PhotonAssay™ and international code *"compliance"* [1]

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Summary
The fifteen CRIRSCO-based[2] international reporting codes/standards (e.g. JORC, CIM inc. NI 43-101, PERC, SAMREC, etc.) set out guidance to listed entities as to how to publicly report Exploration Results, Mineral Resources and Ore/Mineral Reserves. None of the codes define "acceptable" practices, just that the methods used, and the resultant findings, are reported truthfully. PhotonAssay™ is a known and trusted analytical method that has been used globally in market reports since 2018. The international codes outline how assay results should be reported to the market, however they do not outline which assay methods are reportable using said codes. Therefore, it is not which analytical method is, or is not, code "compliant,"[3] but rather the way in which the method is disclosed via the code's guidelines that makes the public report "compliant."[3]

Introduction
Chrysos PhotonAssay™ is a non-destructive assaying technology for gold, silver and copper capable of analysing 400-600 g of coarse crushed (c. 2-3 mm) jarred-lots (Tickner et al. 2017; Tremblay et al. 2019; Dominy et al. 2024). It delivers a fast assay turnaround-time c. two minutes per jar and at a rate of ~70 jars per hour – with the added benefit that samples are able to be re-assayed multiple times. The technology requires fewer staff to operate, entails less sample preparation than other approaches, and removes the need for toxic chemicals such as lead and cyanide. Additionally, its carbon and energy footprints are around 50% lower than a standard 30-50 g fire assay. It is insensitive to matrix composition and granulometry. These characteristics make PhotonAssay™ applicable to gold ores, particularly those bearing coarse gold, as only crushing (i.e. no pulverisation) is required, hence reducing some sampling errors (Dominy et al. 2024; Dominy, Graham & Glacken, 2024). Importantly, the technology has broad and effective applicability across the mine value chain from exploration to resource development, grade control, and through to plant control (Tremblay et al. 2019; Dominy et al. 2024).

Yet despite PhotonAssay's increasing international uptake, a common question posed by explorers and mine operators is: *Can PhotonAssay™ be considered NI 43-101 and JORC (or other codes) compliant?* To best answer this query however, requires an examination of the relevant reporting codes, and an explanation of why the question is not whether PhotonAssay™ is itself "compliant,"[3] but whether the technology can be used in reports that are themselves written in accordance with the given code.

Market reporting overview
The fifteen CRIRSCO-based[2] international reporting codes (e.g. JORC, CIM inc. NI 43-101, PERC, SAMREC, etc.) set out guidance to listed entities as to how to publicly report Exploration Results, Mineral Resources and Ore/Mineral Reserves. One purpose of the international codes is to protect investors from unsubstantiated or fraudulent claims by publicly listed companies. However, none of the codes define what "acceptable" practices are. The codes emphasise that the methods used, and the resultant findings are reported truthfully and that the Competent/Qualified Person(s) (CQPs) has followed some level of "industry best

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[1] This contribution is part of a larger work currently being compiled by the author.
[2] CRIRSCO is a body whose members comprise National Reporting Organisations that are responsible for developing mineral reporting codes, standards and guidelines. Based on the established reporting codes/standards of its member countries, CRIRSCO has developed an International Reporting Template, the purpose of which is to assist with the dissemination and promotion of effective, well-tried, good practices for public reporting of Exploration Results, Mineral Resources and Ore/Mineral Reserves which is already widely adopted through national reporting codes and standards. For the purpose of this document, the term "code" will be used to describe any international reporting code or standard.
[3] Exploration Results, Mineral Resources and Ore/Mineral Reserves do not "comply" with a given code; they are reported by a relevant listed entity in accordance with that code.

practice" or has justified an alternative approach. While the codes imply an overall sense of quality and consistency in reporting, none of them can prevent practitioners from either conducting poor technical work or from making misleading statements.

The international codes outline how assay results should be reported to the market. They do not outline which assay methods are reportable using said codes. For our purposes, it is the difference between saying, "PhotonAssay™ results can be used in reports that are written in accordance with a given code" versus "PhotonAssay™ is code compliant."[3] The former of which is the true and accurate statement.

Key to all reporting codes is "Transparency," "Materiality" and "Competency." Transparency requires the reader to be provided with sufficient information presented in a clear and unambiguous way. Materiality requires the reader (e.g., investor, potential investor or adviser) to be presented with all relevant information so that they may make reasoned judgement on what is reported. Where relevant disclosure is not made, an explanation must be provided for its omission; this is generally achieved through a checklist-style tabulation (e.g., JORC 2012, 2025; Table 1).

