NOTICE: This is a compilation of preliminary individual comments. These preliminary comments do not reflect consensus advice or recommendations, have not been reviewed or approved by the chartered SAB, and do not represent EPA policy. **Do not Cite or Quote.**

U.S. Environmental Protection Agency
Science Advisory Board
Economic Guidelines Review Panel (EGRP)

Preliminary Comments submitted by Dr. Joseph E. Aldy on the EPA's revised Guidelines for Preparing Economic Analyses

May 19, 2020

Dr. Joseph E. Aldy

COMMENTS ON CHAPTER 6

Circular A-4
The discount rate used for RIAs is one of the few parameters in regulatory analysis that OMB specifically prescribes through Circular A-4. This guidance should be a bit more general in its deference to Circular A-4. For example, it specifically references 3% and 7% multiple times. A future OMB may update the guidance, and these rates may be changed. If the OMB circular is updated, with revised discount rates, then this guidance should automatically adjust. This guidance should also be very clear about the contexts in which discount rates in EPA analysis should appropriately deviate from 3% and 7% and EPA should be very transparent about this. If agencies regularly deviate form 3% and 7% based on rigorous analysis, then this may spur OMB to update its guidance as well.

Recommendation 6-1: EPA should be clear about the economic and policy contexts that justify a deviation from 3% and 7% discount rates and it should be very clear about the selected rates in these cases.

Annualized values
Too often I have read RIAs that present annual benefits based on a representative year after full implementation and annualized costs constructed from the stream of costs over a specified timeframe. Indeed, this is the norm – in my recent review of about 40 Clean Air Act RIAs, more than 80% presented monetized benefits and costs in this manner. This is an apples and oranges comparison. The benefits should be annualized for this comparison to be valid, as appropriately noted in these guidelines. The guidelines are very clear in the second bullet of 6.5 that such comparisons of representative year benefits to annualized costs are not adequate proxies for a comparison of the present values of benefits and costs. This explicit description of doing so as inappropriate should be highlighted earlier in the chapter as well, such as when the annualization calculations are introduced.

NOTICE: This is a compilation of preliminary individual comments. These preliminary comments do not reflect consensus advice or recommendations, have not been reviewed or approved by the chartered SAB, and do not represent EPA policy. **Do not Cite or Quote.**

Recommendation 6-2: The guidelines should emphasize in a more prominent part of chapter 6 that the agency should use annualized benefits, not a simple snapshot year, for characterizing benefits and in comparing benefits and costs.

Selecting Time Horizons

The time periods chosen for the analysis matter for discounting for several reasons. First, they affect the annualization of costs, which is common in EPA RIAs. Second, they could influence the discount rate if one opts to account for discount rate uncertainty by employing a certainty equivalent discount rate for long-term policies over which discount rates may be plausibly considered uncertain. As Box 6-5 clearly illustrates, the certainty equivalent discount rate can decline considerably as one extends the time horizon of analysis. The time period assumption in such analysis should be made based on an understanding of the economic and regulatory context. If a rule will be periodically reviewed and updated (e.g., a NAAQS, or tailpipe standard, or NSPS under the Clean Air Act), then it may not be appropriate to use a long time horizon. In such cases, a long time horizon is likely to be overlapped by a future rule-making updating the current rule under consideration. This illustrates again the importance of selecting baselines for analysis.

Recommendation 6-3: EPA should be very clear about the choice of time horizon for its analysis, provide justification for the time horizon selected, and discuss the robustness of the findings to this decision.

Text Boxes

Text Box 6.1: What is the objective of a text box in the guidelines? Does this hypothetical policy – with benefits 30 years in the future – have a real-world analog? GHG regulations? Title VI regulations under the Clean Air Act? It would be better to illustrate practice with real-world policies to make the calculations more salient for the reader. It is also important to be clear about the take-away for the box. What is actionable from the material presented in the box? Why does it need separate treatment in the chapter? The answers to these questions are not obvious to me here or in the boxes in chapter 7 on benefits.

Text Box 6.2: Why use a hypothetical market rate of return? Why not use estimated rates in practice, for example, you could refer to Figure 5 in this 2017 CEA report on discounting: https://obamawhitehouse.archives.gov/sites/default/files/page/files/201701_cea_discounting_issue_brief.pdf. Again, using real-world examples instead of hypotheticals would be more effective. It may also help make it more clearer to the reader what the take-away point is for this box.

Text Box 6.3: Is EPA recommending an application of the Ramsey framework? It's not clear what the take-away is here.

