UHL CONSULTING SERVICES

SUGGESTED IMPROVEMENTS TO NATIONAL INSTRUMENT 43-101 STANDARDS OF DISCLOSURE FOR MINERAL PROJECTS

IMPLEMENTING A REVISED DOCUMENT PROVIDING A CONSISTANT AND TRANSPARENT DOCUMENT TO INVESTORS AND DEVELOPERS

MARCH 2017

EXECUTIVE SUMMARY

National Instrument 43–101 ("NI 43-101") provides a framework for disclosure by mining companies designed to improve consistency and bases for comparisons between projects which are understandable to a reasonably informed investor. It is designed for the purpose of improving investor confidence in the mining industry.

The legislation and related Form 43-101F1 Technical Report and 43-101CP Companion Policy is 44 pages long and focuses primarily on exploration results and the resource with only two sentences devoted to cost factors to generate the Net Present Value (the "NPV") and the Internal Rate of Return ("the IRR"). Investors use this information to assess the economic viability of the proposed mine based upon the resource, capital costs, sustaining costs and operating costs. The minimal guidance regarding the definitions and calculations of these cost factors leaves an opportunity to manipulate cost and schedule inputs to improve the economics. This makes it very difficult for investors to differentiate a good project from a bad project.

Mining Companies are in the business of finding properties with the potential of extracting valuable minerals and to make a profit during the extraction and production process. Investors are seeking confidence that the Mining Company can develop the resources as stated in their public disclosures. Unfortunately, the mining industry has not lived up to this expectation. In 2015, Ernst and Young reported[3] that of 108 mega mining projects evaluated, on average there was a "staggering" 62% cost overrun and 50% were behind schedule even with acceleration mitigation. Part of ~~on~~ the reason is the original cost estimate being unrealistic in order to drive higher NPV and IRR. The original prospective economic viability is disclosed in companies' NI 43-101 and Form NI 43-101F1 Technical Report. It is time to update this document to provide better guidance in developing capital, sustaining and operating costs.

Better definition guidance is required, specifically as to Item 21 in the NI 43-101 Technical Report: "Capital and Operating Costs". Secondly the Qualified Professional definition should be expanded to allow Project Management Professionals or Construction Management professionals with in-field mine construction experience to review the capital costs and the construction schedule.

Australia has the JORC Code which is similar to ~~the~~ NI 43-101. The Australian Government released an Issues paper in 2011 which resulted in 114 written submissions for improvements to the JORC. Comments resulted in improved transparency, materiality and competence in Public Reporting. It is time to do the same in Canada to solicit comments on improvements to NI 43-101.

HISTORY

In October of 1995 Bre-X Minerals Ltd. ("Bre-X") announced a major discovery in Indonesia. The 30 cent share price rose to over $280.00 Canadian and market capitalization eventually exceeded $6 billion. In 1997 Freeport-McMoRan Inc. which held a 15% interest in the discovery conducted independent due diligence and reported only minor amounts of gold in the deposit. Bre-X shares collapsed and the reputation of the Canadian mining industry and the Canadian Securities Commissions were questioned.

To address some of the issues raised by this scandal, and to restore and repair investor confidence, rules were developed in the late 1990's by the Canadian Securities Administrator and Canadian provincial securities commissions. These rules resulted in ~~the~~ National Instrument 43-101, a Canadian Securities Instrument which outlines how Canadian listed companies disclose exploration,

resource and reserve information on mineral projects. NI 43-101 was released in October, 2001 and last updated in June, 2011.

THE DOCUMENT

Mineral companies that are making either oral or written disclosures that are intended to be made available to the public in a jurisdiction in Canada must file a 43-101 Technical Report and follow the report guidelines.

NI 43-101 reports have a number of core requirements designed to protect investors. The most basic requirement is that the report must be prepared by, or the preparation be supervised by a "qualified person" ("QP") who is independent of the Issuer and bound by the rules of an independent professional organization. QP's include engineers or geoscientists with at least five years of experience in mineral exploration, and relevant experience to the subject matter. At least one "qualified person" must sign-off on each section of the technical report and, along with the Issuer, is ultimately responsible for any errors or omissions.

A "qualified person" is an individual who is an engineer or geoscientist with at least five years of experience in mineral exploration, relevant experience to the subject matter, and a member in good standing of a professional association.

Feasibility studies must also be conducted that analyze the viability of a mineral project that has advanced to a stage where the mining method or pit configuration has been established and an effective method of mineral processing has been determined.

These studies include a financial analysis, as well as analysis of economic, social and other relevant factors.

