

Development of a Reliable Field Testing Protocol for Acid-Forming Materials¹

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Abstract: Accurate and rapid prediction of the acid-forming potential of geologic materials in a field setting is challenging and most projects and their analysts rely on conventional acid base accounting (ABA) lab procedures to determine relative risk and appropriate liming requirements. Road improvements for Route 220 in Botetourt County, Virginia, will cut and fill large volumes of soil/saprolite/rock materials derived from potentially acid-forming Devonian black shales. VDOT permit requirements mandate separating all handled materials into four different categories of acid formation risk with differing liming and/or placement procedures. We evaluated a combination of rapid field criteria (color, hardness, 1:1 water:soil pH, 30% H₂O₂ reaction, and 10% HCl reaction) along with conventional ABA lab analyses for over 250 pre-disturbance drill core samples. Combined statistical and meta-analysis of the data sets indicated that > 90% of the samples could be properly placed into correct risk categories via application of the field criteria. From these analyses, we developed a flow chart for sequential field procedures to allow rapid identification and treatment recommendations during active construction operations. The original VDOT categorization and lime treatment criteria were based primarily on % S and ABA net neutralization potential (NNP) values and would have required most native soils and oxidized saprolites to be limed to achieve an NNP of +24 tons of calcium carbonate equivalent per 1000 tons material before final placement, even though they posed essentially no risk of further acid release. The liming prescriptions were modified to employ the ratio of maximum potential acidity (MPA) to neutralization potential (NP) of 3:1 as an alternative target criterion. Active construction was initiated in late 2017 and we will continue to evaluate the effectiveness and efficiency of the field-testing protocol over the project lifetime (~ 2 years).

Additional Key Words: Highway Construction, Acid Base Accounting, Potential Acidity, Liming Requirement, Net Neutralization Potential, Black Shales.

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