Recommendation 6-4: EPA should be very clear about what the take-away messages are from each of the text boxes (in chapter 6 and beyond).

Consistency Across Assumptions

NOTICE: This is a compilation of preliminary individual comments. These preliminary comments do not reflect consensus advice or recommendations, have not been reviewed or approved by the chartered SAB, and do not represent EPA policy. **Do not Cite or Quote.**

If EPA employs a discount rate based on long-term per capita consumption growth (e.g., in a Ramsey-style framework) or a discount rate based on a certainty equivalent to account for uncertainty in long-term rates, then the underlying consumption/income growth rates should be applied when estimating adjustments to the value of statistical life with an income elasticity for monetizing reductions in premature mortality. Likewise, the economic costs of a regulation may depend on how economic growth affects the market(s) in which regulated firms operate. The economic growth assumptions used in the cost analysis should be consistent with those used in the discount rate decision and, where relevant, the benefits estimates. (I've made a similar comment in the context of VSLs in chapter 7.)

Recommendation 6-5: EPA should be consistent in its economic growth assumptions as they pertain to choice of discount rates, the estimation of the social cost of carbon, and the estimated costs of compliance.

Personal Discount Rates
I welcome the discussion in section 6.4 that distinguishes the appropriate discount rate to characterize individual and firm behavior with the discount rate used in calculating net social benefits.

Recommendations
It's not clear why there are separate types of recommendations, with the last four bullets as "principles." Shouldn't they be given the same weight as preceding recommendations? It's also not clear how an analyst can satisfy the first principle – apply the same discount rates to benefits and costs – and comply with the preceding guidance that (A) a regulation that displaces private capital investment should use the shadow price of capital approach; and (B) a long-time horizon regulation should use the consumption rate of interest and consider lower rates as a result of discount rate uncertainty. The guidelines could be more specific in how to manage these circumstances and potential contradictions.

Social Cost of Carbon
This chapter does not explicitly address the social cost of carbon (or other greenhouse gases), although much of the discussion about intergenerational discounting and uncertainty in discount rates is relevant to the social cost of carbon. Previous work by EPA as a part of the former Interagency Working Group on the Social Cost of Carbon produced SCC estimates based on an array of discount rates: 2.5%, 3%, and 5%. More recent applications of the SCC have been estimated based on discount rates of 3% and 7%. To ensure that the benefits measures used in EPA analyses are consistent with the discount rates used in the analysis, EPA consideration of discount rates that deviate from 3% and 7% should inform the work on development of future SCCs. Put another way, if EPA decides to employ a discount rate other than 3% or 7% in an analysis that affects the flow of carbon dioxide (or other greenhouse gases), then it should be able to employ a SCC based on this alternative discount rate.

COMMENTS ON CHAPTER 7

NOTICE: This is a compilation of preliminary individual comments. These preliminary comments do not reflect consensus advice or recommendations, have not been reviewed or approved by the chartered SAB, and do not represent EPA policy. **Do not Cite or Quote.**

Co-benefits

The draft guidelines are much too vague about the inclusion of ancillary impacts – co-benefits and co-costs – in economic analysis. Chapter 7 on benefits does not address in any way co-benefits or ancillary benefits. Indeed, these terms only appear in a brief footnote (#129) on p. 5-18, and even in this case, the characterization is unnecessarily constrained. In the footnote, co-benefits are defined as "changes in environmental contaminants other than those related to the statutory objective of the regulation," but this excludes co-benefits unrelated to environmental contaminants. For example, RIAs for rules targeting CO2 emissions in mobile sources include monetized benefits associated with fuel savings, energy security, traffic accidents, congestion, and noise (note that some of these measures have negative signs, which some analysts may label as disbenefits or co-costs).

Consider the contrast between the 2014 updated version of the Economic Guidelines and this draft:

> 2014: "An economic analysis of regulatory or policy options should present all identifiable costs and benefits that are incremental to the regulation or policy under consideration. These should include directly intended effects and associated costs, as well as ancillary (or co-) benefits and costs" (EPA 2014, p. 11-2).
>
> This Draft: "An economic analysis of regulatory or policy options should present all identifiable costs and benefits that are incremental to the regulation or policy under consideration" (p. 11-1).

There is no credible reason for increasing ambiguity by dropping the second sentence from the 2014 draft in this revision. Indeed, given the confused commentary about this topic among non-economists in the public sphere, it is all the more important to explicitly state the importance of accounting for the economic effects of all changes that result from an EPA rule in comparison with its baseline.

