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OFFICE OF MANAGEMENT AND BUDGET
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REGULATORY AFFAIRS

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On Behalf of

America's Natural Gas Alliance
The American Chemistry Council
The American Petroleum Institute
The National Association of Home Builders
The National Association of Manufacturers
The Portland Cement Association
The U.S. Chamber of Commerce

RE: Request for Correction on the Technical Support Document "Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866" (February 2010) and Technical Support Document "Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis under Executive Order 12866" (May 2013).

Thank you for your Request for Correction (RFC) dated September 4, 2013, filed under the Office of Management and Budget's (OMB) Information Quality Guidelines. Consistent with our guidelines, your request is posted on our web site at http://www.whitehouse.gov/sites/default/files/omb/assets/omb/inforeg/info_quality/info-quality-correction-requests-fy-2013.pdf.

Your letter requests that the February 2010 and May 2013 Technical Support Documents (TSDs) identified above, which include estimates of the social cost of carbon (SCC) that are recommended for use in regulatory impact analyses of Federal regulations, "be withdrawn and not used in rulemaking and policy making." Your RFC articulates five reasons. Below, we respond to each of the five concerns that you raised. As we explain, we conclude that the SCC estimates provide valuable and critical insight for decision makers and the public as they consider the costs and benefits of alternative policy choices, and as such should not be withdrawn. We acknowledge, as discussed in both the 2010 and 2013 TSDs, that there are uncertainties inherent in these estimates; we will work with agencies to ensure that these are

clearly and consistently reiterated whenever SCC estimates are cited. In addition, we are in the process of taking public comment on topics that are consistent with those raised in your RFC. Please see the Federal Register Notice published on November 26, 2013, which is available at <https://www.federalregister.gov/articles/2013/11/26/2013-28242/technical-support-document-technical-update-of-the-social-cost-of-carbon-for-regulatory-impact>.

Response to Specific Concerns Raised in the RFC

The **first** point that you make is in regards to the **transparency of the process** that was used to develop the SCC Estimates. Your RFC asks several questions regarding the Interagency Working Group (IWG) and its role in developing and updating the SCC estimates. It is useful to begin such a discussion by emphasizing that the estimates of the SCC have been developed over many years, using the best science available, and with input from the public. Rigorous evaluation of costs and benefits is a core tenet of the rulemaking process. It is particularly important in the area of climate change, which is already imposing tangible costs through impacts that include an increase in prolonged periods of excessively high temperatures, more heavy downpours, an increase in wildfires, more severe droughts, permafrost thawing, ocean acidification, and sea-level rise.

In February 2010, after considering public comments on interim values that agencies used in a number of rules, an interagency group of technical experts, coordinated by OMB and the Council of Economic Advisers (CEA), released improved SCC estimates. The interagency group estimated the improved SCC values using the most widely cited climate economic impact models. Those climate impact models, known as integrated assessment models (IAMs), were developed by outside experts and published in the peer-reviewed literature.

In order to ensure maximum transparency for the public in how the models were used to develop the specific SCC estimates, the 2010 TSD provided a detailed discussion of each of the input assumptions for the models and how they were derived, including cites to the relevant peer-reviewed literature. The TSD also explains how the output from the three models was combined to produce a single set of estimates for use in regulatory impact analysis.

The interagency group was comprised of departments and agencies that were likely to conduct rulemakings affecting carbon emissions, and thus might need to use SCC estimates in their regulatory impact analyses. Specifically, the following departments, agencies, and offices participated in these interagency discussions: CEA, Council on Environmental Quality, Department of Agriculture, Department of Commerce, Department of Energy, Department of Transportation, Environmental Protection Agency, National Economic Council, Domestic Policy Council, OMB, Office of Science and Technology Policy, and the Department of the Treasury.

Leading up to the May 2013 update, the interagency group met several times and agreed to retain the 2010 SCC methodology and assumptions, while updating the estimates using current versions of the underlying academic models. This group worked only on updating the SCC calculation, and the product of its efforts was the updated May 2013 TSD.

