations. To be credible, any industry-created safety institute would need to have complete command of technical expertise available through industry sources. To be successful, an oil and gas industry safety institute would require in the first instance strong board-level support from CEOs and boards of directors of companies for a rigorous inspection and auditing function. Such audits would need to be aimed at assessing companies' safety cultures and encouraging learning about implementation of enhanced practices. The inspection and auditing function would need to be conducted by safety institute staff, complemented by experts seconded from industry companies. There would also need to be a commitment to share findings about safety records and best practices within the industry, aggregate data, and analyze performance trends, shortcomings, and needs for further research and development. Accountability could be enhanced by a requirement that companies report their audit scores to their boards of directors and insurance companies.

VI. FINANCIAL RESPONSIBILITY AND LIABILITY

Oil spills cause a range of harms, including personal, economic and environmental injuries, to individuals and ecosystems. The Oil Pollution Act makes the party responsible for a spill liable for compensating those who suffered as a result of the spill—through human health and property damage, lost profits, and other personal and economic injuries—and for restoring injured natural resources. The Act also provides an opportunity to make claims for compensation from a dedicated Oil Spill Liability Trust Fund. The Oil Pollution Act, however, imposes limits on both the amount for which the responsible party is liable, and the amount of compensation available through the trust fund. In the case of the *Deepwater Horizon* spill, BP (a responsible party) has placed $20 billion in escrow to compensate private individuals and businesses through the independent Gulf Coast Claims Facility. But if a less well capitalized company had caused the spill, neither a multi-billion dollar compensation fund nor the funds necessary to restore injured resources, would likely have been available.

Liability for damages from spills from offshore facilities is capped under the Oil Pollution Act at $75 million, unless it can be shown that the responsible party was guilty of gross negligence or willful misconduct, violated a Federal safety regulation, or failed to report the incident or cooperate with removal activities, in which case there is no limit on damages. Claims up to $1 billion for certain damages can be

made to, and paid out of, the Oil Spill Liability Trust Fund, which is currently supported by an 8-cent per-barrel tax on domestic and imported oil.

The Oil Pollution Act also requires responsible parties to "establish and maintain evidence of financial responsibility," generally based on a "worst-case discharge" estimate. In the case of offshore facilities, necessary financial responsibility ranges from $35 million to $150 million.

Inadequacy of Current System

There are two main problems with the current liability cap and financial responsibility dollar amounts. First, the relatively modest liability cap and financial responsibility requirements provide little incentive for oil companies to improve safety practices. Second, as noted, if an oil company with more limited financial means than BP had caused the *Deepwater Horizon* spill, that company might well have declared bankruptcy long before paying fully for all damages. In the case of a large spill, the Oil Spill Liability Trust Fund would likely not provide sufficient backup. Thus, a significant portion of the injuries caused to individuals and natural resources, as well as government response costs, could go uncompensated.

Any discussion of increasing liability caps and financial responsibility requirements must balance two competing public policy concerns: first, the goal of ensuring that the risk of major spills is minimized, and in the event of a spill, victims are fully compensated; and second, that increased caps and financial responsibility requirements do not drive competent independent oil companies out of the market. A realistic policy solution also requires an understanding of the host of complex economic impacts that could result from increases to liability caps and financial responsibility requirements.

Options for Reform

As this committee and others in Congress consider options for addressing these problems, the Commission recommends that first, Congress significantly increase the liability cap and financial responsibility requirements for offshore facilities. To address both the incentive and compensation concerns noted above, Congress should significantly raise the liability cap. Financial responsibility limits should also be increased, because if an oil company does not have adequate resources to pay for a spill, the application of increased liability has little effect. Should a company go bankrupt before fully compensating for a spill, its liability is effectively capped. If, however, the level of liability imposed and the level of financial responsibility required are set to levels that bear some relationship to potential damages, firms will have greater incentives to maximize prevention and minimize potential risk of oil spills and also have the financial means to ensure that victims of spills do not go uncompensated.

Second, the Commission recommends that Congress increase the limit on per-incident payouts from the Oil Spill Liability Trust Fund. If liability and financial responsibility limits are not set at a level that will ensure payment of all damages for spills, then another source of funding will be required to ensure full compensation. The Federal Government could cover additional compensation costs, but this approach requires the taxpayer to foot the bill. Therefore, Congress should raise the Oil Spill Liability Trust Fund per-incident limit. Raising the Oil Spill Liability Trust Fund's per-incident limit will require the Fund to grow through an increase of the per-barrel tax on domestic and imported oil production. An alternative would be to increase the Trust Fund through a surcharge by mandatory provisions in drilling leases triggered in the event that there are inadequate sums available in the Fund.

Third, the Commission recommends that the Department of the Interior enhance auditing and evaluation of the risk of offshore drilling activities by individual participants (operator, driller, other service companies). The Department of the Interior, insurance underwriters, or other independent entities should evaluate and monitor the risk of offshore drilling activities to promote enhanced risk management in offshore operations and to discourage unqualified companies from remaining in the market.

The Interior Department currently determines financial responsibility levels based on potential worst-case discharges, as required by the Oil Pollution Act. Although the agency's analysis to some degree accounts for the risk associated with individual drilling activities, it does not fully account for the range of factors that could affect the cost of a spill, and thus the level of financial responsibility that should be required. Interior should analyze a host of specific, risk-related criteria when determining financial responsibility limits applicable to a particular company, including, but not limited to: geological and environmental considerations, the applicant's experience and expertise, and applicable risk management plans. This in-

creased scrutiny would provide an additional guard against unqualified companies entering the offshore drilling market.

VII. RESPONSE AND CONTAINMENT

As part of its charge from President Obama, the Commission looked at the effectiveness of the response to the spill. There were remarkable instances of dedication and heroism by individuals involved in the rescue and cleanup. Much was done well—and thanks to a combination of good luck and hard work, the worst-case scenarios did not all come to pass. But it is impossible to argue that the industry or the government was prepared for a disaster of the magnitude of the *Deepwater Horizon* oil spill. Twenty years after the *Exxon Valdez* spill in Alaska, the same blunt response technologies—booms, dispersants, and skimmers—were used, to limited effect. On-the-ground shortcomings in the joint public-private response to an overwhelming spill like that resulting from the blowout of the Macondo well are now evident, and demand public and private investment. So do the weaknesses in local, state, and Federal coordination revealed by the emergency.

Neither BP nor the Federal Government was prepared to conduct an effective response to a spill of the magnitude and complexity of the *Deepwater Horizon* disaster. Three critical issues or gaps existed in the government's response capacity: (1) the failure to plan effectively for a large-scale, difficult-to-contain spill in the deepwater environment; (2) the difficulty of coordinating with State and local government officials to deliver an effective response; and (3) a lack of information and understanding concerning the efficacy of specific response measures, such as dispersants or berms. Moreover, the technology available for cleaning up oil spills had improved only incrementally since 1990. The technologies and methods available to cap or control a failed well in the extreme conditions thousands of feet below the sea were also inadequate. Although BP was able to develop new source-control technologies in a compressed timeframe, and the government was able to develop an effective oversight structure, the containment effort would have benefited from prior preparation and contingency planning.

Improved Oil Spill Response Planning

The Department of the Interior should create a rigorous, transparent, and meaningful oil spill risk analysis and planning process for the development and implementation of better oil spill response. Several steps are needed for implementation:

- Interior should review and revise its regulations and guidance for industry oil spill response plans. The revised process should ensure that all critical information and spill scenarios are addressed in the plans.
- In addition to Interior, other agencies with relevant scientific and operational expertise should play a role in evaluating spill response plans to verify that operators can conduct the operations detailed in their plans. Specifically, oil spill response plans, including source-control measures, should be subject to interagency review and approval by the Coast Guard, EPA, and NOAA. Other parts of the Federal Government, such as Department of Energy national laboratories that possess relevant scientific expertise, could be consulted. Plans should also be made available for a public comment period prior to final approval and response plans should be made available to the public following their approval.
- Interior should incorporate the "worst-case scenario" calculations from industry oil spill response plans into NEPA documents and other environmental analyses or reviews.

Spills of National Significance

The Gulf oil spill presented an unprecedented challenge to the response capability of both government and industry. Though the National Contingency Plan permitted the government to designate the spill as one of "national significance," this designation did not trigger any procedures other than allowing the government to name a National Incident Commander.

EPA and the Coast Guard should establish distinct plans and procedures for responding to a "Spill of National Significance." Specifically, EPA should amend or issue new guidance on the National Contingency Plan to:

- Increase government oversight of the responsible party, based on the National Contingency Plan's requirement that the government "direct" the response where a spill poses a substantial threat to public health or welfare.
- Augment the National Response Team and Regional Response Team structures to establish additional frameworks for providing interagency scientific and policymaking expertise during a spill. Further, EPA, NOAA, and the Coast Guard should develop procedures to facilitate review and input from the scientific com-

munity—for example, by encouraging disclosure of underlying methodologies and data.

- Create a communications protocol that accounts for participation by high-level officials who may be less familiar with the National Contingency Plan structure and create a communications center within the National Incident Command—separate from the joint information center established in partnership with the responsible party—to help transmit consistent and complete information to the public.

STRENGTHENING STATE AND LOCAL INVOLVEMENT

The response to the *Deepwater Horizon* disaster showed that State and local elected officials had not been adequately involved in oil spill contingency planning, though career responders in State government had participated extensively. Unfamiliarity with, and lack of trust in, the Federal response manifested itself in competing State structures and attempts to control response operations that undercut the efficiency of the response overall.

EPA and the Coast Guard should bolster State and local involvement in oil spill contingency planning and training and create a mechanism for local involvement in spill planning and response similar to the Regional Citizens' Advisory Councils mandated by the Oil Pollution Act of 1990.

In addition, a mechanism should be created for ongoing local involvement in spill planning and response in the Gulf. In the Oil Pollution Act of 1990, Congress mandated citizens' councils for Prince William Sound and Cook Inlet. In the Gulf, such a council should broadly represent the citizens' interests in the area, such as fishing and tourism, and possibly include representation from oil and gas workers as ex-officio, non-voting members.

Research and Development for Improved Response

The technology available for cleaning up oil spills has improved only incrementally since 1990. Federal research and development programs in this area are underfunded: In fact, Congress has never appropriated even half the full amount authorized by the Oil Pollution Act of 1990 for oil spill research and development.

Specifically, Congress should provide mandatory funding (i.e. funding not subject to the annual appropriations process) at a level equal to or greater than the amount authorized by the Oil Pollution Act of 1990 to increase Federal funding for oil spill response research by agencies such as Interior, the Coast Guard, EPA, and NOAA. In addition, Congress and the Administration should encourage private investment in response technology more broadly, including through public-private partnerships and a tax credit for research and development in this area.

Dispersants

Prior to the blowout, the Federal Government had not adequately planned for the use of dispersants to address such a large and sustained oil spill, and did not have sufficient research on the long-term effects of dispersants and dispersed oil to guide its decisionmaking.