In addition, the guidelines could be more explicit about important considerations in the evaluation of co-benefits. For example, the guidelines could address double-counting, regulatory rebound, and related regulatory baseline issues. The guidelines could also consider alternatives analysis that examine alternative regulations that target so-called co-benefits in tandem with alternatives analysis of regulatory approaches that address the so-called targeted pollutant. Such an alternatives analysis would be in the spirit of including assessments of policy approaches beyond EPA's current statutory authority that could highlight for Congress, key stakeholders, and the public the potential for legislative reforms to improve the efficacy and/or economic efficiency of environmental law.

Recommendation 7-1: EPA should explicitly endorse the accounting of co-benefits and co-costs

on par with benefits and costs in the evaluation of regulations and policies. The guidelines should also include specific guidance for measuring such impacts as described above.

Value of Statistical Life

The value of statistical life (VSL) monetizes the single most important public health benefit delivered by the EPA: reducing premature mortality. Indeed, EPA regulations represent about 80% of monetized benefits of regulations promulgated by all executive branch agencies (e.g., see the 10-year look-back in the 2017 OMB Report to Congress on the Benefits and Costs of Federal Regulations), and the vast majority of these monetized benefits are from reducing premature mortality. I have two sets of comments, the first on the primary VSL and the second on the heterogeneity in the VSL.

Primary VSL

The centrality of the VSL to the monetized benefits of EPA regulations and policies makes it all the more peculiar that EPA is using quite outdated VSL estimates. Table B1 lists the 26 studies that serve as the basis for the agency's primary VSL of $7.4 billion (2006$). The average publication date of these studies is 1985 and the most recent paper in this table was published in 1991. Not a single one of the labor market hedonic papers employs measures of occupational fatality risk based on the BLS Census of Fatal Occupational Injuries, which BLS initiated in 1992. As noted in Viscusi (2004) (Viscusi, W. K. (2004). The value of life: estimates with risks by occupation and industry. *Economic Inquiry*, *42*(1), 29-48.), occupational fatality risk data that pre-date the CFOI suffer from numerous deficiencies that undermine statistical estimation. The contingent valuation studies also predate significant improvements in CV methods (such as those recommended by the 1992 NOAA blue ribbon panel on CV, or more recent practices that enable online elicitation).

In 2007, the SAB was asked to address the potential role of meta-analysis in constructing a VSL estimate for use by the agency. Here is an except from the SAB's response (https://yosemite.epa.gov/sab/sabproduct.nsf/4128007E7876B8F0852573760058A978/$File/sab-08-001.pdf):

> "In answer to the meta-analysis charge questions, the SAB does not believe that metaregression—a particular form of meta-analysis—is an appropriate way to combine VSL estimates for use in policy analyses. The SAB does, however, agree that meta-regression is a useful statistical technique for identifying various aspects of study design or population characteristics that are associated with differences in VSL estimates. Once important sample characteristics, model and estimation factors affecting the VSL have been identified, the Agency must determine a set of criteria for what constitutes a set of acceptable empirical studies of the VSL. The SAB urges the Agency to establish such criteria. The Agency must also determine which studies are appropriate for estimating the VSL in a specific

> policy context, depending on the nature of the risk addressed by a policy and the population affected. Once these criteria have been determined, and an acceptable sample of VSL estimates from the literature has been formed, appropriate statistical techniques can be used to combine these estimates."

It's difficult to imagine any of these 26 studies satisfying the criteria that the agency would put forward for "what constitutes a set of acceptable empirical studies." Not only would it be unlikely that they would satisfy standards on current, acceptable empirical methods grounds, five of them seem unlikely to be acceptable on the grounds that they estimate VSLs for a non-U.S. population (two UK, one Canada, one Australia, and one Japan study).

In contrast to EPA, the Department of Transportation updated its VSL in 2013 (https://www.transportation.gov/sites/dot.gov/files/docs/2016%20Revised%20Value%20of%20a%20Statistical%20Life%20Guidance.pdf) and based its VSL estimate on the average of 9 wage hedonic studies conducted over the previous decade. I recognize that EPA has initiated more recent efforts to evaluate VSLs, as alluded to on page B-3. The dated discussion of VSL in the guidelines – I'm not sure if there is a more recent paper cited than a few published in 2007, in addition to the very dated studies used to construct the central VSL estimate for analysis – needs to be addressed.