THE ISSUE

NI 43-101 focuses on mineral resources and the qualifications of those individuals confirming the mineral resources. The document is also used to demonstrate the economic viability of a resource. However, NI 43-101F1 does not provide enough guidance as to how Companies should be consistent in the development of capital costs, sustaining costs and operating costs to bring the resource to market. It is this aspect that will be discussed in detail in this paper.

The author has reviewed numerous NI 43-101F1 reports and has found inconsistencies in the methodology of capital cost estimates that result in higher Net Present Value and Internal Rate of Return calculations. Many investors relay heavily on NPV and IRR calculations in deciding whether to invest in a property or move on to another opportunity. The author will point out these areas of concern so that investors have a better understanding of some of the deficiencies in the report. Hopefully regulators will review and update the NI 43-101F1 report guidance to provide better consistency in reporting.

It is in the best interest of the industry to be able to have confidence in this important report and to be able to identify projects of high value which should be supported by financial institutions and private investment firms and individuals. Conversely projects that are not economically viable should be shelved and not pursued.

The Form 43-101F1 Technical Report must cover the following topics:

Title Page
Date and Signature Page
Table of Contents
Illustrations

1: Summary
2: Introduction
3: Reliance on Other Experts Item
4: Property Description and Location Item
5: Accessibility, Climate, Local Resources, Infrastructure and Physiography Item
6: History Item
7: Geological Setting and Mineralization Item
8: Deposit Types Item
9: Exploration Item
10: Drilling Item
11: Sample Preparation, Analyses and Security Item
12: Data Verification Item 13: Mineral Processing and Metallurgical Testing Item
14: Mineral Resource Estimates Item 15: Mineral Reserve Estimates Item
16: Mining Methods Item 17: Recovery Methods Item 18: Project Infrastructure Item
19: Market Studies and Contracts Item
20: Environmental Studies, Permitting and Social or Community Impact Item
21: Capital and Operating Costs Item
22: Economic Analysis Item
23: Adjacent Properties Item
24: Other Relevant Data and Information Item
25: Interpretation and Conclusions Item
26: Recommendations Item
27: References

This paper will discuss in detail item 21 and the shortcomings found in many 43-101 reports and accompanying Preliminary Economic Analysis document (PEA).

ITEM 21 CAPITAL AND OPERATING COSTS

NI-43-101 is 44 pages long and item 21 is the only reference to capital and operating costs in the development of the economic model. Specifically item 21 states:

***Item 21: Capital and Operating Costs** – Provide a summary of capital and operating cost estimates, with the major components set out in tabular form. Explain and justify the basis for the cost estimates.*

This definition and description give the owner and its consultant's wide latitude to report the capital, operating and sustaining costs.

Examples:

Canadian Gold Mine 43-101 report October 2009 capital costs indicated of $994 Million. Actual capital costs at mine completion $1.45 Billion

Canadian Copper Gold Mine 43-101 report October 2009 capital costs indicated of $915 Million. Actual capital costs at mine completion $1.5 Billion

Copper Mine South America 43-101 report June 2011 capital costs indicated of $2.88 Billion. Actual costs of $5.5 Billion.

Copper Silver Mine South America 43-101 report March 2011 capital costs indicated of $3.47 Billion. Revised capital costs in excess of $8.0 Billion and construction stopped.

There are many reasons why these actual costs bear very little resemblance to their original estimates, not the least of which are changes in scope, project management, and external factors not controllable by the issuer. But the best projects start with best practices in planning and proper estimating. And planning needs to start before investors put their capital at risk.

THE ISSUES

The author has identified key issues that have been found in technical documents that under-report costs associated with development and operation of a project.

1.0 Inflated NPV and IRR

Over the course of 30 years, the author has had the privilege to review numerous 43-101 Technical Reports together with PEA, Pre-feasibility and Feasibility Study documents. The majority of the documents reviewed significantly understated the capital, sustaining and operating costs. This resulted in higher than normal NPV and IRR values which made the project more attractive to investors.

2.0 Costs Identified in the Wrong Category

Technical writers often misunderstand the definition of sunk cost, capital cost, sustaining cost, operating cost, operational readiness/commissioning cost, direct cost and indirect cost as these terms

are used in the context of actually planning, developing, and bringing mineral assets into production. Costs are often mis-categorized or not included at all.

3.0 No Detailed Risk Analysis

No detailed risk heat map is developed along with mitigation plans to reduce risk. Cost of risk mitigation not included in the estimate. At least 10 major risk items should be included in the discussions.