The Administration sought public comment on the SCC through the formal public comment process that applies to all Federal rulemakings. Between 2010 and May 2013, there were many rulemakings that incorporated the SCC. Since publication of the May 2013 updated values, at least six proposed and one final rule have used the updated estimates. The proposed rules are DOE Energy Efficiency Conservation Standards for Metal Halide Lamp Fixtures, Commercial Refrigerators, Walk-in Coolers and Freezers, and Residential Furnace Fans. The final rule is the DOE Energy Conservation Standards for Standby Mode and Off Mode for Microwave Ovens.

As part of our ongoing effort to improve and refine the SCC estimates, in November 2013 we issued updated values that reflect minor technical corrections to the May 2013 estimates. Furthermore, OMB has issued a notice of availability and request for comment on the SCC. You will note that the scope of the request for comment includes all aspects of the TSD and its use of IAMs to estimate SCC values to support agency regulatory impact analyses. We are particularly interested in comments on the following topics:

- the selection of the three IAMs for use in the analysis and the synthesis of the resulting SCC estimates, as outlined in the 2010 TSD and the model inputs used to develop the SCC estimates, including economic growth, emissions trajectories, climate sensitivity and intergenerational discounting;
- how the distribution of SCC estimates should be represented in regulatory impact analyses; and
- the strengths and limitations of the overall approach (see also the February, 2010 TSD available at <http://www.whitehouse.gov/sites/default/files/omb/inforeg/for-agencies/Social-Cost-of-Carbon-for-RIA.pdf>)

Thus, we consider the process used to generate the SCC estimates and our on-going process to ensure that the estimates continue to reflect best science available to be transparent.

The **second** point that you make concerns **peer review for the model inputs**. Recognizing that the models underlying the SCC estimates would evolve and improve over time as scientific and economic understanding increased, the Administration committed in 2010 to regular updates of these estimates. An in-depth discussion of how we arrived at these model inputs is described in the 2010 TSD, and summarized in the appendix to this letter. We further

note that the models that underlie the SCC estimates were published in the peer reviewed literature.

As noted above, we are in the process of taking public comment on topics that are consistent with those raised in your RFC. The nature of the comments we receive, and potential further progression in the science and economics of climate change, will guide the timing and process for further updates to the SCC estimates.

In the interim, we refer you again to the February 2010 TSD, which clearly and transparently addresses the processes by which the inputs to the models were chosen and the resulting uncertainties.

The **third** point that you make is in regards to the **range of accuracy of the SCC's** for use in policy making. You argue that "there is a threshold beyond which uncertainties become so profound, widespread, and compounded that, when further undermined by data limitations and models lack of complexity, render the ultimate estimate flawed and unusable." It is not clear to us, however, how the SCC estimates would be near such a threshold. In the absence of quantitative estimates, we would use a qualitative description of the types of impacts on society that we would expect. The February 2010 document makes it clear that these estimates are not precise, stating:

When attempting to assess the incremental economic impacts of carbon dioxide emissions, the analyst faces a number of serious challenges. A recent report from the National Academies of Science (NRC 2009) points out that any assessment will suffer from uncertainty, speculation, and lack of information about (1) future emissions of greenhouse gases, (2) the effects of past and future emissions on the climate system, (3) the impact of changes in climate on the physical and biological environment, and (4) the translation of these environmental impacts into economic damages. As a result, any effort to quantify and monetize the harms associated with climate change will raise serious questions of science, economics, and ethics and should be viewed as provisional.

Despite the serious limits of both quantification and monetization, SCC estimates can be useful in estimating the social benefits of reducing carbon dioxide emissions. Under Executive Order 12866, agencies are required, to the extent permitted by law, "to assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs." The purpose of the SCC estimates presented here is to make it possible for agencies to incorporate the social benefits from reducing carbon dioxide emissions into cost-benefit analyses of regulatory actions that have small, or "marginal," impacts on cumulative

global emissions. Most Federal regulatory actions can be expected to have marginal impacts on global emissions.

Furthermore, the February 2010 TSD includes a discussion of the “Limitations of the Analysis” (see “fourth set of issues,” below). We do not consider the fact that the estimate changed between 2010 and 2013 to be an indication of “variability over the short term,” as suggested in your RFC. Rather, we consider the publication of the model updates in the peer reviewed literature to be a reflection of the rapid pace of ongoing research on a topic of profound interest to the scientific community. While it is admittedly challenging in such an environment to keep the SCC estimates up to date, and to ensure that they continue to reflect the best science available, this environment of rapidly evolving scientific understanding makes it more important, not less, to review and update the estimates on a periodic basis.

