The output of the assessment is a range of constituent concentrations, reflecting the range of pathway-receptor combinations considered for each waste management unit. The lowest concentration (per constituent) of this range represents the highest exposure pathway-receptor combination for that waste management unit.

c. How Uncertainty is Addressed

Any analysis of the magnitude used in this rule-making will have uncertainty associated with the outputs generated. The uncertainty can be associated with the models or equations used and the data relied on for the model parameters. In addition, policy assumptions, such as waste management units assessed and receptors assessed, may also affect the degree of representativeness of the assessment. In order to be consistent with Agency policy on the characterization of risk, stochastic and deterministic approaches were considered. A stochastic approach, such as Monte Carlo analysis, which produces a distribution of constituent concentrations, was initially considered due to the tremendous interest in, and use of, these techniques in risk assessment. However, after evaluation of the models and data available for use, the Agency decided to use a deterministic approach for the non-groundwater assessment.

The Agency's deterministic approach used for this assessment, like most such approaches, uses point values in all calculations and produced point estimates of constituent concentrations for waste in each management unit-exposure pathway-receptor combination. However, in selecting and developing point values for parameters, EPA considered all available data. Wherever possible, the Agency developed both a central-tendency and high-end value for each parameter used in the assessment. This was not possible in all cases because some parameters were a property, such as density of water, and because some values were fixed by Agency-wide policy decisions. (For example, EPA used standard Agency-wide human toxicity benchmarks and body weights.) EPA then calculated constituent concentrations based on a mixture of central-tendency and high-end values.

EPA believes that the deterministic approach described above (based on identifying critical parameters and using higher-end values only for those parameters and central-tendency values for the other parameters) allowed it to derive constituent concentrations in waste for each waste management unit that are reasonably protective across a range of conditions and for a range of receptors. EPA also believes that this approach is consistent with EPA's risk assessment policy.

EPA further believes that the approach chosen allows both the Agency and the public to determine more easily which parameters played the most critical roles in determining the constituent concentrations in waste for each waste management unit. This furthers general understanding of the assessment and helps commenters effectively target their resources for reviewing what EPA is proposing. It has also helped EPA target its own data collection and input selection efforts. It is often more difficult to identify critical parameters in a stochastic assessment because of the greater number of iterations and because results are reported as probability distributions. This is particularly true for an analysis with a large number of parameters such as the assessment used for this proposed rule.

EPA notes that stochastic approaches are also consistent with Agency risk assessment policy. In fact, EPA applied a stochastic ''Monte Carlo'' approach to the separate analysis of dilution and attenuation of groundwater performed for this proposal. That analysis, however, has been under development for many years and EPA is more familiar with the underlying data and the relationships between various parameters. In addition, the public has had a chance to comment on aspects of that analysis in previous rule-makings. EPA was more comfortable applying a stochastic analysis for the groundwater analysis than a stochastic approach to the non-groundwater analysis.

EPA believes that it is not necessary to resolve all issues relating to the relative merits of the two approaches or to determine which approach would be ideal for each of the assessments described above. Rather, the debate should focus on whether the approaches chosen allowed EPA to reach reasonable regulatory decisions.

The Agency solicits comment on the use of a deterministic approach as described above. Specifically, the Agency seeks comment on whether the approach proposed is a reasonable approach for setting protective levels across a set of types of management units and exposure pathways.

d. Linkage of the Non-groundwater Risk Assessment to the Groundwater Risk Assessment

In the non-groundwater risk assessment, the pathways involving potentially contaminated groundwater (e.g., bathing) are back-calculated from the receptor to the wellhead (i.e., the assessment provides constituent concentrations in the groundwater at the well). In order to determine the concentration of a constituent in leachate coming from a waste management unit that would result in the estimated constituent concentration at the water well, the Agency used a separate groundwater fate and transport risk analysis. That analysis is described in detail in Section D.8. elsewhere in today's proposal. The well concentrations estimated from the pathways involving bathing are used as input to the groundwater fate and transport modeling from which a leachate concentration is determined.

e. Risk Targets Used

As previously discussed in Section V.B. of today's proposed rule, the Agency used existing toxicity benchmarks when available. However, many ecological benchmarks were developed for this rule-making, as discussed in Section V.B. of today's proposed rule. As described in that section, the Agency used a cancer risk target of 1×10^{-6}, and a hazard quotient equal to 1 for non-carcinogens. For ecological benchmarks, a hazard quotient equal to 1 was used. The Agency solicits comment on the risk targets being used for today's proposed rule.

2. Detailed Overview of the Non-groundwater Risk Analysis

The assessment can be broken down into six components: Constituents; toxicity benchmarks; receptors; exposure; fate and transport; and waste management units. Each of these components is discussed in turn below, except the constituents and toxicity benchmarks which were discussed earlier in section V.A and V.B. It is important to recognize that the assessment was not able to evaluate all constituents in all receptor-pathway-waste management unit combinations because of data gaps in either toxicity or chemical properties, or inadequate methodologies. Many of these gaps have been identified in different sections of the Technical Support Document for the Hazardous Waste Identification Rule: Risk Assessment for Human and Ecological Receptors'' (denoted ''Uncertainties and Issues of Concern''). The Agency requests additional data or other information that would assist in filling these gaps.

a. Waste Management Units

The manner in which constituents are released to environmental media and the relative quantity released to each