



Not so equivalent grades

By Vanessa MacLean and James Whyte

Part five of a series on NI 43-101 myths

If you're reading a mining news release and see a company say something like "1.5 g/t AuEq" or "2.4 per cent CuEq," that's an equivalent grade. It is a way of combining multiple metals in a deposit into one simplified number. The problem, however, is that the equivalent grade calculation is often done incorrectly!

Our friend the straw man is confused: "But an equivalent grade just adds up the value of each metal using today's prices. Everybody does it!"

And that is where the trouble begins.

Let's think about it in terms of making a smoothie. Imagine you're blending a smoothie with bananas, strawberries and spinach. You decide to call it a "banana-equivalent smoothie" by counting how much each ingredient costs, and then converting it into banana terms.

But here's the thing: you don't absorb all the nutrients equally, and not everything blends the same way. The blender (your processing plant) handles bananas better than spinach. Plus, you're throwing some of it away (like smelter losses). So, while it sounds like all the ingredients are giving you equal banana power, they're not!

Only considering price-weighted equivalent grade—simply adding together the grades of each metal, multiplied by their market price—suggests that all the metals are equally recoverable, equally payable and equally marketable. In the real world, they are not because:

- You never recover 100 per cent of any metal;
- You recover some metals better than others. Most mines are built to prioritize one key metal; and
- No smelter will pay you for all the metal you recover. Payables, deductions and penalties are part of mining. You're selling concentrate under specific commercial terms, not a theoretical blend.

So, if you only use price to calculate an "equivalent" grade, you're really just expressing a gross metal value. And that just doesn't tell the whole story.

Wait a minute...an equivalent grade is not a gross value?

Yes, it is. When you take the total price of all the metals in a rock and divide it by the price of one main metal (like gold or copper), you're not doing anything special. You're just turning a dollar amount into "metal units." It's still the same total value, just written in ounces of gold or tonnes of copper instead of dollars. That doesn't make it a true equivalent grade, it's just a fancier way of showing the same number.

Gross value doesn't consider recovery, payables or processing costs, and neither does a price-weighted "equivalent."

So, what is the real-world equivalent grade?

Take the grades of each commodity and multiply each by that commodity's unit price, its recovery and the payable fraction of its price. Then divide by the unit price, recovery and payable fraction that applies to the principal commodity.

$$\begin{aligned} \text{Equivalent grade} = & \\ & (\text{Grade}_1 \times \text{Price}_1 \times \text{Recovery}_1 \times \text{Payable}_1 \\ & + \text{Grade}_2 \times \text{Price}_2 \times \text{Recovery}_2 \times \text{Payable}_2 + \dots) \\ & \div (\text{Price}_m \times \text{Recovery}_m \times \text{Payable}_m) \end{aligned}$$

Where:

- Each "1,2..." is a commodity in your resource;
- "m" is the main commodity, the unit you want to express your equivalent grade in (e.g., copper (CuEq), gold (AuEq));
- You apply metallurgical recoveries and commercial payables to each metal; and
- Include the formula in your disclosure! Math makes it real.

"Let's think about equivalent grades in terms of making a smoothie."

But we've always done it this way.

Not really. One of us looked back through the archives of *The Northern Miner* and equivalent grades weren't commonly reported until the mid-1980s, when gold-silver producers reported "gold-equivalent" production and platinum producers reported equivalent grades in concentrates. Those numbers—recovered and payable metal—made sense. Moreover, mine operators using equivalents recognized that any "equivalency" between metals had to take both price and recovery into account. But around 1988, equivalent grades started showing up in resource estimates, before anyone knew whether those resources would be economically extractable. That's when the shortcut turned into a marketing tool.

So, it's not traditional. But isn't it a requirement?

Not at all. Back in 2003, the CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines said this about grade equivalents:

Reporting of mineral or metal equivalence should be avoided unless appropriate correlation formulae, including assumed metal prices, metallurgical recoveries, comparative smelter charges, likely losses, payable metals, etc., are included.

Even before that, Raymond Goldie and Peter Tredger's classic 1991 paper on net smelter return models conceded equivalent grade was widely used but was "misleading" and "should be avoided." No literature we've been able to find accepts pure price-weighting as an equivalent grade. Authors always include recovery and most also include costs. Regulators are not alone in their thinking.

