STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations
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January 15, 2009

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Re. **BMI Plant Sites and Common Areas Projects, Henderson, Nevada**
Revised Toxicological Information on Dichlorobenzil Compounds

Dear Sirs and Madam:

All of the parties listed above shall be referred to as "the Companies" for the purposes of this letter. Revised toxicological information for dichlorobenzil compounds is provided in Attachment A.

Please contact me with any questions (tel: 702-486-2850 x247; e-mail: brakvica@ndep.nv.gov).

Sincerely,

Brian A Rakvica, P.E.
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Attachment A

An earlier memorandum (NDEP, 2008a) outlined the database deficiencies for 2,2'- and 4,4'-dichlorobenzil. This memorandum provides additional research and recommendations on surrogate toxicity criteria for these compounds.

Ochoa and Roberts (2003) provided recommendations regarding toxicity criteria for 4,4'-dichlorobenzophenone (DCBP), which has some structural similarity to dichlorobenzil. They noted that an NCEA provisional RfD for DCBP of 0.03 mg/kg-day was based on a 90-day rat study and use of a combination of uncertainty factors (totaling 3000) that led NCEA to place "low confidence" in this value. The provisional RfD for DCBP was noted to be similar to the RfD of 0.02 mg/kg for chlorobenzilate, but Ochoa and Roberts (2003) cautioned that predictions of carcinogenic potential for both compounds should be considered:

> *"There is some reason to suspect this contaminant may have some carcinogenic potential. NCEA's evaluation included using TopKat, a quantitative structure-toxicity relationship program, to examine the carcinogenic potential of DCBP, dicofol, chlorobenzilate, DDT, and p-chlorobenzoic acid. This program relies on data from actual chronic rodent bioassays in its prediction of carcinogenicity for structurally related chemicals. Four submodels are run by TopKat, for male and female mice and rats. . ."*

The TopKat predictions for carcinogenicity were noted to be positive for DCBP, dicofol and chlorobenzilate in male and female mice, and for dicofol and benzilate in male rats.
The structural difference between DCBP and dichlorobenzil is the addition of a second carbonyl group between the two phenyl rings, making a viscinal diketone structure that bridges two chlorophenyl groups. This change in structure is likely to make dichlorobenzil more stable to environmental breakdown due to tautomerism of the chemical bond strength across the viscinal carbonyl groups and the adjacent chlorophenyl groups. In addition, the presence of viscinal ketones in the bridge region is likely to promote a more coplanar structure for the chlorophenyl groups, particularly for the 4,4'-dichlorobenzil structure. Both of these changes have the capability of increasing environmental persistence and increasing potential for carcinogenicity and/or toxicity of 4,4'-dichlorobenzil.

It appears that DDT and compounds are among the best studied organochlorine compounds with reasonable structural similarity to dichlorobenzil and the possible surrogates DCBP and chlorobenzilate. DDT and its breakdown products (DDE and DDD) are liver carcinogens in multiple strains of mice and exhibit primary neurological and reproductive/developmental effects in mammals that would be primary non-cancer effects of concern for structurally similar compounds (ATSDR, 2002). DDT and compounds have been assigned toxicity criteria by USEPA (2008) in accordance with their carcinogenic properties in mice (SF 3.4E-01 per mg/kg-d for DDT and DDE; 2.4E-01 per mg/kg-d for DDD), with corresponding residential soil criteria of 1.7 to 2.4 mg/kg (NDEP, 2008b). The RfD value associated with DDT and compounds is 5.5E-04 mg/kg-d and would likely correspond to residential soil criteria between 25 and 50 mg/kg. Thus, if DDT and compounds were considered as possible surrogates for dichlorobenzil, a derived residential soil criterion approaching the range of 1.7 to 50 mg/kg may be considered protective despite the considerable database deficiencies.

In sum, the plausible carcinogenic potential of dichlorobenzil is suggested by the TopKat predictions for structurally similar surrogates with limited toxicological data (DCBP and chlorobenzilate), and physical/chemical considerations point to possible greater persistence and coplanar structure of the 4,4'-dichlorobenzil. These considerations support a more conservative approach for defining toxicity criteria for dichlorobenzil. If it is assumed that the better studied surrogates, DDT and compounds, may represent a reasonable upper bound for dichlorobenzil toxicity, then assigning this compound a toxicity criterion within an order of magnitude for DDT may be appropriate. Accordingly, it is recommended that the NCEA provisional RfD for DCBP (0.03 mg/kg-d) be utilized as a surrogate for dichlorobenzil, with the addition of uncertainty factors of 10-fold for likely greater environmental persistence and use of structure-activity relationships, and 10-fold for database deficiencies beyond those recognized for chlorobenzilate and dichlorobenzophenone, resulting in a provisional RfD for dichlorobenzil of 3.0E-04 mg/kg-d. The derived soil criteria for dichlorobenzil based on this provisional RfD should be within 10-fold of those derived based on carcinogenic endpoints for DDT and compounds.

References:

ATSDR. 2002. Toxicological profile for DDT, DDE ad DDD. U.S. Dept. of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Atlanta, Georgia, September 2002.

NDEP. 2008a. Technical Memorandum: Updated toxicology review for 4.4'-dichlorobenzil. Available from Nevada Dept. of Environmental Protection, Bureau of Corrective Action. October 30, 2008.

NDEP. 2008b. Basic Comparison Levels Table, December.
http://ndep.nv.gov/bmi/docs/bcl_table1208.pdf

Ochoa, HG, and Roberts, SM. 2003. Letter to Florida Dept. of Environmental Protection regarding cleanup target level for 4,4'-dichlorobenzophenone. University of Florida Center for Environmental & Human Toxicology, October 21, 2003.

USEPA 2008. Integrated Risk Information System (IRIS). Online database of USEPA toxicity criteria. www.epa.gov/ncea/iris/