PPC 9551.1991(03)

NO-MIGRATION PETITION FOR EXXON, TX

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

JAN 29 1991

Mr. David R. Chapman
Exxon Research and Engineering Company
P.O. Box 101
Florham Park, NJ 07932-0101

Re: Exxon, Baytown, TX No-Migration Petition (F-91-NMEP-FFFFF)

Dear Mr. Chapman:

At our meeting, September 26, 1990, to discuss EPA's technical evaluation of the no-migration petition submitted for the Baytown Refinery's North Landfarm, you requested some documents and further clarifications of a few issues. In response, I have enclosed copies of the Federal Register notices for the §3004(n) rule (June 21, 1990, 55 FR 25454) and the Benzene NESHAP (March 7, 1990, 55 FR 8292) and provided below additional information on static fracturing and the use of indicator chemicals in risk assessment. We are presently developing information that will address the third issue, metals mobility, and will provide it to you as soon as it is completed.

Static Fracturing

The term "static fracturing," although not a formal term, is used to describe the cracking of earthen materials without significant movement along the crack (plane of failure). It is used in contrast to dynamic fracturing (e.g., faults) where the fracture is related to shear or slip along the plane of fracture. The terms are not mutually exclusive as many small fractures with only slight movement can make up zones of slip (e.g., shear zones) that are associated with dynamic processes.

Static fracturing in relation to no-migration petitions is usually limited to shrinkage cracks. Three examples of static fractures are described below for your information. However, the first (desiccation cracks) is the only one that would possibly apply to the Baytown landfarm.

Desiccation cracks - These cracks form as a result of shrinkage from drying. The simplest example is the formation of mud cracks. Soils

and sediments that contain expandable clays routinely expand during rainey periods and shrink and crack (fracture) during dry periods. Although, in most cases, the fractures extend only a foot or so in depth, depending on the makeup of the soil and underlying sediments, they are reported to exist at depths in the tens of feet. In areas where montmorillonitic shales weather from surface soils, desiccation cracks can be exceptionally deep.

Cooling fractures - These fractures are common in basalts and are almost characteristic of plateau basalts. Commonly referred to as "Joint sets" or "columnar jointing," fracture patterns developed in cooled lava, are widespread. These fractures result from shrinkage in the lava as it cools to basalt rock, and often penetrate the entire layer.

Tension fractures - Any rock unit subjected to structural tension may fracture in a direction perpendicular to the tension. This is very typical of folded units where rock layers on the outside of the fold undergo tension relative to rocks along the inside of the fold. Subsequent leaching by downward movement of surface waters can enlarge fractures. This is typical of limestone terrains.

Indicator Chemicals in a Risk Assessment

EPA's recent guidance - Risk Assessment Guidance for Superfund - Volume 1: Human Health Evaluation Manual (Part A) Interim Final (EPA/540/1-89/002) - defines the indicator chemical approach in more detail than the 1986 Superfund Public Health Evaluation Manual, which was used by Exxon in its environmental risk assessment. The methods used to select indicator chemicals for a no-migration petition are similar to risk assessments performed for Superfund sites. However, it appears that Exxon did not completely apply the Superfund approach. EPA's position is described below and an example of how this approach could be applied to the environmental risk assessment in your no-migration petition is presented.

Most Superfund sites have a few chemicals that are usually present in concentrations that present much higher risks (i.e., three or more orders of magnitude or higher) than the remaining chemicals at the site. Based on this experience, EPA suggested, at Superfund sites, that between 5 and 10 chemicals with the highest individual risk factors would be manageable and possibly sufficient for a human health risk assessment. The selection of indicator chemicals is not a process of selecting a single chemical to represent each class of chemicals that may be expected to exhibit similar fate and transport characteristics and similar toxicities, but rather, it is

a process to exclude from further consideration, those chemicals that are unlikely to contribute significantly to risk. Use of the Superfund approach with wastes placed at refinery landfarms may result in a list of more than 5 or 10 indicator chemicals, but it is likely to eliminate from further consideration some of the chemicals that have been detected in the waste. The selection of indicator chemicals is optional; it is often prudent to consider all chemicals. If there are clear reasons to believe that not all chemicals are likely to contribute significantly to the total risks, the number of chemicals carried through the risk assessment modeling may be reduced using a concentration-toxicity screen.