If we have to include recovery factors, what if we assign a partial recovery—say 80 per cent—to all the metals in the equivalent?

Let's check that math. Multiply the numerators by 0.8 and the denominator by 0.8 and you've multiplied the grade by...one. Sadly, you haven't corrected anything. You must apply actual or reasonably assumed recoveries and payables.

Other standards like JORC (Australian Joint Ore Reserves Committee) and SAMREC (South African Mineral Reporting Code) don't restrict price-weighted equivalents.


Both JORC Clause 50 and SAMREC Clause 74 require individual metal grades and recovery factors. SAMREC goes further, requiring the equivalent to take account of netback. So yes, other jurisdictions agree that price-weighted equivalents don't meet best-practice standards.

What about sums of grades, like total platinum group elements? Those aren't equivalents.

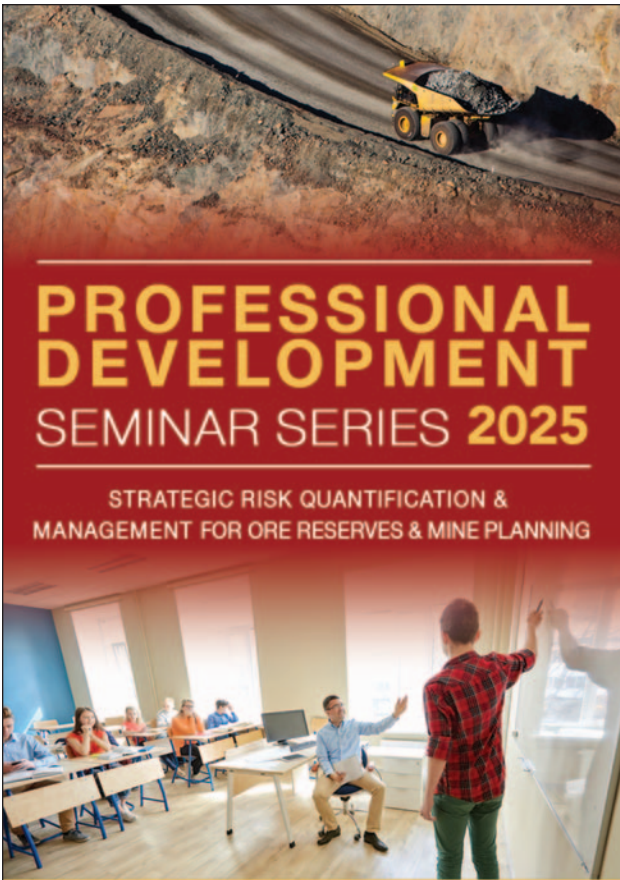
Those are equivalent grades too, just without any weighting. They treat all metals as equally valuable and recoverable, which is rarely true.

But total rare earth oxides are an industry standard.

Let's examine this. Total rare earth oxides include unmarketable rare earths and low-priced commodities that may not figure into a project's economics. Only a few rare earths (like neodymium, praseodymium, dysprosium and terbium) are actually valuable. A lot of public companies think reporting in this way is meaningful, but just because others do it doesn't make it right.

Equivalent grades have to be calculated with care and attention to all the economic factors as they apply to each payable commodity. We leave the last word to Foghorn Leghorn in the classic Warner Brothers cartoon *A Fractured Leghorn*: "It's mathematics, son. You can argue with me, boy, but you can't argue with figures." 






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Make history history

By James Whyte and Craig Waldie

Part six of a series on NI 43-101 myths

Old mineral projects that didn't make it before are often dusted off, given new wings and told to fly again. That's not necessarily a bad thing—better technologies and changing economics can sometimes elevate a project awaiting its chance. And a project with a past could be seen to have a head start based on previous work.

When a company has a project with previous work or previous mineral inventories, that history will often be material information the company should include in its technical disclosure. Accurate and complete disclosure of historical information gives investors a good idea of what kind of work a project may need; that five other juniors poked some holes in the property and cut a few interesting intersections could mean the property has potential or could just mean it's been a five-time disappointment.

If there are historical estimates—and the estimates still have some relevance to the project today—then those numbers will help the public understand a project's potential.