EPA should update and periodically review its dispersant testing protocols for product listing or pre-approval, and modify the pre-approval process to include temporal duration, spatial reach, and volume of the spill. EPA should update its dispersant testing protocols and require more comprehensive testing prior to listing or pre-approving dispersant products. The Coast Guard and EPA should modify pre-approvals of dispersant use under the National Contingency Plan to establish procedures for further consultation based on the temporal duration, spatial reach, or volume of the spill and volume of dispersants that responders are seeking to apply. EPA and NOAA should conduct and encourage further research on dispersants.

Containment

The most obvious, immediately consequential, and plainly frustrating shortcoming of the oil spill response set in motion by the events of April 20, 2010 was the simple inability—of BP, of the Federal Government, or of any other potential intervener—to contain the flow of oil from the damaged Macondo well.

At the time of the blowout on April 20, the U.S. Government was unprepared to oversee a deepwater source-control effort. Once the Secretary of Energy's science team, the U.S. Geological Survey, the national laboratories, and other sources of scientific expertise became involved, the government was able to substantively supervise BP's decisionmaking, forcing the company to fully consider contingencies and justify its chosen path.

The National Response Team should develop and maintain expertise within the Federal Government to oversee source-control efforts. The National Response Team

should create an interagency group—including representation from the Department of the Interior, Coast Guard, and the Department of Energy and its national laboratories—to develop and maintain expertise in source control, potentially through public-private partnerships.

Industry's Spill Preparedness

Beyond attempting to close the blowout preventer stack, no proven options for rapid source control in deepwater existed when the blowout occurred. The Department of the Interior should require offshore operators to provide detailed plans for source control as part of their oil spill response plans and applications for permits to drill.

These plans should demonstrate that an operator's containment technology is immediately deployable and effective. In applications for permits to drill, the Interior should require operators to provide a specific source-control analysis for each well. As with oil spill response plans, source-control plans should be reviewed and approved by agencies with relevant expertise, including the Interior and the Coast Guard.

Improved Capability for Accurate Flow Rate Estimates

Early flow rate estimates were highly variable and difficult to determine accurately. However, the understated estimates of the amount of oil spilling appear to have impeded planning for and analysis of source-control efforts like the cofferdam and especially the top kill.

The National Response Team should develop and maintain expertise within the Federal Government to obtain accurate estimates of flow rate or spill volume early in a source-control effort. The National Response Team should create an interagency group—including representation from Interior, the Coast Guard, the national laboratories, and NOAA—to develop and maintain expertise in estimating flow rates and spill volumes. In addition, EPA should amend the National Contingency Plan to create a protocol for the government to obtain accurate estimates of flow rate or spill volume from the outset of a spill. This protocol should require the responsible party to provide all data necessary to estimate flow rate or spill volume.

More Robust Well Design and Approval Process

Among the problems that complicated the Macondo well-containment effort was a lack of reliable diagnostic tools and concerns about the well's integrity. The Department of the Interior should require offshore operators seeking its approval of proposed well design to demonstrate that:

- Well components, including blowout preventer stacks, are equipped with sensors or other tools to obtain accurate diagnostic information—for example, regarding pressures and the position of blowout preventer rams.
- Wells are designed to mitigate risks to well integrity during post-blowout containment efforts.

Industry Responsibilities for Containment and Response

Industry's responsibilities extend to efforts to contain any big spills as quickly as possible and to mitigate the harm caused by spills through effective response efforts. Both government, which must be capable of taking charge of those efforts, and industry were woefully unprepared to contain or respond to a deepwater well blowout like that at Macondo. All parties lacked adequate contingency planning, and neither had invested sufficiently in research, development, and demonstration to improve containment or response technology.

From now on, the oil and gas industry needs to combine its commitment to transform its safety culture with adequate resources for containment and response. Large-scale rescue, response, and containment capabilities need to be developed and demonstrated—including equipment, procedures, and logistics—and enabled by extensive training, including full-scale field exercises and international cooperation.

To that end, at least two industry spill containment initiatives have emerged that build on ideas and equipment that were deployed in response to the Macondo blowout and spill. The nonprofit Marine Well Containment Company was created in July 2010 by four of the major, integrated oil and gas companies. The second spill containment initiative is being coordinated by Helix Energy Solutions Group, which played a role in the Macondo well containment efforts.

Yet neither the Marine Well Containment Company's planned capabilities nor Helix's go past 10,000 feet despite the fact that current drilling technology extends beyond this depth. Also it seems that neither is structured to ensure the long-term ability to innovate and adapt over time to the next frontiers and technologies. What resources, if any, either initiative will dedicate to research and development going forward is unclear.

The primary long-term goal of a spill containment company or consortia should be to ensure that an appropriate containment system is readily available to contain quickly spills in the Gulf of Mexico with the best available technology. Any spill containment company or consortia should ensure that it remains focused on this goal, even when doing so potentially conflicts with the short-term interests of its founding companies, in the case of MWCC, or the parent company, in the case of Helix. An independent advisory board, with representatives from industry, the Federal Government, State and local governments, and environmental groups could help keep any spill containment initiative focused on innovative, adaptive, effective spill response over the long term.

VIII. SPILL IMPACTS AND GULF RESTORATION

Even before the highly visible damages caused by the spill became clear, many crucial Gulf economic and ecological resources—fisheries, transportation, tourism—faced long-term threats. First, more than 2,300 square miles of coastal wetlands—an area larger than the State of Delaware—have been lost to the Gulf since the United States raised the massive levees along the lower Mississippi River after the devastating Great Flood of 1927. Exceptionally powerful hurricanes, always a threat to the region, struck the coast in 2005 (Katrina and Rita) and 2008 (Gustav and Ike), causing even more wetland loss. Second, low-oxygen bottom waters were in the process of forming a massive "dead zone" extending up to 7,700 square miles during the summer of 2010. Referred to as hypoxia, this phenomenon has intensified and expanded since the early 1970's as a result of nutrient pollution, mainly from Midwestern agriculture. And finally, the *Deepwater Horizon* disaster made matters worse: 11 rig workers killed in the explosion and 17 injured; many thousands of people exposed to contaminated waters, coasts, beaches, and seafood; thousands out of work; birds and sea animals killed and significant habitats damaged or destroyed. The Commission's investigation made plain that existing authorities are not adequate to redress these significant harms and ensure restoration of the Gulf.

Human Health Impacts

The National Contingency Plan overlooks the need to respond to widespread concerns about human health impacts. For smaller oil spills, the response effort is generally carried out by trained oil spill response technicians, but given the scale of the response to the *Deepwater Horizon* spill and the need to enlist thousands of previously untrained individuals to clean the waters and coastline, many response workers were not screened for pre-existing conditions. This lack of basic medical information, which could have been collected if a short medical questionnaire had been distributed, limits the ability to draw accurate conclusions regarding long-term physical health impacts. EPA should amend the National Contingency Plan to add distinct procedures to address human health impacts during a Spill of National Significance. Spills of this magnitude necessarily require a significant clean-up effort, potentially exposing workers to toxic compounds in oil and dispersants.

Consumer Confidence

Images of spewing oil and oiled beaches in newspapers and on television set the stage for public concern regarding the safety of Gulf seafood. Additional factors contributed to the lingering impression that the public could not trust government assurances that the seafood was safe: the unprecedented volumes of dispersants used, confusion over the flow rate and fate of the oil, frustration about the government's relationship with BP in spill cleanup, and lawsuits filed by fishermen contesting the government's assurance of seafood safety. The economic blow to the Gulf region associated with this loss of consumer confidence is sizable. BP gave Louisiana and Florida $68 million for seafood testing and marketing, as well as money to assess impacts on tourism and fund promotional activities. As of early December 2010, BP was considering a similar request from Alabama.

In future spills, however, there is no guarantee that a responsible party will have the means or the inclination to compensate such losses. Such indirect financial harms are currently not compensable under the Oil Pollution Act. Nevertheless, losses in consumer confidence are real and Congress, Federal agencies, and responsible parties should consider ways to restore consumer confidence in the aftermath of a Spill of National Significance.

The Commission recommends that Congress, Federal agencies, and responsible parties take steps to restore consumer confidence in the aftermath of a Spill of National Significance.

Lack of Sustained Funding for Gulf Restoration

A lack of sustained and predictable funding, together with failed project coordination and long-term planning, has resulted in incomplete and often ineffective efforts to restore the Gulf's natural environment. No funding source currently exists to support regional restoration efforts. While cost estimates of Gulf restoration vary widely, according to testimony before the Commission, fully restoring the Gulf will require $15 billion-$20 billion, or a minimum of $500 million per year, over 30 years. A number of different sources currently provide funding to individual states for restoration, however none of these sources provides funds for Gulf-wide coastal and marine restoration, and none is sufficient to support the sustained effort required. Most policymakers agree that without a reliable source of long-term funding, it will be impossible to achieve restoration in the Gulf.

Several Gulf States and the Federal Government have filed or are expected to file suit against BP and other companies involved in the spill, which will likely create opportunities to direct new restoration funds to the region. In some cases, congressional action will be required to ensure that funds are directed to this purpose. The Commission recommends that 80 percent of any Clean Water Act penalties and fines be directed to Gulf restoration. Should such penalties and fines not be directed to the Gulf, Congress should consider other mechanisms for a dedicated funding stream not subject to annual appropriations. Although such mechanisms face hurdles, the fact remains that resources are needed if progress on coastal restoration is to continue. Inaction is a prescription for further degradation. Should CWA penalties not be redirected to Gulf restoration, Congress should consider other mechanisms for a dedicated funding stream not subject to annual appropriations.

Decisionmaking Body for Expediting Work

In order for funding to be most efficiently directed at long-term restoration, a decisionmaking body is needed that has authority to set binding priorities and criteria for project funding. The Gulf Coast Ecosystem Restoration Task Force is now in place, as recommended by the September 2010 report on restoration from Secretary of the Navy Ray Mabus to the President, and subsequently established by Presidential Executive Order. According to the Executive Order, the job of the Task Force is to begin coordinating the different restoration projects being undertaken by various jurisdictions in the Gulf, coordinating related science activities and engaging stakeholders. However, as many in Congress and the Administration have suggested, the Task Force lacks some features necessary to effectively direct long-term restoration efforts in the Gulf—most importantly the ability to set binding goals and priorities.

The Commission recommends that Congress establish a joint state-Federal Gulf Coast Ecosystem Restoration Council. The Council should implement a restoration strategy for the region that is compatible with existing State restoration goals. Experience in major restoration endeavors, including those in the Gulf, has shown that, absent binding goals to drive the process, restoration projects are insufficiently funded, focused, or coordinated. Therefore, the restoration strategy should set short- and long-term goals with binding criteria for selecting projects for funding. Key criteria should include national significance; contribution to achieving ecosystem resilience; and the extent to which national policies—such as those related to flood control, oil and gas development, agriculture, and navigation—directly contributed to the environmental problem. Congress should also ensure that the priorities and decisions of the Council are informed by input from a Citizens Advisory Council that represents diverse stakeholders.

