	RAILROAD COMMISSION OF TEXAS SURFACE MINING AND RECLAMATION DIVISION # ADVISORY NOTICE	ADVISORY ID: ER-BA-127(b) REVISION NO: EFFECTIVE DATE: 06/10/2010

SUBJECT: Identification of Acid Forming Materials (AFM) in Premine Materials and Postmine Top Four Feet

APPROVAL John E. Caudle TITLE: Director

I. PURPOSE

This Advisory Notice provides guidance for the identification of acid-forming materials (AFM) in overburden strata, including the top four feet, and the stratum immediately below the lowest coal seam to be mined. This guidance is intended to facilitate identification of materials suitable for placement in the top four feet of reconstructed minesoil, including topsoil substitutes. Suitable topsoil substitute materials are described as the best available non-toxic, non-acid forming and non-combustible material.

II. REGULATION REFERENCE

Regulations 12.127(b), 12.134, and 12.145(b)(3)

III. SUMMARY

Section 12.127 of the "Coal Mining Regulations" requires permittees to identify AFM in each stratum within the overburden and the stratum immediately below the lowest coal seam to be mined. The following procedures for the identification of AFM may be used as a tool to ensure that the requirements of §12.127(b)(3)-(4) are met. This guidance is designed to facilitate the preparation of a surface mining permit with respect to the information required to address §§12.145(b)(3) and, more specifically, §12.386(a)(1).

IV. DEFINITIONS OF ACID/BASE (A/B) RELATIONSHIPS AND pH

a. Acid/Base Balance (Reference Method)*=[(Effective Cation Exchange Capacity or Cation Exchange Capacity)(0.2)+Inorganic Carbonates] - [Potential Acidity + Exchangeable Acidity]

b. Acid/Base Accounting*=[Neutralization Potential] - [Potential Acidity + Exchangeable Acidity]

c. Either the Acid/Base Account (ABA) or the Acid/Base Balance (ABB) may be used in the calculation of the A/B value. However, the applicant should choose one or the other method and use it consistently.

d. $pH = {}^{-}\log[H^{+}]$ obtained from a 1:1 soil water suspension with a glass electrode in the laboratory.

* ABA and ABB should be expressed as tons of $CaCO_3$ equivalent per 1000 tons of material (t/kt). The results should be rounded off to the nearest ton.

V. PREMINE DETERMINATION OF ACID/BASE AND pH VALUES

a. Acid/Base (A/B) Baseline Determination

1. The stratum of each overburden core section will be analyzed for A/B.

2. Representative soil samples for each major diagnostic horizon for each major soil series found in the permit area or at least in the permit mine plan area (either of these areas are henceforth referred to as the "area") will be analyzed for A/B to a minimum depth of four feet by performing a weight averaging of the horizons of each soil series.

   Major soil series are those which individually comprise at least five percent of the area. In all cases, a minimum of 80 percent coverage will be required for the area. All prime farmland soils must be sampled and included in the baseline.

3. As described in Advisory Notice AG-PS-145(b)(5)(G), when the premine-soil baseline is developed using more than one soil core per soil series, at least 80 percent of the area within the permit boundary must be represented by the series sampled. If only one core is collected per soil series, the analytical data from all soil series must be included.

4. In addition, a weight averaged A/B value for the zero to average topsoil (A + E horizon) depth; average topsoil depth to two feet; two to three feet; and three to four feet; or zero to average topsoil depth and average topsoil depth to four feet should be determined.

5. Should the applicant not provide A/B premine documentation as described above, the A/B value for each depth increment in the premine top four feet will be defined as zero.

b. Soil Reaction (pH Baseline Determination)

1. The stratum of each core will be analyzed for pH.

2. The pH of each soil horizon of each major soil series found in the permit area will be obtained as described in Section V.a. above. Each major soil horizon at each sampling location will be measured for pH. Sampling will be accomplished by a qualified agronomist or soil scientist, and each sample will be measured for pH in the laboratory with a glass electrode.

3. The pH of each horizon at each sampling site will be weight averaged in order to obtain individual pH values for each depth increment in the top four feet. In addition, the percent of pH values falling below pH 5.0 or above pH 8.4 will be determined per depth increment.

4. The data will provide information to calculate the percent of the area with reaction values per depth increment less than pH 5.0 or above pH 8.4.

   These values are defined as the sum total of the fractional occurrence of each soil series in the area by the fraction of each soil series having a pH below 5.0 or above pH 8.4. These calculations will be performed for each depth increment to a depth of four feet.

