

However, research on valuation and benefit transfer continues to progress and the Agency anticipates new research and future efforts to value reproductive and developmental endpoints.

EPA was also unable to quantify or monetize the benefit from potential reductions in other cancers, such as colon and rectal, that may result from this rule. Both toxicology and epidemiology studies indicate that other cancers may be associated with DBP exposure but currently there is not enough data to quantify or monetize these cancer risks.

Other potential non-health related benefits not quantified or monetized in today's proposed rule include reduced uncertainty about becoming ill from consumption of DBPs in drinking water, the ability for some treatment technologies to eliminate or reduce multiple contaminants, and monitoring changes that will ensure that systems can effectively measure their DBP levels resulting in greater equity in protection from DBPs. First, the reduced uncertainty concept depends on several factors including consumer's degree of risk aversion, their perceptions about drinking water quality (degree to which they will be affected by the regulatory action), and the expected probability and severity of human health effects associated with DBPs in drinking water. This effect could be positive or negative depending on whether knowledge of the rule decreases or increases their concern about DBPs in drinking water and potentially associated health effects.

Another nonquantified potential benefit is the impact of technology selection to address DBPs on a system's ability to address other contaminants. For example, membrane technology (depending on pore size), can be used to lower DBP formation but it can also remove other contaminants that EPA is in the process of regulating or considering regulating. Therefore, by installing membrane technology, a system may not have to make new capital improvement to comply with future regulations.

Last, today's proposed rule makes changes to Stage 1 monitoring requirements. The IDSE monitoring provision of the proposed Stage 2 DBPR will help systems identify locations to conduct their routine monitoring to capture high DBP occurrence levels. Also, the proposed Stage 2 DBPR will prevent a system from conducting sampling designed to avoid monitoring when DBP formation is generally higher. For example, the Stage 1 DBPR required systems to take quarterly samples but samples could conceivably be taken in

December (4th quarter) and January (1st quarter) when the waters in the distribution system are colder and DBP formation generally lower. The proposed Stage 2 DBPR addresses this issue by requiring that the samples must be taken about 90 days apart. The benefits of these provisions include the greater certainty that health protection is actually achieved because it is more likely that a system's high DBP levels will be identified. In addition, the rule will reduce variability in the DBP levels throughout the distribution system, ensuring greater equity in public health protection.

## 2. Quantifiable Health Benefits

Although DBPs in drinking water have been associated with non-cancerous health effects discussed previously, the quantified benefits that result from today's rule are associated only with estimated reductions in DBP-related bladder cancer. A complete discussion of risk assessment methodology and assumptions can be found in Chapter 5 of the Stage 2 DBPR Economic Analysis (USEPA 2003i). Section III of this preamble also discusses the health effects that have been associated with DBP exposure.

The annualized present value benefits for reductions in bladder cancer that are the result of today's rule for both community water system (CWS) and non-transient non-community water systems (NTNCWSs) range from \$0 to \$986 million using a three percent discount rate (\$0 to \$854 million using a seven percent discount rate). Overall, the Stage 2 DBPR may reduce on average 0 to 182 bladder cancer cases per year.

The lower estimate of zero is included because of inconsistent evidence regarding the association between exposure to DBPs and cancer. The upper estimate of monetized benefits and cases avoided is based on a population attributable risk (PAR) of 17 percent. Table VII-3 also presents monetized benefits based on a PAR value of 2%. The PAR estimates are derived from an analysis of five epidemiological studies which indicate that perhaps 2 to 17 percent of bladder cancers may be attributable to DBP exposure. These PAR estimates are described in more detail in section III of today's document. These are the same PAR values that EPA used in the Stage 1 DBPR benefits analysis, as discussed in the Regulatory Impact Analysis for the Stage 1 DBPR (USEPA 1998f). Table VII-3 shows the estimated benefits associated with bladder cancer reduction as a result of the proposed rule. Table VII-4 summarizes the mean, median and

confidence intervals used to value reductions in bladder cancer.

To calculate the total value of benefits derived from reductions in bladder cancer cases as a result of the Stage 2 DBPR, a stream of estimated monetary benefits is calculated by combining the annual cases avoided with valuation inputs using Monte Carlo simulation. Use of a Monte Carlo simulation allows the characterization of uncertainty around final modeling outputs based on the uncertainty underlying the various valuation inputs. The Stage 2 DBPR benefits model uses distributions of value of statistical life (VSL), willingness-to-pay (WTP), and income elasticity values to attribute monetary values (with uncertainty bounds) to the number of bladder cancer cases avoided.

Several of the inputs needed in the benefit analysis, such as the VSL and WTP estimates, are based on older studies that were updated to current dollar values. In addition, both the VSL and WTP values are dependent on income levels. Therefore, these values also have to be adjusted for increases in real income growth from when the studies were conducted. The valuation inputs and an explanation of the update factors used to bring these values to current price levels and discussed in the following two sections.

*Valuation inputs.* In order to monetize the benefit from the bladder cancer fatalities, EPA applied a VSL estimate to the cancer cases that result in mortality. EPA assumed a 26 percent mortality rate for bladder cancer (USEPA 1999d). The Agency uses a distribution of VSL values which are based on 26 wage-risk studies. The mean VSL value from these studies is \$4.8 million in 1990 dollars. The mean value reflects the best estimate in the range of plausible values reflected by the 26 studies. A more detailed discussion of these studies and the VSL estimate can be found in EPA's *Guidelines for Preparing Economic Analyses* (USEPA 2000b).

The VSL represents the value of reducing the risk of a premature death. This valuation, however, does not take into account the medical costs associated with the period of illness (morbidity increment) leading up to a death. In its review of the Arsenic Rule, the Science Advisory Board (SAB) suggested that the appropriate measure to use in valuing the avoidance of the morbidity increment is the medical cost attributable to a cancer case (USEPA 2001e). Based on available medical data, EPA estimates the medical costs for a fatal bladder cancer case to be \$93,927 at a 1996 price level (USEPA 1999d). This medical cost value (updated to 2000 price levels) is applied as a point