Restoration Rooted in Science

Finally, but essentially, restoration decisions must be rooted in science. An approach that draws heavily on information and advice from scientists will result in project selection and funding allocations that are more likely to lead to an effective region-wide restoration strategy. Such an approach will also advance transparency in decisionmaking and enhance credibility with the public.

The Commission accordingly recommends the establishment of a Gulf Coast Ecosystem Restoration Science and Technology Program that would address these issues in three ways: (1) by creating a scientific research and analysis program, supported by the restoration fund, that is designed to support the design of scientifically sound restoration projects; (2) by creating a science panel to evaluate individual projects for technical effectiveness and consistency with the comprehensive strategy; and (3) by supporting adaptive management plans based on monitoring of outcomes scaled both to the strategy itself and to the individual projects or categories of projects included in it.

Managing Ocean Resources

The Commission recommends that as a part of management and restoration efforts in the marine environment, greater attention should be given to new tools for managing ocean resources, including monitoring systems and spatial planning. Marine scientists have emerged from the *Deepwater Horizon* incident with more precise questions to investigate, as well as a better sense of monitoring needs in the Gulf of Mexico, which because of its multiple uses and economic value should be a national priority. To that end, the National Ocean Council, which the President initiated in July 2010, should work with the responsible Federal agencies, industry and the scientific community to expand the Gulf of Mexico Integrated Ocean Observing System, including the installation and maintenance of an in situ network of instruments deployed on selected production platforms. Participation in this system by industry should be regarded as a reasonable part of doing business in nation's waters.

Coastal and marine spatial planning has the potential to improve overall efficiency and reduce conflicts among ocean users. Congress should fund grants for the development of regional planning bodies at the amount requested by the President in the fiscal year 2011 budget submitted to Congress. Ocean management should also include more strategically sited Marine Protected Areas, including but not limited to National Marine Sanctuaries, which can be used as "mitigation banks" to help offset harm to the marine environment. Given the economic and cultural importance of fishing in the Gulf region—and the importance of Gulf seafood to the rest of the country—scientifically valid measures, such as catch share programs, should be adopted to prevent overfishing and ensure the continuity of robust fisheries.

IX. THE FUTURE OF OFFSHORE DRILLING

The central lesson to be drawn from the catastrophe is that no less than an overhauling of both current industry practices and government oversight is now required. The changes necessary will be transformative in their depth and breadth, requiring an unbending commitment to safety by government and industry to displace a culture of complacency. Drilling in deepwater, however, does not have to be abandoned. It can be done safely. That is one of the central messages of the Commission's final report. The Commission's recommendations are intended to do for the offshore oil and gas industry what new policies and practices have done for other high risk industries after their disasters. The Commission believes that the potential for such a transformation to ensure productive, safe, and responsible offshore drilling is significant, and provides reason for optimism even in the wake of a disaster.

The significance of the *Deepwater Horizon* disaster, however, is broader than just its relevance to the future of offshore drilling. The disaster signals the need to consider the broader context of the nation's patterns of energy production and use, now and in the future—the elements of America's energy policy. The explosion at the Macondo well and the ensuing enormous spill—particularly jarring events because of the belief they could never happen—force a reexamination of many widely held assumptions about how to reconcile the risks and benefits of offshore drilling, and a candid reassessment of the nation's policies for the development of a valuable resource. They also support a broader reexamination of the nation's overall energy policy.

Important decisions about whether, when, where, and how to engage in offshore drilling should be made in the context of a national energy policy that is shaped by economic, security, pace of technology, safety, and environmental concerns. Offshore drilling will certainly be an important part of any such policy, but its relative importance today will not, and should not, be the same a half-century from now. The nation must begin a transition to a cleaner, more energy-efficient future. Otherwise, its security and well-being will be increasingly dependent on diminishing supplies of nonrenewable resources and on supplies from foreign sources.

Drilling for oil in the Gulf of Mexico, however, is not solely a matter for U.S. consideration. Both Mexico and Cuba have expressed interest in deepwater drilling in the Gulf in the near future. Potential sites are close enough to the United States—Cuba's mainland lies only 90 miles from Florida's coast and the contemplated wells only 50 miles—that if an accident like the *Deepwater Horizon* spill occurs, fisheries, coastal tourism, and other valuable U.S. natural resources could be put at great risk. It is in our country's national interest to negotiate now with these neighbors to agree on a common, rigorous set of standards, a system for regulatory oversight, and operator adherence to an effective safety culture, along with protocols to cooperate on containment and response strategies in case of a spill.

Frontier Areas

Our Commission also examined prospects in so called "frontier areas." On December 1, in the wake of the *Deepwater Horizon* experience, Interior Secretary Ken Salazar announced that the Administration would not proceed with drilling in areas where there are "no active leases" during the next 5-year leasing plan. As a result, exploration and production in certain frontier areas—the eastern Gulf and off of the Atlantic and Pacific coasts—are deferred. The Secretary also indicated that plans for 2011 drilling in Alaska's Beaufort Sea would be subjected to additional environmental assessments.

The major interest in offshore Alaska reflects the likelihood of finding significant new sources of oil there. The Chukchi and Beaufort Sea off Alaska's north coast rank behind only the Gulf of Mexico in estimated domestic resources. But finding and producing those potentially important supplies of oil offshore Arctic Alaska requires the utmost care, given the special challenges for oil spill response and containment, and heightened risks associated with this frontier, especially its extreme cold, extended seasons of darkness, hurricane-strength storms, and pervasive fog—all affecting access and working conditions—and the extraordinary richness of its ecosystems and the subsistence native communities dependent upon their protection. To deal with these serious concerns about Arctic oil spill response, containment and the heightened environmental stakes the Commission recommends three approaches before the Department of the Interior makes a determination that drilling in a particular area is appropriate. First, the Department should ensure that the containment and response plans proposed by industry are adequate for each stage of development and that the underlying financial and technical capabilities have been satisfactorily demonstrated in the Arctic. Second, the Coast Guard and the oil companies operating in the Arctic should carefully delineate their respective responsibilities in the event of an accident—including search and rescue—and then must build and deploy the necessary capabilities. Third, Congress should provide the resources to establish Coast Guard capabilities in the Arctic, based on the Guard's review of gaps in its capacity.

The Arctic is shared by multiple countries, many of which are considering or conducting oil and gas exploration and development. The extreme weather conditions and infrastructure difficulties are not unique to the U.S. Arctic. Damages caused by an oil spill in one part of the Arctic may not be limited to the waters of the country where it occurred. As a result, the Commission recommends that strong international standards related to Arctic oil and gas activities be established among all the countries of the Arctic. Such standards would require cooperation and coordination of policies and resources.

Bringing the potentially large oil resources of the Arctic outer continental shelf into production safely will require an especially delicate balancing of economic, human, environmental, and technological factors. Both industry and government will have to demonstrate standards and a level of performance higher than they have ever achieved before.

Creating and implementing a national energy policy will require enormous political effort and leadership—but it would do much to direct the Nation toward a sounder economy and a safer and more sustainable environment in the decades to come. Given Americans' consumption of oil, finding and producing additional domestic supplies will be required in coming years, no matter what sensible and effective efforts are made to reduce demand—in response to economic, trade, and security considerations, and the rising challenge of climate change.

The extent to which offshore drilling contributes to augmenting that domestic supply depends on rebuilding public faith in existing offshore energy exploration and production. We have proposed a series of recommendations that will enable the country and the oil and gas industry to move forward on this one critical element of U.S. energy policy: continuing, safe, responsible offshore oil drilling to meet our nation's energy demands over the next decade and beyond. Our message is clear: both government and industry must make dramatic changes to establish the high level of safety in drilling operations on the outer continental shelf that the American public has the right to expect and to demand. It is now incumbent upon the Congress, the executive branch, and the oil and gas industry to take the necessary steps.

RESPONSES BY SENATOR GRAHAM AND MR. REILLY TO ADDITIONAL QUESTIONS FROM SENATOR BOXER

1. *Question 1.* Your Commission's report highlighted the inadequacy of the current liability system in the Oil Pollution Act, which sets limits on liability at $75 million per offshore incident.

Under our current system, would local fisherman, tourism businesses and coastal communities be guaranteed compensation if a future, large-scale spill were caused by a company with more limited financial resources than BP? How do limits on liability affect incentives for safety in offshore drilling?

Response. The Oil Pollution Act currently limits liability and compensation for damages caused by a spill from an offshore facility in three ways. First, it caps liability for damages from a spill from an offshore facility at $75 million per incident. Second, under the Oil Pollution Act, the highest level of financial responsibility a covered facility must demonstrate is $150 million. Thus, even though an offshore facility is potentially liable for damages that exceed $75 million, it is not required to demonstrate actual capacity to pay damages beyond $150 million. Third, if the responsible party is not able to compensate all of the damages caused by the spill, the Trust Fund is available to cover certain damages. However, the amount authorized per incident is limited to $1 billion.

Thus, in the case of a very large spill, there is no certainty under current law that a company would have the financial means to fully compensate fisherman, tourism businesses, and coastal communities that were victims of the spill. Moreover, the Trust Fund would likely not provide sufficient backup, and a significant portion of the injuries caused to individuals and natural resources as well as government response costs could go uncompensated.

To the extent that a liability scheme provides incentives to internalize costs, the comparatively low $75 million cap distorts companies' incentives to engage in practices that prevent spills. This point has been made by numerous economists who have reviewed the Oil Pollution Act liability cap. Under basic economic theory, companies that have the potential to cause significant harm should pay for the costs they inflict. However, the incentive argument is somewhat diminished by the fact that there are significant limitations on the scope of the liability cap's applicability: Caps do not apply to removal costs, damage claims under State law, and penalty actions, and they do not apply where there has been gross negligence, willful misconduct, or violation of applicable Federal safety, construction, or operation regulation.

Question 2. In addition to highlighting the problems with existing liability limits, your report suggested options for increasing liability while protecting small, independent operators.

One recommendation was the establishment of a shared insurance pool that would allow offshore drilling operators to share risk.

Can you discuss how such a proposal could ensure that victims of an oil spill are fully compensated for damages while providing a way for drilling operators, particularly small and independent operators, to remain economically competitive?

Response. Substantial increases in financial responsibility requirements and liability caps would make it difficult for many smaller, independent operators—who are generally not in a position to self-insure—to purchase insurance to cover damages from a spill. With a mutual insurance pool, however, companies engaged in offshore drilling would pay premiums into a pool, which would pay out damages in the event of an oil spill. Premiums could be tied to the level of risk posed by an individual company's activities, so that smaller firms operating in shallow, less risky environments would not be required to pay excessively high premiums. This option would allow companies to demonstrate financial responsibility for the cost of spills.

Question 3. The ecosystems of the Gulf Coast are both environmentally and economically important. A large portion of the nation's seafood comes from the Gulf Coast. In addition, Gulf of Mexico fisheries support billions of dollars in annual sales and hundreds of thousands of jobs. The Commission's report called on Congress to dedicate 80 percent of Clean Water Act penalties to the long-term restoration of the Gulf's ecosystems.