VI. MATERIAL SUITABLE FOR USE IN THE TOP FOUR FEET OF RECONSTRUCTED MINESOIL

a. pH

The stable pH of the substitute materials shall not exceed the baseline distribution percentage of pH values less than 5.0 or greater than 8.4. If a baseline is not available, using a normal distribution, the sampling intensity for the stable pH must be sufficient to estimate the mean within 0.3 pH unit at the 90% confidence level. Based upon the pH values of all samples, not more than 5% should be >8.4 and not more than 5% should be <5.0.

b. Textural Class (topsoil substitute materials only)

The proposed topsoil substitute material will have a texture of sandy loam, sandy clay loam, loam, silt loam, silt, clay loam, or silty clay loam. In areas with topsoil sand content above 80% or clay contents greater than 40%, the textural characteristics of the proposed topsoil substitute material will be equal to or better than the available topsoil.

c. Electrical Conductivity (E.C.)

Based upon the total number of samples collected, the EC values must be equal to or less than 4 mmhos/cm in 90% of the cases or shall not exceed the premining conditions. If more than 10% of the EC values exceed 4 mmhos/cm, or baseline values, then further justification for the use of the material may be required by the Commission.

d. Sodium Adsorption Ratio (SAR)

The SAR values must be equal to or less than 13 in 90% of the cases or shall not exceed the premining conditions. If more than 10% of the SAR values exceed 13, or baseline values, then further justification for the use of the material may be required by the Commission.

e. Trace Elements

If more than 10% of the values for an element exceed the concentration listed in Table I, or baseline values, then further justification for the use of the material may be required by the Commission.

f. Acid/Base (A/B)

Materials suitable for use in the postmine top four feet will have A/B values $\geq$ 0 t/kt or are no less negative than the A/B of the premine top four feet of undisturbed soil.

g. Field-site Trials or Greenhouse Tests to Measure Productivity

The Commission may also require the results of field-site trials or greenhouse tests to be used to demonstrate the feasibility of using selected overburden materials.

VII. POSTMINE DETERMINATION OF ACID/BASE AND pH VALUES

a. Representative minesoil samples to a depth of four feet from each sampling grid in the leveled area will be taken and analyzed in the laboratory for pH and A/B.

b. The percent of acreage with A/B values below premine A/B values found in any one depth increment or below zero (whichever is less) plus the percent of acreage with values less than pH 5.0 or below pH baseline values in any one depth increment will be calculated.

c. Postmine topsoil/subsoil substitute materials will not have pH values less than 5.0 and net acidity, as defined by A/B calculation, less than 0 t/kt, or the pH and A/B values will not fall below premine baseline values.

VIII DATA ANALYSIS

Analytical methods for the parameters described in these guidelines are listed in the Railroad Commission of Texas, Surface Mining and Reclamation Division Advisory Notice AG-RP-145 (Overburden and Minesoil Samples – Preparation Procedure for Large and Small Volume Samples).

TABLE I

Suggested Maximum Total Concentration of Trace Elements in Materials to be Placed in the Top Four Feet of Reconstructed Minesoil

Element	Method of Determination*	Maximum Total Concentration ppm
As****	Hydride Generation AA** or Inductively Coupled Plasma	50
B***	Inductively Coupled Plasma	5
Cd	Inductively Coupled Plasma	0.7
Cr****	Inductively Coupled Plasma	1000
Cu****	Inductively Coupled Plasma	100
K	Inductively Coupled Plasma	15,000^{+}
Mn****	Inductively Coupled Plasma	3000
Mo****	Inductively Coupled Plasma	5
Ni****	Inductively Coupled Plasma	500
P	Colorimetric or Inductively Coupled Plasma	500^{+}
Pb****	Inductively Coupled Plasma	200
Se	Hydride Generation AA	2
U	Inductively Coupled Plasma/Mass Spectrometry (For West Texas and Jackson-Yegua formation mines)	4
Zn****	Inductively Coupled Plasma	300

* The Commission has established the exact analytical methods to be used.

** Atomic Absorption.

*** From a Hot Water Extract

$^{+}$ Plant available

**** Not applicable to Wilcox sediments (RCT letter dated 2/1/94, responding to TMRA position paper dated 5/4/93, as supplemented by TMRA letter dated 11/18/93).

References

Lindsay, W. L. 1979. Chemical Equilibria in Soils. John Wiley & Sons. New York.

Askenasy, P. E. and R. C. Severson. 1988. Chemical Procedures Applicable to Overburden and Minesoil, pp. 55–80. *in* Hossner, L. R. (ed.) Reclamation of Surface Mined Lands, Vol. 1, CRC Press.