If you've been following this series of columns, you'll know we always pull out the “damning but.” This time, it's to say *but* historical information is not your work. You did not control it, and you don't know for sure how good it is. That is why National Instrument 43-101 provides a way to let the public see the information without forcing the company to file a technical report. But that also means the need for handling the information responsibly. Historical information requires a source and date, an opinion on its relevance and reliability, and context.

Historical estimates

Historical estimates can be anything from a detailed data set transferred to a new project operator to a simple record of an old tonnage and grade calculation in an assessment file. Solid information about that “relevance and reliability” that the Instrument requires you to comment on is easy to come by in the first case, and a closed book in the other. It is important to assess whether that closed-book estimate brings any value at all to an investment decision—and it certainly won't if you can't trace it to its origin.

The fact is that a long list of old estimates does little more than tell the public there's some mineralization there—quantifying that may not help much.

It is worth noting that a historical estimate—whatever label a previous operator might have stuck on it—is no longer a mineral resource or mineral reserve, even though the mineralization might still be there. Loose talk about having “a mineral reserve from 1962” or “an NI 43-101 compliant mineral resource by a previous operator” is nonsense. Why?

Because it's only a resource or reserve once it meets the CIM definitions, and it's only a current mineral resource or reserve

once the company discloses its own estimate (and starts the clock on filing its own technical report).

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We should also draw a distinction between historical estimates and legacy data. Having legacy data can permit you to go back and verify it through resampling core, twinning holes or infill drilling. Having old estimates, but no access to core or data, means only that you can tell the public an old operator thought it had a mineral deposit, but the new operator has to verify this for itself.

History in technical reports

Once a company is ready to file its own technical report on the property, it becomes important to remember that Item 6 on Form 43-101F1, the “History” section, is intended only to be a summary and not an exhaustive documentation of everything that has been done since Georgius Agricola swung his pick. Chances are most of that history is not material.

The History section gets even worse when it is used to shoe-horn an in-depth account of the previous operator's resource estimates, which directly contradicts the cautionary language that is supposed to accompany it—especially the part that says you're “not treating the historical estimate as current mineral resources or mineral reserves.” What you are actually saying is “Look at the exquisite work that last operator did. Look at its quality control, its semivariograms and its swath plots, aren't they pretty? We're immensely confident in their mineral resource estimate, as you should be too. We're just not putting our names on the estimate ourselves.”

Old economic studies by others are not historical estimates so the allowance for disclosure with caution does not apply.

In the 2003 movie *Big Fish*, Albert Finney plays a character whose fondness for historical accounts of his fantastical past complicates his relationships with others who try to separate fact from fiction. You can avoid complications by always keeping project histories simple and limiting them to their genuinely important and relevant parts. While Albert Finney's character continued on, your mineral project may not. **CIM**

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Send comments to editor@cim.org



A cautionary tale

By Chris Hachkowski and James Whyte

Part seven of a series on NI 43-101 myths

Nobody works in the mining business for very long without realizing that knowledge of what’s under our feet is variable, conditional and revised whenever new information surfaces. But problems can arise when investors, who may not have had similar surprises from Mother Nature, read estimates of mineral potential or predictions of future production and cash flows. That’s where cautionary language comes in: whoever reads your disclosure should know how uncertain it is. It turns out William Shakespeare’s plays have some cautionary language of their own—and, as always, Willie’s words are very much to the point.

“Nature disclaims in thee; a tailor made thee!”

One of the myths surrounding cautionary language is that it’s a “disclaimer”—a statement made to push away responsibility for information you’re telling the public. It is no such thing. The company that discloses information requiring a cautionary statement, and the qualified person approving the disclosure, remain responsible for it.

Cautionary statements aren’t meant to be weasel words disavowing responsibility for information you make public. They are the opposite, there to rub the reader’s nose in the uncertainties of your disclosure. Cautionary language is prescribed by the mining disclosure rule for three kinds of disclosure: historical estimates, exploration targets and preliminary economic assessments.

“Presume not that I am the thing I was”

Historical estimates need cautionary language for a mass of reasons: they were done at another time, by other operators, possibly using other categories, often with unstated assumptions or without verification. But the most important thing is that they aren’t yours, and until the company is ready to put its name to them (and an estimator is willing to sign off on that mineral resource estimate), you shouldn’t invite the public to think they’re correct or current.