The indicator chemical selection procedure is a quantitative approach that requires an evaluation of each chemical detected at concentrations above background levels: specifically, one must compare the concentration of the chemical in a medium to a toxicity benchmark for that medium. Other considerations such as persistence, solubility and bioaccumulation are included in the final selection of chemicals.

To select indicator chemicals, each chemical is assigned a score by dividing the concentration (C) of the chemical in a medium by the toxicity benchmark (TB). The medium may be a source medium (e.g., applied wastes), or a transport medium (e.g., surface water), depending on the availability of measurement data. The source of the toxicity benchmarks are dependent on the potential receptors (e.g., recommended criteria values for the protection of freshwater aquatic life can be calculated from Ambient Water Quality Criteria documents). The scores are then summed for all chemicals to estimate a "total risk factor" to serve as an initial screen. After consideration of other factors (e.g., persistence, bioaccumulation), one may eliminate from the risk assessment chemicals with C/TB values that are very low compared with C/TB values for other chemicals of the same class in that medium. "Very low" may be defined as a lower limit to the percentage of the total risk factor accounted for by a single chemical. For Superfund sites, the remedial project manager may choose a "cutoff" for "very low" of one percent of the total risk factor screen, or a lower value if the site risks are expected to be high.

In the no-migration petition, it appears that Exxon did not follow the indicator chemical selection approach as described above. The concentrations of the chemicals in the composite waste sludge were discussed with qualitative statements about relative aquatic toxicity of the chemicals rather than comparing them to numeric toxicity benchmarks. When the appropriate application of the indicator chemical approach is followed, there appears to be no justification for Exxon's exclusion of any of the VOCs and most of the PAHs from further analysis. To assist Exxon, we have prepared a

couple of exhibits applying the suggested indicator chemical selection approach using the same organic waste constituents information provided in the risk assessment section of the no-migration petition. The same principles also apply to inorganic constituents, but are not illustrated in the example. Note that Exxon should begin the risk assessment by evaluating comprehensive waste characterization data from all the wastes applied to the landfarm, not just the listed hazardous wastes.

Exhibit 1 shows the aquatic toxicity values that are recommended for the particular organic constituents in the waste as identified by Exxon in the petition. Please contact EPA if you need assistance in determining appropriate toxicity benchmark values for additional chemicals if they are detected in the waste. Calculations for the indicator chemical selection process are presented in Exhibit 2. In this exhibit, column 1 is the reported concentration of the chemical in the composite sludge waste that Exxon used to select waterborne indicator chemicals for the no-migration petition; column 2 lists the aquatic toxicity benchmarks shown in Exhibit 1; and column 3 is the ratio of waste constituent concentration to the aquatic toxicity benchmark, or the chemical-specific risk score. The chemical-specific risk scores are then slimmed for all chemicals within a chemical class to estimate a "total risk factor" for the medium and the chemical class. The chemical classes are evaluated separately because they are likely to exhibit different fate and transport characteristics.

In this example, if one follows the guidance for Superfund sites, four chemicals (anthracene, benzo(b)fluoranthene, pyrene, and fluoranthene) each have a total risk factor of less than one percent (1%). These chemicals could probably be eliminated from further consideration if there are no other reasons for retaining the chemical (e.g., high bioaccumulation potential). However, we need to stress that the risk assessment report should include a discussion of each chemical that is eliminated from further modeling, indicating that other characteristics of the chemical, such as bioaccumulation and persistence, have been considered.

I hope this information will be useful in the preparation of Exxon's response to EPA's technical evaluation of the no-migration petition. If you need additional assistance, please contact Athena Rodbell of my staff at (202) 382-4519.

Sincerely,

James F. Michael, Chief
Disposal Technology Section (OS-343)

Office of Solid Waste

Attachments (2)

cc: Dave Reeves, PSPD, OSW
Athena Rodbell, PSPD, OSW
Terry Keidan, PSPD, OSW
Howard Finkel, ICF