An important part of any activity that will result in public disclosure, is the appointment of the CQP. It is beholden on the reporting company to assign a CQP(s) that has the right experience. The codes do not mandate a given level of professional expertise beyond the criteria to function as a CQP. The CQP self-determines their appropriateness to act, based on the criteria listed. It is the responsibility of the professional organisations, through their disciplinary processes, to deal with technical malpractice, including breaches of ethics codes, by the CQP(s).

The codes do not regulate how a CQP does their work, or how to specifically collect and assay samples, estimate resources and/or reserves, etc. Furthermore, the codes do not "approve" any sampling protocol or assay method but rather regulate the qualifications and experience of the individual CQP. What is key, is not whether the method is "compliant,"[3] but whether the method can be reported in accordance with a code, given the disclosure requirement. This includes Table 1, Section 3 of The JORC Code (2012) [also Table 1, Section 3 of The JORC Code 2025], and Section 3.3 of NI 43-101 and/or Item 11 of Form 43-101F1, in the case of a Technical Report.[4]

To summarise – Exploration Results, Mineral Resources and Ore/Mineral reserves do not "comply" with a given code, they are reported by a relevant listed entity in accordance with it.

The choice of assay method used is up to the CQP. It is the duty of CQPs to remain current in their professional practice, understand what analytical methods are available, and to select the most appropriate method(s) for their application and mineralisation style.

The requirements of both JORC and NI 43-101/CIM are effectively same.[5] Key disclosures related to assaying include:

- Field sampling / sample preparation and associated QAQC
- Laboratory sub-sampling, sample preparation and associated QAQC
- Laboratory assaying, analytical details and associated QAQC
- Identifying the laboratory and any relevant certification
- Verification steps by the CQP

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[4] Both The JORC Code and NI 43-101/CIM are currently at various stages of revision. Whilst changes are expected, the overall matters pertinent to the reporting of assay/analytical methods are not expected to change materially. The updated JORC Code is referred to here as The JORC Code 2025. NI 43-101/CIM is at an early stage of revision.

[5] For this discourse, the emphasis is on The JORC Code and NI 43-101/CIM; however, they do not differ materially from other codes in terms of reporting on the assay method used.

In the context of PhotonAssay™ application, the key disclosures related to the principles of *Transparency and Materiality* are:

Field sampling/sample preparation and associated QAQC[6]
Whilst field/site-based sampling activity is not directly related to PhotonAssay™, it is important to ensure the integrity of samples through proper drilling techniques; rig/core shed activities; underground sampling; sub-sampling (e.g. core splitting or reverse circulation (RC) splitting); packaging, and security procedures for onward shipping ("chain of custody"). A key QC step during field sampling is the collection of field duplicates, e.g. RC rig splits or half diamond drill core, and the submission of field blanks and CRMs.[7] All site/field activities must be documented by the CQP as part of QA.

Laboratory sub-sampling and sample preparation and associated QAQC[6]
Sub-sampling and sample preparation at the laboratory is relevant to PhotonAssay™, as it includes the step(s) that feed the PhotonAssay™ jars directly. The codes require transparency on the methods used, details of any crushing and/or pulverising and riffle or rotary sample divider (RSD) splitting. As with all activities, QA procedures must be in place and declared. Company defined QC actions include laboratory coarse (crushed) duplicates, blanks, CRMs,[7] barren washes, and effective hygiene (e.g., barren washes, cleaning of equipment, etc.) of all equipment (e.g. crushers). The laboratory will also undertake its own QC actions which should be reviewed by the company/CQP.

Laboratory assaying and analytical steps and associated QAQC[6]
The assay/analytical method(s) must be declared. Analytical precision and bias must be monitored via QC tools, such as the insertion of CRMs, blanks and analytical duplicates. Matrix matching of CRMs for PhotonAssay™ is not required, although the selected CRM grades should cover the anticipated cut-off, through to run-of-mine and high grade(s). CRMs can be reused given that PhotonAssay™ is non-destructive.[7] An additional advantage of the technology is that the true analytical precision can be determined, again because the method is non-destructive, and jars can be re-assayed any number of times.

Check assays can be undertaken via PhotonAssay™ or via another analytical method at a second laboratory.[8] A common action is to pulverise PhotonAssay™ jar material and undertake a fire assay for comparison. Note that a pulverised 30-50 g fire assay is not equivalent to a 400-600 g crushed PhotonAssay™. If an identical assay, by mass, on the jar lot is required then multiple fire assay, screen fire assay or LeachWELL™ (with fire assay of tails) are required for direct mass comparison. These methods require pulverisation of the sample (400-600 g) prior to analysis which may impart sampling error via the increment extraction and/or preparation errors.

Identify the laboratory and any certification
The identity and location of the laboratory used must be stated, with reference to whether the laboratory is located on the mine/company site or elsewhere, and whether it is operated and owed by the issuer/reporting company or owned and independently operated.