Let me offer a few specific recommendations on the primary VSL. The first two can be addressed in this guidance. The second two are flagging areas which likely require longer reviews.

Recommendation 7-2: EPA should reevaluate how it is accounting for income growth in its primary VSL. The agency adjusts the VSL over time to account for inflation (i.e., updating base year dollars) and for growth in income per capita with an income elasticity (see discussion on pp. B-4 – B-5). For example, the 2002 EPA rule "Control of Emissions From Nonroad Large Spark-Ignition Engines, and Recreational Engines (Marine and Land-Based)" (RIN 2060-AI11) adjusted VSLs for income growth for its year 2030 full-implementations snapshot of the rule's public health benefits. If it's appropriate for accounting for income growth over 2002-2030, then it should also be appropriate to account for income growth over 1985-2020 (the period of time for the average VSL study in the set of 26 used by EPA for its primary VSL). This is not inconsequential. For example, personal income per capita (https://fred.stlouisfed.org/series/A792RC0A052NBEA), deflated with CPI-Urban (https://fred.stlouisfed.org/series/CPIAUCSL#0), shows a 59% real growth in income over 1985-2019. With an income elasticity of 0.4 (the middle of three values EPA uses), that implies a 23% increase in the VSL due to income growth relative to the $7.4 billion (2006$) that is the EPA default.

Recommendation 7-3: EPA should ensure consistency in accounting for income growth over time across its analyses. The same rate of growth should be applied for updating a VSL for a future year as is used in the regulatory cost of compliance dimension of the analysis and, where relevant, the social cost of carbon calculation.

NOTICE: This is a compilation of preliminary individual comments. These preliminary comments do not reflect consensus advice or recommendations, have not been reviewed or approved by the chartered SAB, and do not represent EPA policy. **Do not Cite or Quote.**

Recommendation 7-4: EPA should identify a VSL for policy evaluation based on a review of the more-recent peer reviewed VSL literature. I recognize that this can serve as the charge for a full panel to the SAB and involves more time and effort than is available for this current review.

Recommendation 7-5: EPA should review the VSL income elasticity literature and determine whether to update its income elasticity for adjusting VSLs for income growth over time. For example, Viscusi and Masterman 2017 JBCA find that the US VSL income elasticity ranges from 0.5 to 0.7.

VSL and Population Heterogeneity

The discussion of the Heterogeneity in Risk and Population Characteristics on p. 7-13 (and related text in Appendix B) requires revision. Lines 36 and 37 state: "The empirical and theoretical literature on the effect of many of these characteristics or willingness to pay is incomplete or ambiguous." This statement and the following discussion of the literature as it pertains to how VSLs vary over the life cycle do not do justice to the literature.

First, this should be framed in terms of how willingness to pay for reductions in mortality risk vary over the life cycle. It is not simply as a function of life expectancy, or an issue for the elderly, or a "senior discount" as once described in the context of the Clear Skies Initiative.

Second, the theoretical literature – which includes simulations based on calibrated models – is not ambiguous about how the value of reducing mortality risk varies over the life cycle. Shepard and Zeckhauser (1984) does an excellent job of illustrating two extreme cases that illustrates that the value of reducing mortality risk may decline over the life cycle or may take an inverted-U shape over the life cycle. Most of the rest of what is an extensive literature falls within these two cases and illustrate how the life-cycle pattern of consumption coupled with life expectancy influences the life-cycle pattern of willingness to pay to reduce mortality risk. The bottom line is that at some point in the life cycle, WTP to reduce mortality risk begins to decline for a given population of individuals as they move from middle age to later ages in the life cycle. Let me note some of these papers here:

Córdoba, J. C., & Ripoll, M. (2017). Risk aversion and the value of life. *The Review of Economic Studies*, *84*(4), 1472-1509.

Hall, R. E., & Jones, C. I. (2007). The value of life and the rise in health spending. *The Quarterly Journal of Economics*, *122*(1), 39-72.

Murphy, K. M., & Topel, R. H. (2006). The value of health and longevity. *Journal of political Economy*, *114*(5), 871-904.

Johansson, P. O. (2002). On the definition and age-dependency of the value of a statistical life. *Journal of Risk and Uncertainty*, *25*(3), 251-263.

Rosen, S. (1988). The value of changes in life expectancy. *Journal of Risk and uncertainty*, *1*(3), 285-304.

Shepard, D. S., & Zeckhauser, R. J. (1984). Survival versus consumption. *Management Science*, *30*(4), 423-439.