Can you explain why this proposal is important for the long-term recovery of the Gulf Coast? Why is it important to establish a science-based decisionmaking body to guide restoration efforts?

Response. The Gulf suffers from continual degradation due to years of pipelines and canals built by industry, channeling of the Mississippi River Delta for shipping, building of levees for flood prevention, and nutrients flowing down the Mississippi River. Numerous ecosystem challenges faced the Gulf before the oil spill, and even

more so now: Barrier islands and shorelines are eroding, and essential habitats in coastal bays and estuaries have been lost or degraded due to pollution, changes in freshwater inflows, or overfishing. The result is a rapidly disappearing Gulf landscape, with wetlands vanishing at the rate of a football field about every 38 minutes and a massive "dead zone."

To truly address this continual degradation, Congress must dedicate a sustained stream of funding to restoration. Lack of sustained funding has hampered and undermined restoration efforts to date. Estimates are that Gulf Coast restoration will cost $15–$20 billion over 30 years. The Clean Water Act litigation presents an important opportunity to direct funding, at the scale needed, to the critical need for restoration in the Gulf.

Restoration decisions that are rooted in good science will result in project selection and funding allocations that are more likely to lead to an effective, region-wide restoration strategy. It will also advance transparency in decisionmaking and enhance credibility with the public.

Question 4. The Commission's report notes that the technology available for cleaning up oil spills has improved only incrementally since 1990 when Congress passed the Oil Pollution Act in response to the *Exxon Valdez* disaster.

What can be done to improve oil spill research by both the Federal Government and the private sector so that technologies for cleaning up oil spills and minimizing damages continue to improve?

Response. Mandatory funding for oil spill research and development should be a top priority. Government and industry were caught completely unprepared. The technology used to fight the Deepwater Horizon spill was largely the same as the technology used to fight the *Exxon Valdez* spill, and the response suffered as a result. Under the Oil Pollution Act, Congress authorized up to $28 million for oil spill research, but not even half of this amount has ever been appropriated. Since the *Exxon Valdez* spill, funding has averaged only roughly $10 million per year. By removing oil spill research and development funding from the ordinary appropriations process, Congress can avoid the experience that followed *Exxon Valdez*, when support for response research and development quickly decreased as memory of the spill faded.

With agencies, industry, and entrepreneurs intent on developing response technologies for the first time in 20 years, promising technologies were developed during the Deepwater Horizon spill response period. We believe it is crucial to capitalize on this recent activity and interest. As such, the Commission also recommended establishing an advisory board, made up of experts from relevant Federal agencies as well as from professional societies, academia, industry, and non-governmental organizations, to develop a research agenda and roadmap.

RESPONSE BY SENATOR GRAHAM AND MR. REILLY TO AN ADDITIONAL QUESTION FROM SENATOR CARPER

Question. In the Commission's report and in your testimony today, you cite the need to increase the limit on per-incident payouts from the Oil Spill Liability Trust Fund. As you know, under current law the per-incident payout limit is $1 billion. On Friday, the Obama administration submitted the tenth bill to BP and the other Responsible Parties for response and recovery operations related to the BP/Deepwater Horizon Oil Spill. The first nine bills have been quickly paid by BP. These ten bills total about $694 million that has been paid out by the Oil Spill Liability Trust Fund. Given that figure, we are quickly approaching that $1 billion limit. What concerns do you have about reaching that $1 billion threshold and who would foot the bill if we did indeed reach it? Second, while the report suggests that Congress should increase the payout limit, a specific policy or dollar figure isn't offered. Do you have any thoughts or suggestions as to what specific action you believe Congress should take?

Response. Our hope is that Congress would take the steps necessary to continue funding any remaining clean-up activities and ensure that victims are compensated even if the payout limit is reached, especially in light of the fact that BP has reimbursed the trust fund for its expenditures.

The fact that we are approaching this limit underscores the need for Congress to act on this issue. Because of the complexity of this issue and its linkage to liability caps for individual companies, however, the Commission did not recommend a particular amount.

RESPONSE BY SENATOR GRAHAM TO AN ADDITIONAL QUESTION FROM SENATOR LAUTENBERG

Question. In your written testimony, you call on industry to update its voluntary standards.

The Chemical Safety Board has a long history of conducting independent and technically sophisticated investigations into industrial accidents—and then making recommendations to improve standards. However, the Commission has refused to turn over documents critical to the CSB's investigation of the oil spill.

Will you work with the Chemical Safety Board to provide better access to evidence in your possession?

Response. Throughout most of the Commission's tenure, the Commission and its staff enjoyed a constructive relationship with the Chemical Safety Board—one marked by mutual cooperation. However, on February 25, 2011, the Chemical Safety Board submitted a subpoena to the Commission that was of such an extraordinary scope—covering millions of pages of documents and hundreds of thousands of emails—that compliance would have taken at least many weeks if not months.

The Commission was required by Executive Order to terminate within 60 days of the release of its report. The Commission received the subpoena just 2 weeks before our scheduled closing. Any effort at compliance would have wholly disrupted the remaining Commission staffs essential obligation to close the Commission down completely by March 11, 2011, including compliance with government recordkeeping requirements, as required by the President's Executive Order establishing the Commission. It is not clear to us why the Chemical Safety Board, without any advance notice, chose just days before the Commission ceased to operate to submit a subpoena, let alone a subpoena of such an extraordinary scope and wholly inconsistent with the temporal bounds of the Commission's existence.

Even more important, however, is the fact that the subpoena raised many important legal issues that needed to be resolved prior to compliance but that could not be resolved in the little time then remaining. Several of these legal issues had implications far beyond the scope and expertise of this Commission and needed to be resolved in the first instance by other parts of the Executive Branch, particularly the Department of Justice. For instance, the Chemical Safety Board's subpoena raised the legal issue whether one executive branch agency (the Chemical Safety Board) could compel the production of documents from another executive branch agency through the use of a subpoena. This issue involved internal executive branch legal policy that did not relate to the Commission's charter or expertise.

In addition, the subpoena further raised the issue whether compliance with the subpoena would violate the Executive Order establishing the Commission. That Order states that "The Commission shall ensure that it does not interfere with or disrupt any ongoing or anticipated civil or criminal investigation or law enforcement activities or any effort to recover response costs or damages arising out of the Deepwater Horizon explosion, fire, and oil spill." Executive Order No. 13543, Section 4(d). The Chemical Safety Board's subpoena demanded documents that were potentially relevant to the kind of "civil or criminal investigation or law enforcement activities" referred to by the Executive Order. The Commission could not fairly determine in the exceedingly short time existing between the time the subpoena was submitted and the Commission's closing date of March 11th whether release of all these documents would in any way "interfere with or disrupt" those activities. Indeed, the Executive Order expressly required the Commission to "consult with the Department of Justice concerning the Commission's activities to avoid any risk of such interference or disruption." For that reason, as required by its Charter the Commission provided all of its documents to the Department of Energy upon closing on March 11th and notified the Department of Justice of the receipt of the subpoena and the legal issues that it raised.

The Commission ceased all operations on March 11, 2011. At that time, all Commission documents were turned over to the custody of the Department of Energy. There is, accordingly, no Commission or Commission staff that can work with the Chemical Safety Board on these issues. The Chemical Safety Board needs therefore to contact the Department of Energy and the Department of Justice.

RESPONSES BY SENATOR GRAHAM AND MR. REILLY TO ADDITIONAL QUESTIONS FROM SENATOR INHOFE

Question 1. One of the overarching purposes of the National Environmental Policy Act (NEPA) is to, quote, "create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans."

Certainly, one component of that is ensuring that our activities take into account environmental impacts—and that we minimize those impacts to the extent practicable. Implied in that, though, is that we can actually move forward with planned activities, such as, in this case, offshore energy production. In other words, there isn't a conflict between environmental protection and offshore energy production.

- Yet certain environmental are manufacturing that conflict and using NEPA as a legal tool to stop offshore production—indeed, all energy production they don't like. How can we make NEPA work more efficiently, so that we can fully account for the environmental impacts, but do so in a way that doesn't unnecessarily delay projects, especially offshore projects?

Response. The Commission has stated that it does not believe offshore drilling should be abandoned. It can proceed safely and in a way that protects our environment. The Commission's recommendations are aimed at improving safety and environmental protection so that drilling can proceed. And in fact, the Commission recommended several steps the Department of Interior could take to improve its NEPA review process and provide greater efficiency, transparency, and consistency.

First, the Commission recommended that Interior develop and make public a formal NEPA handbook that provides consistent guidelines for applying NEPA in an appropriate manner. A Government Accountability Office report released just prior to the Deepwater Horizon spill noted that the lack of formal guidance leaves the process for meeting NEPA requirements ill-defined. Such guidance and clarity will allow Interior staff to more quickly and efficiently move through the NEPA process.

The Commission also recommended reforms to the practices of "area-wide leasing" and the use of "tiering." In particular, in less well-explored areas, Interior should reduce the size of the lease sales so that more meaningful environmental reviews can be undertaken. It is especially important this be done before substantial private-sector commitments are made to purchase leases. Better environmental reviews conducted on a finer geographic scale are less likely to face challenges later in the permitting process.

Question 2. Evidence used by the Commission to demonstrate an industry-wide "systemic" problem was the "loss of well control" statistic showing 79 such incidences since 1996. How minor can an event be to qualify as a "loss of well control"? How many of these "loss of well control" situations resulted in major spills? Even if all 79 events, considering 14,000 deepwater wells have been drilled, does that demonstrate a systemic problem?

Response. We do not claim that any of the other loss of well control incidents resulted in a major oil spill. At least three, however, resulted in fatalities, which is clearly serious. The significance of the many other "loss of well control" incidents, moreover, is that they confirm the riskiness of drilling.

A loss of well control does not, by itself, indicate that an operator was engaging in unsafe drilling practices. Some risk is inevitable in offshore drilling, especially in deep water. The purpose of the chart in the report describing the 79 incidents of loss of well control is not to suggest that each of those incidents demonstrates unsafe drilling practices. It is instead simply to document the inherent risks of offshore drilling, and to underscore the need to ensure that government and industry have the best possible safeguards in place so that incidents do not result in the kind of major disaster that occurred with the Macondo well blowout.

Question 3. Senator Graham, with 14,000 deepwater wells drilled previously without a major incident before Macondo, wouldn't it be fair to say that the industry-wide capacity to prevent this type of incident was systemic?

Response (Senator Graham). Of course, the industry has drilled many thousands of wells safely, and we commend them for this overall record. Nonetheless, offshore oil exploration and production has, over the past two decades, consistently moved into deeper waters, thereby increasing the risks of drilling. And in coming years, the industry expects to move into "ultra-deepwater," which will require even more diligence to avoid a Macondo-type blowout. Our recommendations are aimed at ensuring regulatory practices and standards reflect the risk associated with these types of environments.

