

Nevada Modified Sobek Procedure Summary

Below are the minimum reporting requirements. The Nevada Division of Environmental Protection, Bureau of Mining Regulation and Reclamation (Division) has determined that the Nevada Modified Sobek Procedure will be the only accepted method for determination of acid neutralization/generation potential (ANP/AGP) and will not accept data from other methods without prior approval.

The Nevada Modified Sobek Procedure¹ is identical to the Montana State University Modified Sobek procedure with the following modifications, summarized below.

For all analyses, sample is pulverized to a 95% -150 mesh.

Alternative I

- 1 - Total sulfur (%) reported as AGP as tons CaCO₃ per 1000 tons material (T/kT)
- 2 -
 - a) ANP titration to phenolphthalein endpoint of pH 8.3 su.
 - b) Pre-treatment with hydrogen peroxide (Siderite correction^{2,3})
- 3 - Paste pH
- 4 - Calculate Net Neutralization Potential (NNP) as ANP-AGP and ANP/AGP ratio. If ANP/AGP ratio <1.2:1, the Division requires sulfur speciation per Alternative II below and recalculation of ANP/AGP ratio.

Alternative II

- 1 - Sulfates (water soluble acid-forming sulfates, %) via hot water extraction
- 2 - Sulfates (sulfate sulfur, %) via Hydrochloric acid extraction
- 3 - Pyritic sulfur (%) via Nitric acid extraction, reported as AGP (T/kT)
- 4 - Non-extractable sulfur (%)
- 5 - Calculate AGP from pyritic sulfur content⁴ (AGP-PYR). Calculate NNP as ANP-AGP and determine ANP/AGP ratio.

¹ The Nevada Modified Sobek Procedure can also be found on the Division

² Siderite Correction Method (from <http://technology.infomine.com/enviromine/ard/Acid-Base%20Accounting/acidbase.htm#Siderite>, developed by a Pennsylvania-West Virginia Overburden Task Force (Leavitt et al., 1995)

³ The Division's concern is that unless mineralogical analysis has been completed and the laboratory has the appropriate information, there is no definitive method for the laboratory to determine if ferrous iron is present. Because of this, the Division is considering this step as part of the standard procedure.

Unless the operator has provided sufficient mineralogical data to indicate that ferrous iron is not present in all rock types, the siderite correction method must be utilized on a minimum of 50% of all samples analyzed.

⁴ If barite, alunite or similar type minerals that have been known to result in false positive results from the NMS procedure for acid generation are thought to be present, the operator must provide either XRD or SEM analysis data and the appropriate NAG test (single addition or sequential) in conjunction with the NMS results. The preferred Nevada method can be found in:

ADVANCES IN ACID ROCK DRAINAGE (ARD) CHARACTERISATION OF MINE WASTES²

Warwick A. Stewart², Stuart D. Miller, and Roger Smart. Paper presented at the 7th International Conference on Acid Rock Drainage (ICARD), March 26-30, 2006, St. Louis MO. R.I. Barnhisel (ed.) Published by the American Society of Mining and Reclamation (ASMR), 3134 Montavesta Road, Lexington, KY 40502