4.0 Estimate Range

There are several industry standards that define the class of estimate and the associated estimate range for PEA, Feasibility and Pre-Feasibility Estimates. Many of the reports reviewed deviated from the estimate range. Additionally, NPV analysis is not completed for the higher estimate range. Economic Model Sensitivity Analysis should also include the capex range.

5.0 Contingency Development

Many technical documents use a simple factor of 10% to 20% against the direct costs to determine the contingency factor. There are several other methods to determine a more accurate contingency range. Furthermore, there should also be a management reserve to allow for changes in resource estimates, metal prices and extraordinary escalation cost.

6.0 Schedule Contingency

Many of the reports reviewed did not have a schedule contingency included in the baseline schedule nor costs associated with the extension required as identified in the schedule risk analysis.

7.0 Reliability Factor

A study conducted by insurance company FM Global indicated that equipment failures occurred in the majority of cases either during start up or at the end of the equipment expected life. Most technical documents use a high consistent reliability factor to determine cash flow in the economic analysis. This drives a high NPV. Reliability factors should be in the range of 80% to 92% per annum and should be adjusted to a lower range at start up and near the end of the mine life.

8.0 Standard Industry Benchmarks

There are several industry reference books for estimating that provide industry benchmarks for concrete placement, structural steel erection, piping installation at various elevations and the same for electrical and instrumentation installation. Many of the reports reviewed had placement rates well below the industry norms resulting in significantly reduced capital cost.

9.0 Standard Ratios

EPCM costs, owner's costs, direct costs and indirect cost ratios have industry benchmark standards. For example: indirect costs normally range between 30% ~~to~~ and 40% of ~~the~~ direct costs with high indirect costs for projects in remote locations. Many of the reports reviewed had indirect costs below the industry standard.

10.0 Key Quantities

Depending upon the production rates of the mine to be developed and the metal, there are a range of key quantities for concrete, structural steel, mechanical equipment, electrical equipment that are associated with projects. A key quantities table should be developed and used as a baseline comparison as the project progresses from prefeasibility to feasibility to detail engineering.

11.0 Understanding Labour Productivity

Attracting qualified tradespeople in hot market cycles can be challenging. This has a direct impact on the productively of labour during construction and also during operation. Often technical documents are overly optimistic about labour productivity.

12.0 Lack of Computer Simulations

Computer simulations are an excellent tool to determine cycle times for hauling material at the surface and also underground. For underground operations ventilation simulations will confirm equipment required to properly ventilate the mine. Hydrology simulations will confirm the water requirements for processing and also dewatering a mine. These models are not completed because of short-term cost and time considerations.

13.0 Operations Personnel Input in Design

The ideal project has key operational staff participating in design development. However, in many cases operational input is restricted to Hazard Reviews termed HAZOPS. The end result is significant rework once the project is commissioned to make the process more functional for the operators and maintenance staff. Capital costs are thus impacted.

14.0 Escalation and Inflation not included in the estimate

Most capital cost estimates do not allow for escalation and inflation. These should be included when items such as labour agreement contracts include increases during the construction and operating period. Currency fluctuations and potential increases in consumer indexes should be considered.

15.0 Not understanding the dynamics of the ore

Rock Hardness, amount of clay and ore screening are often underestimated due to lack of testing and alternate testing methodologies. Standard Ball Mill Index Testing is not enough to confirm rock hardness. The result is that recovery percentages are lower than anticipated which significantly reduces the revenue stream during operation.

16.0 Insufficient Geotechnical Investigations

As a cost savings measure, some Companies limit the number of geotechnical drill locations, open trench work and assume minimal top soil removal. Significant cost overruns are continually found when developing on site infrastructure for production, maintenance and temporary accommodations. Significant impacts have been found in the development of Tailings Storage Facilities in trying to find glacial till conditions to support a water tight enclosure.

17.0 Quality Assurance and Quality Control Issues

Lack of quality assurance protocol has resulted in significant delays and rework to correct shoddy workmanship. Contractor inspection and test plans are being approved without an understanding of the underlying issues. This leads to faulty plans and lack of oversight.

18.0 Permitting delays

Many projects are delayed from commencing construction due to slow environmental permitting. This results in additional indirect costs, escalation costs and may result in loss of contracts, and personnel. More definition is required in 43-101 section 20 to address this issue.

19.0 First Nations Demands

First Nations' potential property interests and labour content requirements and or additional costs required to train First Nations persons are often understated. Relationships with First Nations and the potential impact on work schedules should be considered.