The **fourth** set of issues addresses **disclosure of the key uncertainties**. The February 2010 TSD includes an extensive discussion of uncertainty on pages 29 through 33. Specifically, this section notes that any estimate of the SCC must be taken as provisional and subject to further refinement (and possibly significant change) in accordance with evolving scientific, economic, and ethical understandings:

The damage functions underlying the three IAMs used to estimate the SCC may not capture the economic effects of all possible adverse consequences of climate change and may therefore lead to underestimates of the SCC (Mastrandrea 2009). In particular, the models’ functional forms may not adequately capture: (1) potentially discontinuous “tipping point” behavior in Earth systems, (2) inter-sectoral and inter-regional interactions, including global security impacts of high-end warming, and (3) limited near-term substitutability between damage to natural systems and increased consumption.

The damage functions in the models are calibrated at moderate levels of warming and should therefore be viewed cautiously when extrapolated to the high temperatures found in the upper end of the distribution.

The February 2010 TSD clearly indicates that the following caveats, and additional observations are necessary to consider when interpreting and applying the SCC estimates:

- Incomplete treatment of non-catastrophic damages.
- Incomplete treatment of potential catastrophic damages.
- Uncertainty in extrapolation of damages to high temperatures
- Incomplete treatment of adaptation and technological change:
- Assuming a risk-neutral representative agent

- Extrapolation of climate damages to high levels of warming
- Failure to incorporate inter-sectoral and inter-regional interactions
- Imperfect substitutability of environmental amenities

To ensure that agencies clearly disclose these uncertainties to readers of their regulatory impact analyses, we will ensure that agencies also clearly highlight these caveats in any regulatory impact analysis that makes use of the SCC estimates.

Your **fifth** set of issues center around the use of the **preference for global estimates over domestic estimates**. We continue to conclude that the use of a global value is a reasonable conclusion, based on the reasons explained in the 2010 TSD:

Under current OMB guidance contained in Circular A-4, analysis of economically significant proposed and final regulations from the domestic perspective is required, while analysis from the international perspective is optional. However, the climate change problem is highly unusual in at least two respects. First, it involves a global externality: emissions of most greenhouse gases contribute to damages around the world even when they are emitted in the United States. Consequently, to address the global nature of the problem, the SCC must incorporate the full (global) damages caused by GHG emissions. Second, climate change presents a problem that the United States alone cannot solve. Even if the United States were to reduce its greenhouse gas emissions to zero, that step would be far from enough to avoid substantial climate change. Other countries would also need to take action to reduce emissions if significant changes in the global climate are to be avoided. Emphasizing the need for a global solution to a global problem, the United States has been actively involved in seeking international agreements to reduce emissions and in encouraging other nations, including emerging major economies, to take significant steps to reduce emissions. When these considerations are taken as a whole, the interagency group concluded that a global measure of the benefits from reducing U.S. emissions is preferable.

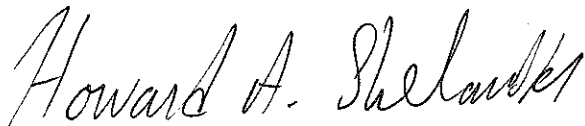
*As an empirical matter, the development of a domestic SCC is greatly complicated by the relatively few region-or country-specific estimates of the SCC in the literature. One potential source of estimates comes from the FUND model. The resulting estimates suggest that the ratio of domestic to global benefits of emission reductions varies with key parameter assumptions. For example, with a 2.5 or 3 percent discount rate, the U.S. benefit is about 7-10 percent of the global benefit, on average, across the scenarios analyzed. Alternatively, if the fraction of GDP lost due to climate change is assumed to be similar across countries, the domestic benefit would be proportional to the U.S. share of global GDP, which is currently about 23 percent.*⁸

On the basis of this evidence, the interagency workgroup determined that a range of values from 7 to 23 percent should be used to adjust the global SCC to calculate domestic effects. Reported domestic values should use this range. It is recognized that these values are approximate, provisional, and highly speculative. There is no a priori reason why domestic benefits should be a constant fraction of net global damages over time. Further, FUND does not account for how damages in other regions could affect the United States (e.g., global migration, economic and political destabilization). If more accurate methods for calculating the domestic SCC become available, the Federal government will examine these to determine whether to update its approach.