The Commission's final report makes clear that many companies have exemplary safety records. The basis for the Commission's conclusion that the offshore drilling industry suffered from a "systemic" problem was based on the nature of the mistakes that the Commission found were the cause of the Macondo well blowout and rig explosion, as well as the identity of those making the mistakes. The Commission did not discover one or two isolated mistakes, but a pattern of repeated mistakes in well-drilling operations that revealed a fundamental failure of risk management and safe drilling practices by three of the companies working on the Deepwater Horizon. They included the largest operator of deepwater drills in the Gulf (BP); the

largest supplier of cement for all deepwater wells, not just to BP but to all operations in the Gulf (Halliburton); and the largest operator of deepwater drilling rigs in the Gulf that services not just BP but all major operators (Transocean).

Question 4. Does the Commission feel that the industry, through its own affirmative actions, has addressed many of the issues related to proper spill response through its creation of a deepwater spill containment system?

Response. We applaud the industry for the many steps they have taken in response to the spill, including the creation of the Marine Well Containment Corporation and the Helix spill containment system, as well as the establishment of a new industry-sponsored safety organization under the auspices of the American Petroleum Institute.

However, we note that after the *Exxon Valdez* spill, the industry created the Marine Spill Response Corporation—an industry nonprofit initiative dedicated to maintaining response capabilities and responding to spills. Over time, industry funding for the Marine Spill Response Corporation declined, and there was a clear failure by the industry to innovate and find new methods to clean up oil. Industry must implement specific policies and procedures to monitor these new institutions and guarantee their long-term readiness as well as funding and investment levels.

Question 5. What would the potential pitfalls be to allowing liability to extend beyond the lease holders who are typically the operators?

Response. The Commission did not examine in detail the question of whether liability should extend beyond operators. However, a research paper prepared for the Commission by Professor Thomas Merrill of Colombia Law School notes the following:

[The Comprehensive Environmental Response Compensation and Liability Act (CERCLA or Superfund)] has been plagued, especially in its early years, by squabbling among potentially responsible parties over who would assume the burden of cleaning up waste sites. The emphasis in the Oil Pollution Act on identifying one responsible party for each incident was likely driven by a desire to avoid these sorts of problems. In particular, Congress appears to have concluded that the process of filing claims and obtaining damages for spills would be greatly expedited by having one responsible party for each incident. Singling out one responsible party also greatly simplifies the administrative process of certifying that producers have complied with the requirement of demonstrating financial responsibility. Not surprisingly, therefore, Department of the Interior regulations provide that each covered offshore facility "must have a single designated applicant."

While we do not have a particular position on this issue, the Commission's research suggests that any effort to extend liability requirements beyond the operator should be undertaken only after Congress has carefully weighed both the potential advantages and disadvantages of such changes.

Question 6. Mr. Reilly, I have heard you talk about how impressed you have been with the Shell proposal to drill in Alaska. Can you please elaborate on what aspects of it impress you the most?

Response (Mr. Reilly). Speaking for myself and not the Commission, I found several impressive aspects. First, it should be noted that Shell has experience drilling in the Arctic. They drilled several exploration wells in the Beaufort and Chukchi Sea in the late 1980's, and they have worked with Russia over the past 15 years on sub-arctic offshore oil development. It should also be noted that Beaufort and Chukchi are shallow water plays, with relatively well understood formations and pressure conditions—these are not considered "risky" wells.

In addition, Shell has assembled a state-of-the-art system of response and containment equipment that can deploy within an hour. These include helicopters, barges, boats, boom, skimmers, and other needed equipment, and they have sponsored a substantial amount of scientific research in the region. While I certainly believe that additional scientific assessment on the environment is needed as we move forward with drilling in the Arctic, as well as additional R&D on responding to spills in those conditions, in my view Shell is committed to ensuring they can effectively deal with a spill in this region.

Finally, it is clear that other countries, including Russia, intend to move forward with drilling in the Arctic. The United States must take the lead in this area, and develop the gold standard for safe, environmentally responsible energy exploration and production in the Arctic.

Question 7. The administration is continuing with the moratorium to this day, only having permitted a handful of deepwater wells which were not new permits, but were both being drilled at the time of the BP spill. Given two of you opposed the moratorium, and that industry has affirmatively taken significant steps to im-

prove containment capabilities in the case a spill should ever happen again, isn't it about time to start issuing new permits in the Gulf and producing our own resources?

Response. It is true that both of us opposed the moratorium for various reasons. However, we do not believe that Administration wants to permanently shut down offshore drilling in the Gulf. The President has made clear in his public remarks, and his remarks to us privately, that he supports offshore drilling. And the President once again stated the importance of offshore drilling to America's energy security in his speech at Georgetown on March 30th. Interior has issued several deepwater drilling permits since the companies finalized and submitted their containment plans in mid-February. And nearly 50 new permits for shallow water wells have been issue over the past several months. Again, while we disagreed with the moratorium, the pace of permitting appears to be picking up in our view.

We also call on Congress to ensure that the Bureau of Ocean Energy Management, Regulation, and Enforcement is adequately funded, so that they have the staff and resources needed to efficiently process new permits and provide the best possible oversight of the industry. The Commission recommended creating a mechanism for offshore oil and gas operators to provide ongoing and regular funding of the agencies regulating offshore drilling through industry fees, similar to the way other regulatory agencies are funded (for example, the Federal Communications Commission). Given our current budget woes, and substantial oil industry profits, this is simply a common-sense way to address this pressing need.

Senator BOXER. Thank you so much. I am glad you raised dispersants because I was going to ask a question but you really kind of answered it.

What I am going to do, because the vote has started, is just ask, anyone who wants to stay, just ask one question. So, let me start it and we will get through as many as we can.

The one thing that will stick with me forever is BP's permit application. When they were asked to describe the likelihood of a spill and the likelihood that it would cause damage, it was shocking. It just said, absolutely impossible. Basically, that is what they said. Now, I read it here, I had it blown up.

So, it worries me that we have these forms people fill out and they do not really take it seriously. Did the Commission talk about the response plans? Do you find them just universally lacking credibility or do some do better than others? I would ask each of you and that is my question.

Senator GRAHAM. We use the term in our report that many of these failures were systemic, that is they were not peculiar to BP, they were reflective of an industry culture. Certainly there is no area in which that is more true than the response plans. Few, if any, of the response plans, particularly for deep water drilling, were effective in addressing the issues that would be faced or were credible in the statement of the resources available to carry out effective containment and response.

So, one of our major recommendations, which is primarily in the hands of the Department of the Interior under its responsibility to condition to permits to drill in the first instance, is that there be much greater attention to oil spill response to the specific area in which that response will be called upon, because it is a lot different responding at 500 feet than at 15,000 feet, and that there are credible technologies ready to be deployed to limit the discharge to the extent possible.

Senator BOXER. So, so if I could just cut through this because of time problems, basically you have a situation where a company, in this case, said something that was not true, and the Interior Department under both Administrations, I think, just rubber stamped

it. So, you are saying that it is up to the Interior Department to be more rigorous in examining these permit applications. Is that right?

Senator GRAHAM. Yes. Senator Vitter made some comments which Mr. Reilly and I have considerable sympathy for about the moratorium and the delays in getting new excavation underway. From what I gather, the principle reason for that delay has been exactly this one, that the Department was not satisfied with the response plans and would not issue permits until it became satisfied——

Senator BOXER. Well, good for them. Why on earth would they not, if they are responsible for the next spill? So, good for them and good for you.

Senator GRAHAM. It has now issued two permits——

Senator BOXER. Yes, they have begun——

Senator INHOFE. We are going to have to kind of move on to a question each——

Senator BOXER. Yes, Senator, go ahead.

Senator INHOFE. Let me first of all say it is very unusual that I have two good friends as witnesses. That does not happen very often. So, I am glad you are here.

Let me just quote from the Commission's Chief Counsel's report, just one or two sentences here. What the investigation makes clear above all else is that management failures, not mechanical failures, were the ultimate source of the disaster. In clear, precise and unflinching detail the report lays out the confusion, lack of communication, disorganization and inattention to crucial safety issues and test results that led to deaths of 11 men and the largest offshore spill of our Nation's history. It goes on and we have other statements that were made. Mr. Reilly, you had said that a good operator is in charge of everything that happens and is extremely rigorous with respect to policing contractors.

My question would simply be this. I think you made it very clear, Senator, that if we demonstrate the capability to respond to a spill, would both of you agree that we should start issuing permits, deep water drilling permits, in the Gulf, those conditions being met? I think, Mr. Reilly, you had made the statement that you think the moratorium should be lifted up in Alaska. Should it be lifted there, too?

Mr. REILLY. We have, I think both of us made clear, personally, that we thought the moratorium, insofar as it penalized companies that were not in any way implicated in the spill, responsible companies that had good environmental and safety records, went on too long. That was very difficult to understand and so, in that sense, I would agree with that.

Senator INHOFE. Alright. Thank you, sir.

Senator GRAHAM. Let me just supplement what Bill said.

Senator BOXER. Senator, do it quickly if you can, because the vote awaits us. Remember those days, Bob?

Senator GRAHAM. Absolutely. Oil spill response plans are a critical part of the decision as to whether to permit or not. But they are not the only factor that needs to be taken into consideration.

Senator BOXER. Senator Cardin.

Senator CARDIN. I am just going to put on the record this question and I really would like your help.

I conducted a hearing as the Subcommittee Chairman of the Water and Wildlife Subcommittee dealing with the damage assessment issue, trying to get an understanding as to what we are looking at. The difficulty is that a lot of the damage may be hidden for decades to come. As we saw in the *Exxon Valdez*, the lingering impacts can be great.

We are using technologies to do water column sampling that I am not sure is necessarily the best techniques and I welcome your thoughts on it. There has been some work done by the National Aquarium in Baltimore along with Mote Marine in Florida to look at more sophisticated sampling techniques so that we can get a more accurate assessment of the damages that have been done.

My major concern is whether we have the best scientific information available to assess the long-term needs for remedial work so we get it done accurately. Because once we sign off on this, we are not going to be able to have the resources necessary if in the future we find out that there is more damage than we anticipated with our early surveys.

So, any help you could be in directing us to make sure that we have the process in place to get the best science information and sort of think out of the box on this a little bit because sometimes the current relationships do not lead to the best protection to the public.

Mr. REILLY. Senator, I would respond to that by saying two things. First of all, the Commission gives a very high priority to science and to the need for continuing scientific examination of the impacts on the Gulf. We recognize that it is going to take time to be definitive about those.

But that leads me to my second point. The settlement moneys that were agreed after the *Exxon Valdez* provided a very significant amount of money for 10 years of ongoing scientific research monitoring. The only reason we know about so many of the impacts that this spill had and the fact that there is still is substrate of oil crude on many of the beaches is because of that scientific research and the funding that was included in the settlement to provide for it. I would strongly——

Senator CARDIN. My last point is that there is conflicting information now about the quality of the sea bottom and I just would urge us to make sure that we are as comprehensive as possible in the way we——

Senator BOXER. I am sorry to interrupt. We have like 3 minutes remaining to vote. Thank you very much.

When we come back, Senator Lautenberg has some very interesting show and tell with his something over there. I do not even know where he has gotten that from. But I will let him take over.