Arthur, W. B. (1981). The economics of risks to life. *The American Economic Review*, *71*(1), 54-64.

Third, the discussion of the revealed preference and stated preference literatures is incomplete and misleading. I recommend citing Aldy and Viscusi (2008) in addition to the Viscusi and Aldy (2007a). The former is the original research published in the *Review of Economics and Statistics*, and the latter is more of a survey paper in the *Review of Environmental Economics and Policy*. The 2008 paper presents VSL estimates over most of the adult life cycle (the age 18-62 segment of the life cycle), while the empirical illustration in the 2007a paper is focused on a single EPA policy proposal in which the epidemiological outputs were for only two age groups. The claim that "older population have higher WTP" does not fully represent the findings in the Kniesner et al. 2006 paper. They find an inverted-U over the life cycle (working years' segment of life cycle) – older populations have higher WTP than young adults, but lower WTP than middle-aged adults. Appendix B cites Viscusi and Aldy (2003) in footnote 513 and note that in this paper's review of the literature, only 5 of 8 papers that included age-risk interactions in labor market hedonic studies found negative, statistically significant coefficient estimates on the interaction. The three insignificant findings are for an Indian sample (used in two papers) and a Canadian sample in the other.

The revealed preference literature could also include more recent references on how VSLs vary over the life cycle, such as:

Aldy, J. E. (2019). Birds of a feather: Estimating the value of statistical life from dual-earner families. *Journal of Risk and Uncertainty*, *58*(2-3), 187-205.

O'Brien, J. (2018). Age, autos, and the value of a statistical life. *Journal of Risk and Uncertainty*, *57*(1), 51-79.

Evans, M. F., & Schaur, G. (2010). A quantile estimation approach to identify income and age variation in the value of a statistical life. *Journal of Environmental Economics and Management*, *59*(3), 260-270.

The discussion of the stated preference literature references the Alberini et al (2004) paper. I am not as familiar with the CV literature, but I would recommend the Krupnick 2007 REEP paper here. Krupnick, who is a co-author on the Alberini et al paper, provides an excellent review of more than two dozen CV studies that evaluate how VSLs vary with age. The evidence is much more mixed than what is implied by citing only the Alberini et al paper. It would also be worth exploring the more recent CV literature.

Let me also note that several of the papers cited above support for the claim on lines 28-29 of p. 7-13 that a constant VSLY is not consistent with the literature. E.g., Hall and Jones (2007) in the theoretical/simulation literature and Aldy and Viscusi (2008) in the revealed preference literature.

NOTICE: This is a compilation of preliminary individual comments. These preliminary comments do not reflect consensus advice or recommendations, have not been reviewed or approved by the chartered SAB, and do not represent EPA policy. **Do not Cite or Quote.**

Recommendation 7-6: EPA should revise and update the description of the VSL and population heterogeneity in the context of how willingness to pay to reduce mortality risk over the life cycle based on the points noted above.

Additional Comments

(1) Page 7-1: Why limit benefits analysis to the "social benefits resulting from environmental changes"? If "environmental changes" means "environmental regulations" or "environmental policy," then that would be fine. Rules and policies can influence social benefits beyond environmental and/or public health dimensions.

(2) Page 7-2: This would appear to include co-benefits along several dimensions, which is good. Again, this appears to limit benefits as noted in (1). I would not prejudge whether it is impossible or impracticable to do modeling for a comprehensive assessment in "most circumstances." Evolving data collection and modeling techniques are constantly reducing the time and resource demands of sophisticated analysis.

(3) Page 7-3: Chapter begins with emphasis on WTP measures, but includes a cost of illness in the "commonly used valuation methods" entry for morbidity. This may be accurate – COI is used commonly – but this table should focus on WTP-based methods.

(4) Page 7-15: Is COI really biased down? Or could it be either biased up or down? Since many individuals pay a small fraction of medical care (if there are insured), it's not obvious to me that there is a thoughtful relationship between COI and WTP.

(5) Page 7-16: If EPA is going to include a box on non-WTP measures (7.3), then it needs more than the weak "should be used only in a limited set of circumstances" language. It should provide criteria for determining when to use these measures, and how that should also inform the interpretation and communication of results.

(6) Page B-3: Footnote 503 – describing how EPA has recently engaged EEAC on meta-analysis re: VSL – is out of date. The EEAC has since reported on its review of the role of meta-analysis in estimating a primary VSL and EPA has since disbanded the EEAC.