

## 1.1 RT3: Essay Question Response

The third component of the RSO's point rated criteria is a request for offerors to respond to one of three questions with an essay of not more than four pages, excluding references. For this criterion, we are providing a response to the second essay question, provided below for reference and italicized to distinguish it from the start of the response.

*Question 2:*

*Consider a proposed environmental health regulation that is designed to protect human health and natural assets. Provide a detailed outline of the economic valuation considerations that would allow you to determine the best course of action to defensibly estimate the health and environmental benefits of the proposed regulations.*

### **Introduction**

A comprehensive assessment of a proposed environmental health regulation by policymakers and the public requires consideration of defensible estimates of the regulation's potential benefits. Because monetary estimates of the costs for compliance with the regulation are typically available for consideration, there is often a keen interest in and, in some instances, legislative or policy mandates for monetizing these potential benefits to support comparisons with the available cost estimates.

Ideally, the monetary valuation of these benefits would reflect society's willingness to pay (WTP) to achieve the anticipated improvements in the timing, nature, quality, and/or quantity of environmental resources, including risks to human health. WTP-based valuations are preferred as they reflect the value (including "consumer surplus") that individuals place on the anticipated beneficial outcomes. Accordingly, WTP-based benefits estimates are the conceptually correct economic measures to compare to the cost of achieving the potential health and environmental benefits associated with a proposed regulation.

Monetizing potential human health and environmental benefits is likely to pose two main challenges. First, many of the important benefits are related to "nonmarket" goods and services, meaning that there are not observable market prices that can be observed and properly interpreted as indicative of their true "value" to individuals. There are nonmarket valuation techniques that can be applied to address this challenge, and it would be ideal if case-specific WTP-based estimates could be developed using such suitable primary research. However, the second challenge is that using applicable revealed and/or stated preference techniques, which are suitable for developing such WTP-based nonmarket value estimates, are both time and resource intensive. As a result, the primary research approach is rarely taken, except for the most costly or controversial policies.

Fortunately, there is a fairly well developed body of published economic research that provides useful indications of the WTP-based nonmarket values of several important nonmarket values. This body of knowledge can be tapped using “benefits transfer” (BT) techniques. BT, if applied with proper cautions (e.g., recognizing the site- and circumstance-specificity of many of the empirical values), can play a very constructive role, even if only as an intermediate step as part of a scoping exercise, in most benefit estimation efforts. As a result, our proposed outline of the economic considerations to chart the best course of action to defensibly estimate the health and environmental benefits of a proposed regulation focuses on BT techniques for monetization (rather than lengthy discussions of the potential issues with using stated and revealed preference methods for monetized benefits estimation).

### **Steps for Estimating the Benefits of a Proposed Environmental Health Regulation**

There are multiple steps required for this estimation and each produces quantitative input into the next step. This requires a multidisciplinary team because many areas of expertise are involved. Limitations in any step have an effect on approaches and results in subsequent steps.

***Step 1: Establish the scope, purpose, and resource constraints of the benefits estimation.*** A critical step in estimating benefits is to fully understand the nature of the desired/required results (e.g., quantified, monetized, and/or qualitative benefits) and the extent of the available resources (e.g., time, data, financial support). Executing this step effectively defines the project goals and critical constraints. For example, one project may call for a simple scoping of potential benefits to meet a quick turnaround request in the initial stages of evaluating a proposed regulation. In contrast, benefits estimates that support a formal regulatory analysis for a proposed regulation with extensive national impacts will typically require estimates supported by peer-reviewed works with a comprehensive assessment of uncertainty.

***Step 2: Define the baseline and control scenario.*** A proposed regulation’s potential benefits are determined by the *change* in health risks and natural assets attributable to efforts and impacts associated with achieving regulatory compliance. The first step in defining these asset changes is to clearly describe the state of human health and natural assets in the future periods of interest with and without the regulation. First, this state is defined assuming the regulation is not enacted. The associated results define the baseline scenario. Next, a similar state must be defined where all assumptions in the baseline scenarios are again incorporated along with any natural asset changes being attributed to achieving regulatory compliance. This outcome defines the control (or policy option) scenario. Economic and demographic changes expected over the relevant time period, as well as other regulations that may have effects over time, need to be identified. Results of this step include estimates of changes in emissions of pollutants or other changes in environmental quality that will have an effect on human health and natural assets.

***Step 3: Identify all potential direct and indirect environmental resource or human health impacts of the regulation.*** Comparing the status of human health and natural assets under the baseline and control scenario identifies changes that, by the construction of the scenarios, reflect the regulation's impacts. These changes, both improvements and decrements, provide the qualitative summary of the regulation's impact. For each impact, this assessment should account for the timing (initiation and cessation of the change), magnitude (both the extent and the severity), and the location of the status changes. To ensure there is a comprehensive assessment of potential impacts, a multidisciplinary team (e.g., including natural scientists and human health risk assessors) should define the scenario differences. This team will also look to "net out" conflicting and complementary stresses on individual classes of assets in order to produce a summary of the overall magnitude and direction of the assets' status change in a given time period.