We will be back. We thank you for your contribution to this great Nation and to one of the greatest challenges we face. We just, to become energy independent, to do this in a way that is safe as, again, as we see what is happening over in Japan, our heart goes out and that feeling of just not being able to control things.

Americans, we are people who like to be able to control things. When every day we watched BP explode there in the ocean, we had

no sense that we could do anything about it. So, we really need to follow your advice. Speaking for myself as Chairman of this committee, which Senator Graham was a very proud member of, remember those days, Bob, I am going to follow your lead and follow your advice.

So, stand by. We will take a break. There are two votes and we will be back.

[Recess.]

Senator LAUTENBERG [Presiding]. The committee is restarting and I think we have already done the nice things, so you will forgive me if I do not repeat them. Is that all right, Bob?

Senator GRAHAM. That is fine.

Senator LAUTENBERG. Anyway, thanks very much for hanging in. Each of you knows the routine here and what we have to go through to keep on top of everything.

Mr. Reilly brought up the subject of dispersants and I want to continue there. But since the Chairman let the cat out of the bag, this is what I brought with me. It was a gift. I do not think it was from a friendly person, but it is water from the Gulf. As ugly as it is, that is not the key issue.

The key issue is the long-term effect of something that is as threatening as this appears to be. We certainly would not want it on our beaches or anywhere in our, in the things that our children had contact with. But that is the truth. The ugliness simply emphasizes the high risk of having these spills in front of us on a regular basis.

Today, I am introducing my Safe Dispersants Act which would require advanced testing of dispersants and disclosure of the ingredients in those products. Now, EPA Administrator Jackson testified last year that such a change in the law is essential. I would ask each of you for your thought on whether or not better testing of chemical dispersants can be of value and what should we do about them?

Mr. REILLY. Well, this is a subject I have been long interested in, Senator. The issue of dispersants was a major concern of mine in Alaska in Prince William Sound and it was very, as it always is, strongly favored by the responsible party there and also supported by the Coast Guard at the time.

I did not permit dispersants to be used in the sensitive areas of Prince William Sound essentially on the advice that I was given that to use a dispersant, essentially, is to distribute materials into the water column and make it unavoidable to fish that happen to be swimming through there. We had salmon fry that were expected to be released from four hatcheries and they would have encountered the oil and the dispersants, the combination in the water column, had we used it in those areas where they intended to migrate down to the ocean.

We later sampled the fish and discovered that they had swum right under the oil and there was no indication of any contact or any fish tissue that they had encountered. So, that proved to be a good decision.

So, I came into this experience with a strong prejudice against the use of dispersants. I had tended to see them as a cosmetic de-

vice, keeps it out of sight but concentrates it in a place where it may do more damage.

We looked at that issue very carefully and concluded that there was a responsible decision made by the EPA Administrator to permit the dispersants to be used, and she obviously anguished over that decision, given the sensitivity of the marshes, to make the call that she would favor or that we would favor as a matter of policy the protection of the marshes which the dispersants did effect over the possible impact, long term, probably, on fish and fish larva.

I have not seen anything that would dispute that. However, I would strongly support your initiative to determine in advance of the use of dispersants what we know about them, how effective they are, corrects it, it had, I think, according to one table I looked at, a 55 effectiveness number, and I wondered whether that was the best that one could get under the circumstances. It happened to be available in sufficient supplies, I know, and it had been pre-approved, pre-authorized, by EPA though the volume in which it was used was never contemplated before.

So, all of these questions, I think, need to be addressed and particularly the issue of dispersants used in the icy waters of the Arctic where they are likely to respond very differently, have very different effects, and perhaps be less effective or maybe even more so, but if they are persistent, possibly even do more damage.

Senator LAUTENBERG. So, examining what the results are using dispersants, that it is essential, critical if I might emphasize, that we find out more about what is really in there and what the long-term damage might be.

Mr. REILLY. I agree.

Senator LAUTENBERG. I thank you very much and I will move along. What is the order, Senator Cardin, Senator Alexander is next in line here. So, Senator Alexander.

Senator GRAHAM. Senator Lautenberg, could I just add one more point to what Bill has said? It is also critical that we test these dispersants not just for surface distribution, which has been their traditional use, but also for deep water purposes. They were used for that in the Gulf and that may have been one of the most anguishing decisions because nobody had done any research as to what were the consequences of releasing dispersants at 5,000 feet. So, there are a broad range of issues to which the research that you have referred need to be applied.

Senator LAUTENBERG. Thank you very much.

Senator Alexander.

Senator ALEXANDER. Thanks, Mr. Chairman.

Thank you, again, for your hard work and for your long service to our country.

Did you consider whether it would be a good idea for the oil industry to self-insure in the way the nuclear industry does? As we look at what is happening in Japan, which, and we are grateful for the fact that in our country, as I mentioned earlier, we have 104 nuclear reactors, we have not had a death, nobody was hurt at Three Mile Island. Our nuclear navy has traveled to Mars and back a couple of times without a death in connection with a reactor.

But as we look for, and maybe one reason for that is the Price-Anderson Act which requires all of the nuclear operators to have, I think it is about $110 million of, be responsible for $110 million of damage if there is an accident at any reactor. In addition to the private insurance they have, I suppose if you are going to be responsible as a nuclear operator for an accident at any reactor you would keep a fairly close watch on what your competitors are doing so you would not be out that money.

Would it help if in the oil industry that everybody who drilled in the Gulf would be responsible for any accident? Would that help change the culture within the industry that you write about in your report?

Senator GRAHAM. Senator, speaking personally, I do not know the answer to that question. We touched on the issue of liability and it was obvious to us that the 1990 standard was no longer adequate, just on the most basic inflation factors. We then recommended a number of alternatives that might be considered, one of which was close to what you have just outlined, the nuclear industry.

I might say that throughout our discussions, we were very impressed with INPO, which is the organization that has been established by the commercial nuclear power industry of the United States as a means of improving the level of safety throughout the 104 plants in the United States and that the offshore oil industry should take cognizance of some of the steps that the nuclear industry has taken. The one that you have suggested may be another area in which that should occur.

Mr. REILLY. Senator, you might wish to look at the British system, which has a system like that where the industry is required to make contributions to an organization which then has, I think, $250 million available to it in the event of a spill that can cover what a particular responsible party may not be able to cover.

I was impressed in our conversations about liability how one has to be careful to not create a system in which a company might decide well, if they are insured, maybe they are a little less rigorous or anxious about safety than they might otherwise be. That is something that was raised by the insurance industry with us. That there are, possibly, inadvertent consequences to setting premiums at certain levels.

I had the sense that the majors basically do consider that they self-insure, that is the companies on the size scale of BP——

Senator ALEXANDER. But the point is that they would be responsible for their competitor's oil spill.

Mr. REILLY. I understand. There probably would be some resistance to that on the part of some of the majors, but the direction——

Senator ALEXANDER. It might make them more interested in, I mean, what I am getting at, and I think I have just less than a minute, you are right about the practices that you found placed the culture of the entire industry in doubt. Well, was BP an outlier? Were they playing fast and loose? Were other offshore drillers more conservative and, if that were the case, if the other offshore drillers were responsible, were actually liable for a spill by any competitor

that was playing faster and looser with its practices, would that tend to help create safer practices?

Mr. REILLY. Well, what they now know, Senator, is that they were liable because they all got shut down. One hopes that is a sufficient wake up call to cause them to create the kind of institution that we talked about, which is modeled on INPO, as Senator Graham said, that causes everybody to be able to police and hold accountable all of the players.

It is certainly true that there was a sense in the industry that BP was a problem company, that it was challenged from the point of view of safety, and I know of two CEOs who actually went to the CEO of BP and tried to get some changes made, without success. They had no means to do that in any formal sense, in any rigorous sense that would force compliance. With the right kind of institute, an insurance could play a part in it and certainly third party auditing with policing you could possibly protect everybody against an outlier who is capable of implementing them all.

Senator ALEXANDER. Thank you, Mr. Chairman. I think that is a very important statement.

Senator LAUTENBERG. Thank you. Senator Whitehouse, you are next.

Senator WHITEHOUSE. Thank you, Chairman. Thank you, gentlemen, for your hard work in this cause. I appreciate it very much.

I am interested in the phenomenon of regulatory capture, or agency capture. It has been written about for near on 100 years now, very distinguished folks, the leaders of administrative law, Nobel Prize winning economists, Presidents of the United States, leaders of significant educational institutions and foundations have over and over again described it. When I was in law school, it was taught both in my administrative law class and in my law and economics class.

It seems that we have had very telling examples of agency capture in our recent history, whether it is the Mine Safety and Health Administration or the SEC authorizing 30 times leverage at the request of its regulated industry, which I think had a lot to do with economic meltdown or, and I think perhaps most trenchantly for our purposes here in this hearing, MMS.

One of the things that concerns me is that, although the doctrine of regulatory capture is accepted in the discipline of economics and the discipline of administrative law, and has been for decades now, it is basically part of the sort of background understanding of those disciplines, we, in Congress, have never undertaken any kind of a substantive effort to address it. We wait until there is a disaster, a catastrophe, and then we raise hell with the agency that was responsible and then, as if it was a one-time thing that just happened to strike us like lightning, we go on to the next one.

But now we have seen probably the worst environmental incident, certainly the worst oil spill in our history as a country. We have seen one of the worst economic and financial collapses. Do you think that it is time that we started to consider the problem of agency capture, or regulatory capture, more systemically, so that we can get ahead of the next disaster? Who knows where the next disaster is?

There are all sorts of corners of the Federal Government that get very little public attention but are immensely important to the industries that they regulate and who knows what is going on in those dark corners? What, a, do you think that there is an agency capture issue at the heart of what went wrong in the Gulf and b, do you think it is a recurring enough problem, or a significant enough problem, that we should start looking forward and not just backward at trying to prevent agency capture in the future?

Senator GRAHAM. Senator, the answer is yes and yes. If you did a case study of agency capture, I believe that the MMS would be a good place to start. There is a well documented history of the coziness of price chipping, including some really despicable personal behavior. I agree that this is not peculiar to the offshore oil industry. This is a recurring phenomenon.

We made some specific recommendations as to how to try to mitigate that as it relates to this industry. One of those was that the entity within the Department of the Interior which has the responsibility for safety should be independent. We defined independent as having a director who served a term of years rather than at the pleasure of either the Secretary of the Department or the President so that that person would feel that their job was not at risk if they did not lower the standard of safety.

That will require congressional action. The Department of the Interior has already taken administrative action to separate the function of collecting royalties from the function of safety, which is a good step but we think insufficient in terms of its long-term viability.

Senator WHITEHOUSE. But how do you get the next one? I actually agree with what you have recommended with respect to MMS itself, but what if it is Bureau of Land Management someplace? What if it is forestry? What if it is contracting in the Defense Department? I mean, we do not seem to have a systemic way for having somebody scout around the executive branch of Government and say, whoops, there are some real red flags in this agency, we ought to take a look there.