The cautionary language means what it says: nobody is signing off on the old work, an investor should not rely on it and

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the company isn't going to rely on it until it has its own estimate. Do not undermine that with statements about "building on the historical resource," or by making economic projections on a resource you don't have.

"Until I know this sure uncertainty, I'll entertain the offered fallacy"

National Instrument 43-101 specifies cautionary language for exploration targets too, and CIM's newly proposed definition and guidance tells you a lot about what the cautionary statement needs to say. Exploration targets are estimated ranges of tonnage and grade on projects where there has been "insufficient exploration to estimate mineral resources."

Protection from misleading disclosure and keeping information about exploration targets transparent are the reasons cautionary language is required when exploration targets are disclosed. Due to high uncertainty around exploration targets, they cannot be categorized using CIM definitions of mineral resources. A company that decides to estimate a metal or commodity content should not pretend it has a resource.

Any estimate around an exploration target should be disclosed as a range of tonnes and grade to demonstrate the high level of uncertainty around the potential target. These ranges must be accompanied by accepted cautionary language as outlined in s.2.3(2) of NI 43-101.

Companies have attempted to showcase their exploration targets by using misleading terminology. Recently, we have seen language to describe exploration targets as "potential resources." Describing exploration targets as "resources," even with a qualification to the term, will result in a comment letter from regulators to remove this language. These are not resources, as defined by CIM, as they have not seen sufficient work to classify them as such.

"Promising is the very air o' th' time"

Early-stage economic projections are the mythical sprites of the mineral industry, ranging from honest uncertainties to airy nothings with a net present value. The industry knows these weak spots too well: inferred and indicated resources that dissolve into waste, capital cost estimates that inflate like the *Hindenburg* and meet the same end, and economic analyses that promise much and deliver little. Not only is cautionary language necessary on those projections, the disclosure shouldn't oversell the results with hype words like "robust" or "rigorous" or with claims of "exceptional economics."

A quaint little expression pops up three times in Part 2 of the Instrument: "states with equal prominence." Oddly enough, it means what it says—clarity demands that the cautionary statements be just as prominent as the disclosures they apply to. Footnotes or long paragraphs of boilerplate texts don't cut it. Warnings need to be delivered centre stage, not as an aside, whispered from the wings. **CIM**

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The subheads come from Shakespeare in *King Lear*, II:2; *Henry IV*, V:5; *Comedy of Errors*, II:2; and *Timon*, V:1. Or maybe from the Earl of Oxford, Francis Bacon, Kit Marlowe or the Earl of Derby. A qualified literary critic has not done sufficient work to determine authorship.



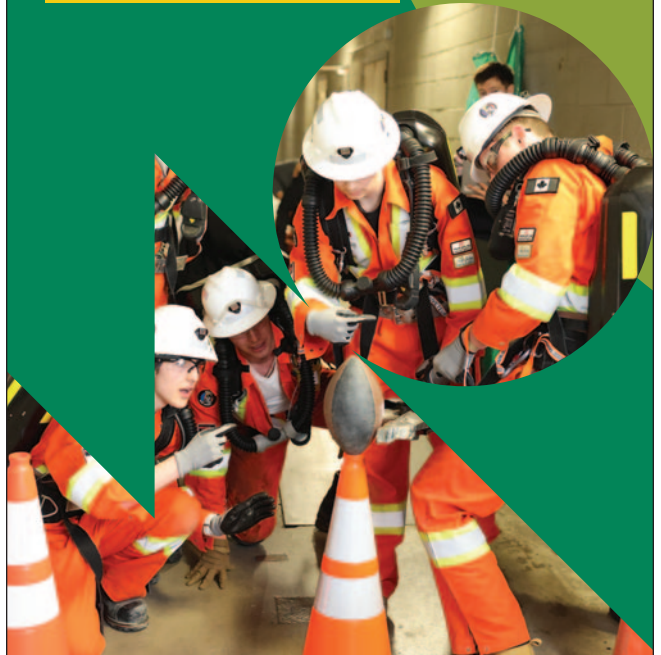
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