This step generally requires the intermediate steps of estimating changes in exposure or dose followed by the estimation of the associated physical effects on human health and natural assets.

Estimation of exposure or dose involves all transport and transformation of pollutants in air or water and quantifies concentrations or dose to the population or natural assets of concern. For example, emissions from automobiles are transported and transformed in the atmosphere into concentrations of ambient air pollutants that affect human health, including particulate matter and ozone.

Estimation of physical effects on human health and natural assets uses epidemiology or toxicology to quantify the concentration-response effects on human health. Similarly, effects on natural assets such as flora, fauna, and ecosystem services are quantified.

***Step 4: Identify impacts that can be monetized.*** With human health and natural asset impacts defined over time, those that can be monetized using the BT method need to be identified. Human health effects will typically include changes in mortality and/or cases of chronic or acute illness. This identification process can utilize electronic searches, for example, of the online Environmental Valuation Reference Inventory (EVRI), to identify classes of impacts with monetary estimates in the economics literature. For the remaining impacts, the project team can evaluate revealed preference sources of data that may be available to develop values, as well as the reasonableness of pursuing stated preference methods (i.e., surveys) to develop new monetized estimates for specific impacts. If such primary methods are either technically infeasible or implausible within the applicable time and budget constraints, then the benefits that cannot be reliably monetized will be described in relevant descriptive, qualitative terms (e.g., through a TBL approach).

**Step 5: Select valuation estimates for impacts and monetize.** From the pool of identified valuation estimates, results needed to be selected so that monetary estimates can be developed for the associated portion of human health and natural asset impacts. A number of reports have produced guidance for selecting and incorporating monetized value estimates in the BT methodology (e.g., U.S. EPA, 2000; Treasury Board of Canada, 2007). In general, this guidance notes that a careful evaluation should be made of the factors, including the similarity of the scenario, the scale and timing of impacts, and the quality of the study (e.g., data, analytical methods). Similar considerations are important in the design of any primary revealed or stated preference methods to obtain new valuation estimates. With a selection of monetary values for impacts, a preliminary monetization can be completed for each of the identified time periods.

**Step 6: Address the time dependence of benefits, and compare present value (PV) benefits to PV costs.** Many proposed regulations will impact health and/or natural assets over multiple time periods. The variable timing of benefits generally will require a series of adjustments, including changing unit values for different periods to account for changes in income and real prices over time. In addition, social time preferences should be accounted for as part of summarizing the PV of benefits (and costs) that accrue over multiple periods. This will require defining a discount rate, or series of rates, so that monetized PV benefits can be compared to suitable cost estimates that are equivalently expressed in terms of their PV.

**Step 7: Formally address uncertainty in the benefit (and cost) estimates.** The uncertainty surrounding both monetized and non-monetized benefits estimates needs to be formally recognized and addressed to produce defensible results. This uncertainty comes from sources such as variations in the assumptions in baseline and control scenarios to the quantified uncertainty in response functions and monetary valuation estimates for specific impacts. Quantitatively, there are a range of techniques that can be considered to recognize uncertainty. At the less formal end, this could include conducting sensitivity analyses using simple ranges of parameter values to produce corresponding ranges of impact estimates (both monetized and non-monetized). Slightly more complex methods include conducting more complex sensitivity analyses and scenario analyses, while more formal methods such as defining distributions for the various parameters in order to complete Monte-Carlo simulations could be considered depending on the project needs. In addition, this step should incorporate a qualitative summary of potential omissions, biases, and uncertainties in the analysis with some description of the potential importance of these factors on interpreting the “best” results of the analysis.

**Step 8: Conduct supplementary analyses.** In situations where there is an emphasis on monetized benefits estimates, it may be possible to conduct supplemental analyses that can help provide valuable information when considering a regulation. For example, a break-even analyses may be completed where monetized benefits are being compared with monetized compliance cost estimates, and the cost estimates are currently greater than the value of the monetizable benefits. In this analysis, the difference in the monetized, and presumably discounted, benefits and cost

estimates is compared to the non-monetized and potentially nonquantified potential benefits identified in the analysis. The analyst then evaluates the likelihood of the social WTP for the additional benefits being equivalent to the identified monetary difference. An investigation of how the benefits and costs are distributed (i.e., who pays, and who receives the benefits) is also a useful equity element to add to a policy discussion for a benefit-cost analysis.

### **Conclusions**

The nature of defensible benefits estimates for a proposed environmental health regulation will vary by regulation. The process for developing these benefits estimates, however, should follow the general sequence of steps described above. With our proposed multidisciplinary team of experts and decades of experience designing and executing benefits assessments for a wide range of active and proposed environmental regulations, policies, and actions, the Stratus Consulting team is extremely well qualified to assist PRI with this task.