Mr. REILLY. Could I add to what Senator Graham said? I think that the place I would begin, before the hearings, is looking at the statutes themselves. In the case of MMS, the statute was conflicted. It gave them a conflicted mandate. It said you are supposed to increase offshore oil and gas development and leasing revenues, and you are supposed to attend to safety and environment.

When the moneys got to as high as $18 billion a year, in 2008, and they are typically anywhere from 6 to 12 or so, needless to say, money wagged that dog. It turned out to be, as three MMS Directors said to us, the controlling concern that they had. In personnel decisions, all sort of things were made that had the implication that revenue is really what your job is about.

So, the statute would have invited trouble in our view. That, I do not know if that is as true for BLM statutes. There is no organic act, as you know, for MMS. I would begin by looking to see whether the incentives that have been created in the statute are clear and protect against that kind of capture.

Senator WHITEHOUSE. Thank you.

Senator LAUTENBERG. Thank you very much. What I am going to do, time has flown, I will call on Senator Vitter next, but I want to restrict this to 3 minutes each. We have been joined by Senator Sessions. We will keep the record open for written questions. So, with that, Senator Vitter.

Senator VITTER. Thank you, Mr. Chair.

Thank you again for your specific recommendation about Clean Water Act fines related to the event. I just want to underscore, particularly for my colleagues, you all specifically recommended that we legislate and dedicate 80 percent of the Clean Water Act fines related to this event to Gulf restoration. Is that correct?

Senator GRAHAM. Yes, Senator, and it is our understanding that if the Congress does not do so, then these funds would go into the Oil Spill Liability Fund.

Senator VITTER. Right. It is also correct that the Administration, although I do not think they have used a specific 80 percent figure, supports the same notion. Is that correct?

Senator GRAHAM. That is correct.

Senator VITTER. OK. Now, the Clean Water Act, as I understand it, is about environmental impact. So, is it fair that we would use that money and designate that money in terms of dealing with the environmental impact of the event?

Senator GRAHAM. We certainly felt that not only was it fair but that it was urgent that the deterioration of the Gulf is at such a pace that if we wait another 20 or 30 years, it may be irredeemable. This is a rare opportunity to do something that will have very positive long-term impacts on an extremely important part of the United States of America.

Senator VITTER. Right.

Mr. REILLY. I would just add that we set out a number of criteria for making that judgment, among which is whether national policy and national interests were involved. Well, the national policy, particularly agriculture policy, has contributed greatly to the degradation of the Gulf and to the hypoxia. Dredging policies and activities of the Corps of Engineers have had substantial impacts on the marshes and the ecology as well.

The oil and gas industry, which is very much a consequence of our energy policy and our approvals of activities there, are also responsible for a number of dredging activities and canals that have not been necessary to service the industry.

All of those make very clear that the country itself, the Nation, is implicated in this and it has a national interest in correcting it.

Senator VITTER. Right. Beyond the 80 percent dedication, when it gets to implementing that and using that money, how would you all suggest we structure that in a way, I would hope it is in a way that uses objective criteria, objective factors, about the environmental impacts of the event?

Senator GRAHAM. We certainly agree with that objective. We feel that there is a model that has a lot of history and value in terms of answering the question of how to organize and that is the model that was used in Alaska. Now, Alaska is a somewhat easier situation because you only had one State whereas you have five States in the Gulf of Mexico.

But we think that some of the principles that came out of that, one was that there should be a balance of Federal and State interest, two, that the group should have the obligation of developing a comprehensive plan first and then allocation of resources should be to execute on that plan, three, that it should be a long-term commitment as Bill said earlier, in Alaska it has lasted now for more than 20 years because many of the impacts of this event are not going to be known even in the next decade.

So, those are some principles that have proven effective and just, I might add one more, in Alaska they made extensive use of local citizens groups to assess specific regional impacts or impacts to a particular part of the environment or economy of Alaska. I think that is another important principle.

Senator VITTER. Thank you.

Senator LAUTENBERG. Thanks very much. Senator Sessions, we welcome you to the committee and invite you to give your questions. I would ask unanimous consent than at no longer than 4 minutes after you start that the committee be adjourned and that you close the committee down.

Senator SESSIONS. Mr. Chairman, reserving the right to object, I would say Senator Alexander, I do not know if he has permanently left or not, but if he arrived, would it be OK——

Senator LAUTENBERG. Well, he has already had a round before.

Senator SESSIONS [presiding]. OK. I see. Thank you then, that will be fine.

Senator Graham and Mr. Reilly, thank you very much for your service in working on this report. I believe this accident should not have happened. I do not think it is the kind of thing that is part of some risk that is certain to have happened. I believe there was a series of errors and that they should not have happened.

I also believe that we should have had a better response capability, that things that had to be constructed, it seems to me they should have been constructed in advance because this was, some saw there was always some possibility that an event like this could occur. This frustrated us about that.

BP is, I am not here to criticize them, they are a secular institution, they are out to make money and they do not make money if they make these kinds of mistakes. I know they did not want to make this kind of mistake but I do believe they have responsibility under law and under legal precedent to pay.

They made an indication that they would do so but we are having, Senator Graham, a good bit of frustration in my people along our coast and I think the Northwest Florida Coast, that particularly small businesses who can show clearly how their businesses were damaged as a result of this spill, that Mr. Feinberg and his team are slow in processing those claims and some of them are on the verge of losing their business, actually some have closed.

Have you had an opportunity to examine that and hear any of those complaints?

Senator GRAHAM. Well, we have certainly heard the complaints. One of the first things that our Commission did was visit the five affected States and then have our first meeting in New Orleans, which was essentially a listening meeting. We said little but heard a lot from dozens a people who were effected by this and the issue

of the promptness with which particularly what I would describe as emergency claims were being processed was a point of criticism. I know in Florida there has been a gubernatorially-appointed group that has been monitoring that and they have reported to me regularly on the progress.

I would suggest this would be a topic that would be appropriate for this or some other Senatorial Committee to review. Our Commission went out of business on March 11th so we are sort of over the hill at this stage.

Senator SESSIONS. Well, only as a man of the committee. Mr. Reilly, do you want to comment on that, if you did?

Mr. REILLY. No, I think that, we did not really try to second guess Feinberg, Senator. We had enough on our plate in the 6-months that we had and it was still early days to make any definitive judgments.

I experienced, with you, particularly was struck by the poignancy of the Vietnamese fishermen who had no livelihood, did not have the language, and simply we were standing in line at 4 o'clock in the morning before Catholic Charities to get $100 food baskets. Those are very tragic stories.

There was even some question about whether they went out to records for previous years' fish take, a lot of them, subsistence people, some of them, would be able to present compelling evidence of their entitlement. We heard a lot of sad stories.

I know I have experienced in the north an unwillingness to serve seafood. When I asked were the oysters in New York from the Gulf, I was proudly assured by the waitress that no, they would not serve seafood from the Gulf. This was as late as late October. So, I understand very much those concerns and I think Mr. Feinberg does, too. I think he has a tough job.

Senator SESSIONS. Well, he does have a tough job. He is a capable person and he has responded to some of our concerns and has changed policies on it. But I just would say that we have a large backlog, I think, of some deserving, particularly smaller businesses, that do deserve prompt response. He will be well compensated for his work and he is, in essence, hired by BP, so it is not as if he is from the Government and there to help us. I mean, he has a responsibility to try to serve his masters. I just would say that that is a concern and would share it with you.

We have had a good record of production safety in the Gulf. There have been 42,000 wells, over 2,500 deep wells, and more than 14,000 deepwater wells worldwide. So, I do not think there is a record that demonstrates incapability of producing oil and gas safely.

One of the things I noticed, and we have all sort of jumped on the bandwagon to be critical, but we do not want to misrepresent the dangers and the circumstances. I was a little uneasy about your report that noted that there is a fatality rate of four to one between the loss of lives in our Gulf and worldwide production. But I noticed that if you took out two aviation accidents, it would be 1.3 to 1, which is higher than the world average but not a lot higher than the world average, not of four to one. Do you think it is fair to consider the aviation accidents? Because your report would

suggest that is the result of some sort of oil explosion or event of some kind.

Mr. REILLY. Senator, on those numbers, we had strong anecdotal evidence that the accident rate, the incident rate, is much higher in the Gulf in addition to the fatality rate. The reality is that the Interior Department has not been enforcing the rule that these incidents be reported. I do not think it has collected those numbers since 2006. So, there is a lack of reliable information on lost work days, total recordables, and the usual metrics for all of that in the Gulf.

I would just say, though, we have been criticized for some of the determination that this was a systemic accident, a systemic problem, or that this is an aura of complacency affecting the industry. I would turn those numbers a little bit around and say yes, we have had 2,500 deepwater wells, which makes it even more hard to understand how the Chairman of BP could have told me the first week of my appointment that we have no effective sub-sea containment capability. I was startled by that at the time.

Senator SESSIONS. I was, too. That, to me, was one of the more startling events in this whole process because a good sub-sea response capability could perhaps have been successful in very short order. Is that right?

Mr. REILLY. Yes, it could, and we are assured now that they do have this capability——

Senator SESSIONS. Let us talk about that. That is so important and I am not, I am glad to hear you authoritatively address it because I have not gotten myself the authoritative answer that I would like to have. You believe that the containment capability that is present now, it if had been deployed in a matter of days or weeks, could have capped that well?

Mr. REILLY. Yes. There are two parts to it. The first is an effective determination of the flow rate because the failure to get the flow rate right is the reason that they tried a lot of things that did not work. They had no idea that they were dealing with the force that they were confronting. But Marcia McNutt, the head of the U.S. Geological Survey, has assured that we now have the capability to assess and determine the flow rate relatively promptly.

We also have containment capability that should be prepared, ready, basically it is the containment capability that finally was successful, the top hat containment capability, and that that would be deployed in a matter of days and possibly 2 weeks to staunch any serious spill that we encounter.

Senator SESSIONS. I believe that is reassuring to those of us who believe, as a matter of national interest, we should produce oil and gas from the Gulf. I just believe it is a matter of national interest when you see the, well, that we export to buy oil from abroad creating from this industry 1,000 jobs in Alabama, 200,000 along the Gulf Coast. These are high paying jobs and they are producing wealth for the State and the Federal Government in terms of the royalties that are paid.

So, I guess I am troubled that we are moving slowly on our permitting new production. I do believe the United States is in an economic period of challenge and productivity is important. Energy

costs as low as possible are important and much domestic energy is important.

I think your report is so valuable. I know you took it seriously. I thank both of you for it. Florida, I think, and Alabama particularly have such a tourist industry. It is not, there were economic losses that are absolutely indisputable along that coast and one of the things we are concerned about is getting proper compensation.

I guess my time is up and I would glad to hear any final words the two of you have.

Senator GRAHAM. Well, I would just say, I could not agree more with your comments, Senator, that this is a very important industry for America. One-third of our oil and gas is coming out of the Gulf of Mexico. The consequences of a shutdown of this would be indescribable.