It is not a requirement of any code that a laboratory needs to be accredited. The required disclosure is to whether the laboratory is accredited or not (e.g., JORC 2025 Section 3.6.1 and

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[6] For this discourse, it is not intended to provide an extensive discussion on QAQC programmes.
[7] CRMs are usually submitted pre-laboratory with a sample number so that the CRM cannot be identified. In the case PhotonAssay™, CRMs are often pre-jarred and retained at the laboratory with an instruction from the client to insert a given CRM into the stream at a given point. CRMs should be replaced and/or a different CRM used during a set period agreed with the laboratory. CRM submission/insertion procedure will be set up and documented by the CQP.
[8] Leading practice is to submit Check assays to a second laboratory for analysis by the same method; PhotonAssay™ in this case. Some CQPs may opt to assay via an alternative method, which is their choice. Where the Original versus Check assays disagree, then the CQP may opt to use a third or Umpire laboratory.

NI 43-101 F Item 11b). Accreditation of laboratories via the International Organisation for Standardisation (ISO) is accepted as leading practice. ISO 9001 provides accreditation that a laboratory operates a quality system. It does not, however, assess actual quality or competence. ISO 17025 covers laboratory testing and calibration performed using standard and non-standard methods. ISO 9001 is applicable to all laboratories regardless of the activities undertaken, e.g., sample preparation, assaying, test procedures, etc. It requires laboratories to state their policies and procedures, provide appropriate facilities and equipment, train staff properly and maintain a high level of document control.

Whilst ISO accreditation is no absolute guarantee of rigorous testwork or assay results, it does provide a degree of comfort to the CQP(s). Total reliance on ISO accreditation is no substitute for personal inspection of the laboratory by the CQP(s) and engagement with laboratory staff as part of the verification process.

Most independent commercial laboratories offering PhotonAssay™ are accredited to ISO 17025. Whereas most mine site laboratories are not accredited, unless operated by an accredited independent commercial service group.

Verification steps by the CQP

Key assay-related verification steps are:

- In-person audits of the laboratory to check effective Laboratory Information Systems (data management); laboratory organisation; cleanliness and potential for contamination; internal quality systems (QAQC), including adherence to agreed protocols; analytical equipment calibration methods; compliance with accreditation; and health and safety
- Review of laboratory assay certificates and validation against the database
- Timely analysis of QC data and subsequent liaison with the laboratory as required
- Timely analysis of internal laboratory QC and liaison with the laboratory as required

Conclusions

The application of PhotonAssay™ across the mine value chain requires a decision by the CQP(s), who should be satisfied that the method is robust, appropriate, and produces fit-for-purpose results as indicated by effective QAQC. From a public reporting perspective, the CQP must disclose all material matters as required by the given code. Therefore, it is not which analytical method is employed, but rather the way in which the method is disclosed via the code's guidelines, which makes a specific public report correct.

Junior explorers through to major mining companies have been using PhotonAssay™ since 2018, where the technology has been applied to numerous public releases (e.g., JORC and NI 43-101), different gold mineralisation styles, and from exploration results through to Mineral Resource estimates.

In answering the question of whether PhotonAssay™ is reporting "compliant," it is important to understand that analytical methods are not themselves assessed as being "compliant" with any code, but whether any reports in which they are mentioned are themselves correctly stated in accordance with the given code.

The position of PhotonAssay™ in the minerals industry as a robust and reportable assay technique is now undeniable. Beyond public releases (e.g., news releases and technical reports), a growing number of cases studies referring to PhotonAssay™ have been published (Hitchman et al. 2024; Dominy, Graham & Glacken, 2024; Dominy et al. 2024; Dominy & Glass, 2025).

In summary, there are no barriers to the application of PhotonAssay™ in market releases, provided that the CQP has used their competency to disclose all material matters in a transparent manner. The codes provide clear guidance on these matters**.**

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About the author

Dr. Simon Dominy is a mining geologist-engineer with over 25 years of international experience in consulting, academia, and operational roles. He specialises in the evaluation of high-nugget effect deposits particularly gold and tin; geometallurgy; mine value chain sampling; resource development; resource/reserve estimation; and mine operations. Dr. Dominy has been involved in a number of evaluations of PhotonAssay™. This includes implementation of the method at the Beatons Creek gold project (Western Australia) and reporting one of the first Mineral Resources in accordance with NI 43-101 using the technique. He has extensive experience of acting as Competent/Qualified Person for most styles of gold mineralisation. His academic contributions include over 100 peer-reviewed publications and regular involvement in teaching and research at the Camborne School of Mines (University of Exeter, UK), where he holds a Visiting Professorship. He serves as a technical advisor to several companies and sits on the PERC Reporting Standard Committee. In 2022, he received the Pierre M. Gy Sampling Gold Medal for his contributions to sampling practice.