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RapidRAEF: New Software for Economic Valuation of Undiscovered Mineral Resources

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Estimating the economic viability of extracting undiscovered mineral resources is an important step in mineral resource assessments conducted by the U.S. Geological Survey (USGS). The USGS quantitative mineral resource assessment (QMRA) approach employs engineering cost models originally developed by the U.S. Bureau of Mines. These equations estimate capital and operating expenses of mining and milling the hypothetical resources compared to deposit valuations, yielding an estimate of the total amount of resource that might be economically recoverable. This approach is termed an “economic filter” because of the use of present value analysis to remove subeconomic resources from consideration.

Implementing the USGS QMRA methodology in open-source software tools using best practices can help ensure trust and longevity in the methodology and ensure that USGS and its stakeholders benefit from improved transparency and reproducibility, increased collaboration, and increased opportunities for rapid improvement. The Resource Assessment Economic Filter (RAEF) R package was the first iteration of this approach and provided a user-friendly software tool for applying economic filters. It has been used in several mineral resource assessments worldwide, but is deprecated due to newer versions of R.

The RapidRAEF software package represents the next generation implementation of the economic filter approach for QMRAs developed to help achieve USGS goals of assessing critical and strategic minerals. The RapidRAEF software package includes several methodological improvements aligned with recently identified needs for improving QMRAs. These include allowing custom cost models, incorporation of the effects of new technologies and market dynamics in mineral processing, a wider range of assessable commodities, and more granular modeling of costs in multi-commodity assessments. RapidRAEF is designed for efficiency and performance, with the ability to process outputs from large datasets such as Monte Carlo simulations, ensuring interoperability with other tools that comprise the USGS QMRA software stack.