For this industry, however, to continue to have the public support, we need to achieve and be the standard of the world in safety. We are not there yet. We can be there. The statistic that you cited was not a worldwide statistic but a North Sea statistic, the comparison. The reason that we used that is that we are dealing with two very sophisticated countries, the U.K. and Norway in the North Sea. Many of the companies that are in the Gulf are also in the North Sea. The North Sea, if anything, is a more formidable environment than the Gulf of Mexico.

So, our concern was that there was such a gap between those two areas in terms of their safety record and some of the standards that have been applied in the past which we think can be easily and without great cost or disruption applied in the Gulf of Mexico. So, we think the long-term well-being of this industry is very much tied to its commitment to being the safest application of offshore oil activities in the world an attainable goal.

Senator SESSIONS. Well said.

Mr. REILLY. I would just add, Senator, that the most important recommendation that the commission made directly to industry was the establishment of a safety organization modeled on those of the chemical industry and the nuclear power industry after their catastrophes.

I understand that a decision will be made and reported later this week on whether they intend to go forward with such an enterprise. I think if they do they will show that they really have understood the magnitude of this challenge and will have a system in place to correct a number or the problems that we identified, including that fatality history and that accident history. They will be able to police one another to identify and agree upon best practices to carry out third-party audits and have a means of influencing companies that may be specially challenged from the point of view of safety as BP clearly was before this event.

So, I think that could be one of the most promising things that comes out of all of this. It is a salient recommendation of our Commission, and the prospects, I think, are reasonably good that it will happen.

Senator SESSIONS. Well, thank you very much and I really do appreciate your evaluation because I know it is independent and honest that we now have a capability that we did not have to respond

to a blowout like this in an effective way. There are always dangers out there but it gives us more confidence.

In addition to that, the series of events that led up to this explosion, surely the policies that you have recommended and that are already being undertaken, frankly, would eliminate the likelihood of an event ever occurring to begin with, which is the best way to proceed.

So, I do think we are moving along better and I hope that we can gain the confidence, the industry can gain the confidence of the American people because this is a valuable resource that the Nation needs at this point in time.

Now, we have a new Chairman. Under the UC we have, we are supposed to, I would propound that the previous UC be vitiated and would be allowed to proceed.

Senator CARPER. Reserving the right to object——

[Laughter.]

Senator CARPER. I just want to be able to ask some questions.

Senator SESSIONS. Well, I will allow you to do so. Senator Lautenberg had proposed that after my UC, that after I completed, the committee would adjourn.

Senator CARPER. I do not object.

Senator SESSIONS. Very good.

Senator CARPER [presiding]. That would be great. I would ask unanimous consent that I be allowed to ask a question or two of our colleagues. Thank you for your courtesy.

It is very nice to see you. I just want to start off by saying thank you for all the good that you continue to do with your lives. It is nice to know that there is a life, a productive life and a full life, after politics. I am grateful to both of you for your continued service to our country.

I am not sure which of you did this but one of you, I believe, in your testimony, actually mentioned that I think the Commission recommends that the Council of Environmental Quality and the Department of Interior revise and strengthen NEPA policies. I think I just wanted to know what specific actions do you believe are needed to strengthen NEPA such that the environmental impacts of offshore oil, offshore gas projects, are better assessed and what can we do here in the legislative branch to make sure that NEPA is adequately improved?

Mr. REILLY. Senator, some years ago at the beginning of the implementation of the National Environmental Policy Act, I wrote the guidelines with Tim Atkinson, our General Counsel of the Council for Environmental Quality, for the implementation of Section 1022(c), the Environmental Impact Statement part of it. We were first of all distressed to see that the approaches taken by the Interior Department in leasing, area wide leasing, tiering and categorical exclusions, did not, in our view, provide an adequate opportunity for specific assessment of environmental consequences that might ensue from decisions.

I think that the implications of that are that the area wide leasing has typically comprehended too large an area, that there has been a sense that once written, an impact statement has been done and therefore nothing further, or at least nothing of the elaborateness of a real impact statement be necessary, even though there is

a much more specific understanding of what will happen, what the impact will be, what the potential consequences may be, maybe a species, different species, or different ecologically that will be affected.

Categorical exclusions, in our view, were over utilized, and some of these problems are being addressed, both by the Council on Environmental Quality and by the Interior Department. It remains to be seen how that new process works.

But I was just disappointed, as a student of NEPA, to see that it seemed to have played a much lesser role than it should have. I will go further and say, in the testimony of the Chairman of the Council of Environmental Quality, we heard that she did not consider that there was a role for the Council with respect to the decision to broaden the coastal area that was open to leasing because there was no specific Federal action. It was when specific leases were granted that NEPA would kick in.

My reaction to that was that, first of all, I would have expected under the statute that the principle advisor on the environment in the Executive Branch, who is the Chairman of the Council, would have been consulted on that decision. She made clear that she had not been.

There is another section of NEPA, 101, that establishes national policy of the United States to give a high priority to protection of the environment and the resources and so forth that seems to me not to have the attention and understanding and support that it should have. I would single it out and I would also, and I know in my time on the Council of Environmental Quality, Russell Train, who was my boss, would have been consulted on such a decision and would have thought it appropriate and even necessary that he be consulted on it.

So, there is an understanding of NEPA, I think, that can be improved and processes in the regulations that can be strengthened.

Senator CARPER. Great. Thank you. Senator Graham, I have one more question. Thank you for that response very much. One more question and then we are going to let you guys escape and go back and get on with your lives.

Our country, I am told, accounts for more than 20 percent of global oil consumption. I do not know if that is going up or down or if it is a stable number, but it is a lot. That is some 19 million barrels per day, I understand, that is consumed right here in our country.

However, about 70 percent of the oil that we consume in the U.S. comes from other countries, some of which are undemocratic, unstable. We see that play out every day in Libya, although the amount that we receive from them is small. It is all fungible in the end.

The BP oil spill is evidence of the environmental and the economic consequence, an impact of our oil dependence. I say to a lot of people, every 5 years we get a wake-up call, we get a message, we ignore it, and how often do we have to be reminded that we need to develop our energy independence and do it in a way that creates jobs, economic opportunity and actually cleans up our environment? How foolish can we be here? We have been warned or

given that message one more time. I hope this time we actually do something with it.

Do you believe that it is in our Nation's best interests to reduce our consumption of oil? I think I might know what you might say, but from both domestic and foreign sources, and if so, give us a couple of quick examples of how you think what we are doing actually makes sense and some more things that we ought to do.

Senator GRAHAM. Well, the answer is yes. Let me just give you some further statistics. The United States is using about 22 percent of all the petroleum lifted around the world. As you say, it is approximately 19 million barrels a day. We sit on top of about 1.5 percent of the proven reserves in the world. Those are unsustainable statistics.

Now, people will argue that the proven reserves is a soft number. It may well be, but it is the only number that we have and if we are going to try to make intelligent policy decisions, I think it is important.

I calculated that at the current rate of our consumption, if we were to go totally independent, that is, rely on our remaining proven reserves to meet our needs, we would lift the last drop of oil in the United States in approximately the year 2031. If we were to maintain our current allocation, which is actually 48 percent domestic, 52 percent foreign, we would reach that same last drop in about the year 2064. So, we can see the end of the horizon.

There are some events that are in the news today which I think indicate just one of the consequences of that. Bahrain has become the last, most recent country to have reached that zero amount of petroleum. I think that fact, and the fact that the people understand what the economic consequences of that shift in Bahrain's economic future, have been contributing causes to the unrest that is going on there today.

I believe that we should be wise enough to manage what we have left in a manner that will stretch those dates that I gave as long as possible, at least as long as it is going to take us to make the transition from a heavily fossil fuel dependent America to a significantly less fossil fuel using America.

You asked for some specific things. I would say probably the single most important thing that we could do to reduce our dependence on oil, because today 70 percent of those 19 million barrels are being used for it, is our vehicles. If we could get a significant percentage of our vehicles off petroleum and onto electricity or other alternatives, that would have a dramatic impact on our oil consumption, as well as our environment by reducing the emission of chemicals that contribute to global warming. So, that is where I would put my emphasis.

Senator CARPER. Thank you. As you know, we passed, I believe you may have still been serving in December, we passed the first update that we have had in CAFE in so many years, a couple of years ago, 35, 36 mile fleet average per gallon, and I think our target date was 2020. The President has updated that and moved it ahead by 4 years.

It is interesting to see the auto companies, I was at the Detroit Auto Show back in January, comparing the kinds of cars, trucks, and vans that I saw and the power trains and so forth, consider

what I saw now to 5 years ago, night and day, just night and day in terms of what we were thinking about doing, like, 5 years ago and what it is today. It is very, very encouraging.

Our GM plant in Delaware closed about a year, a year and a half ago, sadly. We were the last State on the East Coast to have any auto assembly operation from Maine to Florida. We lost our Chrysler plant and our GM plant within, like, months of each other. The GM plant is going to be reopened next year. They will be building a new vehicle, a couple of vehicles built by Fisker, a new startup, and Henry Fisker is a great auto designer, some of the most beautiful cars I have ever seen, and they will get about 80 miles per gallon.

Our friends at GM are building the Volt. They initially are going to do 10,000 this year, they are going to do 50,000 this year, they are going to do 200,000 next year. So, we are heading in the right direction. Our tax policy, as you know, is to try to incentivize people to do that. One thing that they are considering doing at GM, they are interested in natural gas. They are interested in being able to convert especially heavier equipment from diesel to natural gas.

I would like to ask for maybe a 1-minute comment, if you would, Mr. Reilly. The use of natural gas, there is a lingering concern a number of people have about the fracking and what that, the potential stress to the environment that could pose. Could you just give us 60 seconds on that issue, please?

Mr. REILLY. I am not an expert on fracking, Senator, but my impression is that it can be done safely and securely and is by a number of operators. The number of incidents that have been noted where it has gotten into the groundwater, which it should not do, are limited to a relatively small number of operators and my sense is that this is an industry that would do very well to figure out how to police those operators lest it get them all in trouble and find that they have been discredited and then are subject to onerous constraints. It might even be necessary to regulate this on a more uniform basis to make sure that the casings, the designs, a lot of the kinds of things that exist in the oil and gas industry are tended to much more professionally.

The surface water impacts are a second set of concerns and I was surprised to read the recent stories in the *New York Times* about radioactive water and things of that sort. I just do not know how serious those are and have in mind to talk to people at EPA about what they really think about it. But I know the EPA Administrator has indicated that they will take a very close look at this and begin to consider responses to it. I think that based upon what we know, that is a good idea.

Natural gas is, I would think, an ideal intermediate field of choice for the United States. It is much less in carbon emissions than coal, it can support power, our powerplants, mine cycle of natural gas would be an improvement over coal plants that are shutting down, some of the oldest ones, as a consequence of EPA regulations, and I think that is very much in the national interest. So, this is something I hope we can be more careful about.

Senator CARPER. Our thanks to both of you. Thanks so much for your time and for your testimony and your responses to our questions. Again, thanks for your continued service to our country.

With that, not hearing any objection, this hearing is adjourned.

[Whereupon, at 12 p.m., the committee was adjourned.]