organic compound is more treatable in some systems than in others and without information about the extent to which the lagoon supports aerobic and anaerobic processes we cannot assess how treatable these constituents are.)

In addition, the overall composition of each waste—i.e. the entire matrix must be considered in order to characterize its relative amenability to biological treatment. In particular, waste composition can enhance or inhibit a particular organic compound's amenability to biological destruction. Enhancement occurs, for example, if microorganisms can use one compound as a co-metabolite or co-substrate in metabolizing another. A feature story on biological treatment in the February 1993 issue of Environmental Science and Technology reports "\* \* \* highly chlorinated compounds such as trichloroethylene, 1,1,1-trichloroethane and chloroform will transform under aerobic conditions if methane, phenol or toluene is provided as a primary source of carbon and energy for biological growth. However, these reactions are cometabolic \* \* \*. Therefore it is important to define exact conditions when discussing biodegradation results." Inhibition occurs when one compound poisons the metabolic pathway by which another compound is otherwise degraded. The degree to which the microbial population in the impoundment has been acclimated to a particular constituent is a significant factor in determining that constituent's amenability. Acclimation determines the balance between inhibition and enhancement and is a factor to be defined in discussing biodegradation results.

The fact that "consortia" of microorganisms, rather than members of a single bacterial strain, accomplish the degradation of complex molecules further complicates the extent to which a compound can accurately be labeled "amenable" (Rittman and Saez in Levin and Gealt Biological Treatment of Industrial and Hazardous Wastes, 1993, McGraw-Hill, New York). The presence of different microorganisms in a consortium increases the number of compounds that can be degraded in that impoundment by virtue of the wider array of metabolic degradation pathways present. However, the various microbial species may require a narrower range of pH, dissolved oxygen and other parameters in order to function and may therefore be more liable to collapse and fail than a simpler more robust microbial strain.

Some of the technical issues that are likely to arise include:

(a) Biotreatment systems vary. Constituents that are amenable to treatment in one system may be nonamenable in another, thus an accurate determination of what is a nonamenable waste might have to consider site-by-site factors, which would present considerable problems in the implementation of the program. If EPA set up a more generic approach, other problems are likely to occur, as described below.

(b) The ETC uses the term "battery limits" to describe where nonamenable ICR wastes should be segregated. This term, however, is undefined and could represent the point where the wastestream leaves the production equipment, or a variety of aggregation points.

(c) What levels of constituents justify requiring segregation and recovery?

(d) If EPA required segregation of nonamenable wastes from biological treatment impoundments, there is a very good possibility that facilities would merely replace the surface impoundments with RCRA exempt tanks. Biological treatment in tanks could have the same air emissions unless they are properly controlled.

With respect to specific hazardous organic constituents, EPA is currently investigating whether the BDAT list of compounds could be ordinally ranked into a series of compounds more or less amenable to biological treatment, based on published treatability data. "Amenability" is a continuous variable. Treatability data shows that some compounds are more amenable to biological degradation than are other compounds: there are no organic chemicals, other than polymers, which are absolutely resistant to biological degradation.

Due to the technical problems associated with determining which wastestreams should be kept out of certain impoundment lagoons, and the policy concerns raised by these approaches, we are setting out these issues for comment in this proposed rule.

## 3. Constituent Properties of Concern

The following three items are criteria ETC suggests in addition to individual constituent concentrations. EPA invites comments on means of managing these waste properties.

a. Water solubility. EPA does not share ETC's concern that less soluble compounds are significantly less amenable to biological treatment than relatively hydrophilic compounds. For example, PCB's are virtually insoluble; nevertheless the literature documents cases where PCB's have been successfully degraded to hydrochloric acid, carbon dioxide and water.

b. TC Metals. EPA believes the LDR Phase IV limitations on land disposal of wastes that meet the definition of toxicity based on their metals concentration will address ETC's and CMA's concerns about the inadequacy of surface impoundments for metal treatment.

c. Toxicity. EPA solicits comments on the suggestion that P-waste constituents be managed as particularly toxic and thus likely to poison metabolic pathways in the degradation process. EPA further solicits comment on additional constituents or categories of constituents that are likely to be acutely toxic to biological treatment processes, rather than merely resistant to biological treatment.

The target mass removal approach described earlier in this preamble can be applied to biological treatment units to determine whether constituents managed in the units are being effectively degraded. The application of this approach could address the question of wastes nonamenable to biotreatment. The target mass removal approach requires a waste determination prior to the waste entering the treatment unit, and either (1) a waste determination after treatment in the unit, or (2) a determination of the operating efficiency of the treatment unit. This approach has been applied to biotreatment units for at least two promulgated standards that regulate hazardous organic chemicals: the HON and the Subpart CC air rules. Comments are solicited on the approach to address the nonamenable waste concerns.

## F. Additional Issues

In addition to the issues raised in the section "Summary of EPA's Preliminary Response" above, there are other technical issues arising in developing a list of UTS constituents that are not amenable to biological treatment. Another issue concerns those UTS constituents for which biological treatment is BDAT: could a wastestream containing such constituents have such a high concentration of other compounds known to be refractory to biological treatment that biotreatment no longer effectively treats the constituents? A third issue considered here is the extent to which "nonamenable" constituents evade treatment by volatilizing into the air or by adsorbing onto sludge, in addition to flowing out untreated in effluent.

## 1. List of Hazardous Constituents

In order to ensure that all the constituents in a decharacterized waste