This reasoning remains applicable to the 2013 updates to the SCC estimates.

If you are dissatisfied with this response, you may submit a Request for Reconsideration (RFR). OMB requests that any such RFR be submitted within 30 days of the date of OMB's response. If you choose to submit an RFR, please email it to informationquality@omb.eop.gov. Additional information about how to submit a RFR can be found on OMB's website (http://www.whitehouse.gov/omb/info_quality_igq_oct2002/).

Sincerely,



Howard A. Shelanski
Administrator
Office of Information and Regulatory Affairs

Appendix: Using Model Inputs to Produce SCC Estimates

The three IAMs translate emissions into changes in atmospheric greenhouse concentrations, atmospheric concentrations into changes in temperature, and changes in temperature into economic damages. The emissions projections used in the models are based on specified socioeconomic (GDP and population) pathways. These emissions are translated into concentrations using the carbon cycle built into each model, and concentrations are translated into warming based on each model's simplified representation of the climate and a key parameter, climate sensitivity. Each model uses a different approach to translate warming into damages. Finally, transforming the stream of economic damages over time into a single value requires judgments about how to discount them. Further discussion of the specific models and why they were selected is found on pp 5-10 of the 2010 TSD.

To produce a range of plausible estimates that still reflects the uncertainty in the estimation exercise, the distributions from each of the models and scenarios are equally weighed and combined to produce three separate probability distributions for SCC in a given year, one for each assumed discount rate. These distributions are then used to define a range of point estimates for the global SCC. In this way, no integrated assessment model or socioeconomic scenario is given greater weight than another. Because the literature shows that the SCC is quite sensitive to assumptions about the discount rate, and because no consensus exists on the appropriate rate to use in an intergenerational context, the TSD presents SCCs based on the average values across models and socioeconomic scenarios for each discount rate. Further discussion of how the models were run and their outputs combined to produce a single set of recommended estimates is found on pp 24-29 of the 2010 TSD.

The key inputs to the models are equilibrium climate sensitivity, socioeconomic and emissions trajectories, and discount rates. Equilibrium climate sensitivity is defined as the long-term increase in the annual global-average surface temperature from a doubling of atmospheric CO₂ concentration relative to pre-industrial levels. In the 2010 TSD, The IWG selected the "Roe and Baker" distribution of climate sensitivity, because it was the only one that is based on a theoretical understanding of the response of the climate system to increased greenhouse gas concentrations. Further discussion of the selection of the climate sensitivity input parameter is found on pp 12-15 of the 2010 TSD.

For the socioeconomic and emissions trajectories, the IWG considered how to model several input parameters in tandem: GDP, population, CO₂ emissions, and non-CO₂ radiative forcing. A wide variety of scenarios have been developed and used for climate change policy simulations. In determining which scenarios were appropriate for inclusion, the IWG aimed to select scenarios that span most of the plausible ranges of outcomes for these variables. To accomplish this task in a transparent way, the IWG decided to rely on the Stanford Energy Modeling Forum

exercise, EMF-22. Further discussion of the selection of socioeconomic and emissions trajectories for use as model inputs is found on pp 15-17 of the 2010 TSD.

The choice of a discount rate, especially over long periods of time, raises highly contested and exceedingly difficult questions of science, economics, philosophy, and law. Although it is well understood that the discount rate has a large influence on the current value of future damages, there is no consensus about what rates to use in this context. For rules with both intra-and intergenerational effects, agencies traditionally employ constant discount rates of both 3 percent and 7 percent in accordance with OMB Circular A-4. As Circular A-4 acknowledges, however, the choice of discount rate for intergenerational problems raises distinctive problems and presents considerable challenges. After reviewing those challenges and the guidance contained in Circular A-4 the IWG chose three discount rates, 2.5%, 3%, and 5%. The TSD recommends that values reflecting all three discount rates be presented in regulatory impact analyses in order to show a reasonable range of SCC estimates. Further discussion of the selection of discount rates and the recommendation for presenting estimates reflecting a range of discount rates is found on pp 17-23 of the 2010 TSD.