20.0 The optimistic effect

Most of the underestimation of costs and overestimation of benefits of capital projects is the result of people taking what's called an "inside view" of their forecasts. That is, they use typical bottom-up decision-making techniques, bringing to bear all they know about a problem, with special attention to its unique details—focusing tightly on a case at hand, considering a project plan and the obstacles to its completion, constructing scenarios of future progress, and extrapolating current trends. [6]

21.0 Qualified Persons

Presently Qualified Persons only include Professional Engineers and or Professional Geologists. These individuals may not have any experience in project management, construction execution or schedule review. Project Management Professionals (PMP), with relevant mine construction experience together with cost and schedule review experience should be included in the 43-101 review and commentary.

22.0 Standardized Economic Models

Economic Models vary in complexity. Formulas and links between worksheets are integral in the development of the Financial Summary. Some economic models had errors as a result of improper cutting and pasting of data with associated formulas. The ability to make adjustments for metal prices, exchange rates and fuel costs are key to a good economic model. More definition and or a standard economic model template should be provided in the companion policy. Confirmation that the spreadsheet is free of errors should be made by the qualified professional.

22.0 Owner's Cost

Many items that are not related to actual costs during project development is included in the owner's cost as part of the capital cost. Better definition of items to be included in owner's cost is required to provide constancy between projects.

SUMMARY

NI 43-101 provides a framework for disclosure by mining companies designed to improve consistency and bases for comparisons between projects which are understandable to a reasonably informed investor. It is designed for the purpose of improving investor confidence in the mining industry.

Company disclosures are used to provide economic and financial information to demonstrate potential return on investment. The guidance for the preparation of the 43-101 Technical Report does not provide enough information to provide consistency when reporting capital, operating and sustaining capital cost. Of the 44 pages of the template only two sentences reference capital cost reporting requirements. There is also considerable latitude in adjusting the financial information to make the resource more attractive to potential investors.

To address this issue it is recommended that the Form 43-101F1 guidance provide more detail as to the development of costs and schedule information. Furthermore the Qualified Persons definition should be expanded to include Project Management Professionals to review construction execution, schedule and estimates in regards to section 21 of the disclosures.

These two recommendations should help identify those projects that are worthy of moving forward to eventual operation and provide a healthy revenue stream to investors.

REFERENCES

1. Ontario Securities Commission, National Instrument 43-101 Standards of Disclosure for Mineral Projects, Form 43-101F1 and Companion Policy 43-101CP, June 2011

2. Walde, Craig ; Whyte, Jim (March 5, 2014) Mineral Disclosure Standards Under NI 43-101 Basics, Pitfalls and Practical Guidance

3. EY, Opportunities to enhance capital productivity, Mining and Metals megaprojects, May 5, 2015

4. American Association of Cost Engineers, Cost Estimate Classification System – As Applied in Engineering, Procurement, and Construction for the Process Industries, March 1, 2016

5. American Association of Cost Engineers, Risk Analysis and Contingency Determination Using Parametric Estimating May 5, 2011

6. Flyvbjerg, Bent; Garbuio, Massimo; Lovallo, Dan (December 2014) McKinsey & Company Better Forecasting for large capital projects

7. BDO, Bre-X scandal: A History timeline, Jan 25, 2015

ABOUT THE AUTHOR

Warner Uhl has over 30 years of experience managing large industrial projects around the world. Mr. Uhl is a principal with Uhl Consulting Services whose services comprise reviewing 43-101 technical documents, Prefeasibility, Feasibility and Basic Engineering Reports. He also reviews cost and schedule estimates together with construction, commissioning and operating plans. With his Risk Management and Insurance background he has provided in depth risk analysis and mitigation strategies. Mr. Uhl has also facilitated Optimization and Class of facility workshops. Highlights of his career include:

Employment history

Uhl Consulting Services 2016 to present
KGHM International Management Board Member, 2013 to 2016
AMEC, Project Director 2009 to 2013
Leighton Constructors, Manager Mining and Metals
SNC-Lavalin, Manager of Construction
BHP Billiton, Construction Manager
Graham Industrial Construction, Project Manager
PCL Industrial, Manager Prairie Region
Nepcan, EPC Manager
PBK Engineering, Construction Manager

Gisborne Group, EPC Manager
Marsh & McLennan Insurance Brokers, Vice President
Factory Mutual Engineering, Loss Prevention Engineer

Education

MBA, B.S., City University, WA, USA
Project Management Professional, PMP
Certified Safety Officer
Diploma, Canadian Risk Management
Underground and Surface Mining Supervision Certified
Mechanical Engineering Technology, Fanshawe College

Memberships/Affiliations

Member, Project Management Institute
Member, American Association of Cost Engineers
Member, past Director, Independent Contractors Business Association
Past Director, Vancouver Regional Construction Association
Past Director, Progressive Contractors' Association of Canada