Consultation response

Part 1: Your details

Original language of response: English

Name: Knight Piesold

Country of residence: Other

Are you willing to let us publish your response publicly on the Global Tailings Review website? Yes

Please select which stakeholder group you are representing: Consultant (geotechnical)

If 'Other', please specify below:

Are you responding on behalf of an organization? Yes

Please give the name of the organization: Knight Piesold

Your level within the organisation: Executive Management

Part 2: Your views on each of the Principles and Requirements in the Standard

Topic I: Knowledge Base

Principle 1

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Partially

Which aspects of Principle 1 do your comments relate to?

Your comments on Principle 1

Principle 2

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Not sure

Which aspects of Principle 2 do your comments relate to?

Your comments on Principle 2

Topic II: Affected Communities

Principle 3

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Not sure

Which aspects of Principle 3 do your comments relate to?

Your comments on Principle 3

Topic III: Design, Construction, Operation and Monitoring of the Tailings Facility

Principle 4

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Partially

Which aspects of Principle 4 do your comments relate to?
Comments on the Principle itself

Your comments on Principle 4
The assumption of Extreme Consequence Classification for new facilities, unless rebutted by evidence to the contrary, is a paradigm shift, but is similar to approaches currently employed by KP, many mining companies, and other tailings designers with similar dedication to safety. The application of this concept to existing facilities will present challenges to the mining industry, the consulting engineers who will support these efforts, and regulatory agencies, all of whom have limited resources. We encourage the use of risk-based methods, such as the Failure Modes and Effects Analysis (FMEA), to consistently evaluate the global portfolio of existing tailings facilities and prioritize the limited resources available. It will be important to develop reasonable compliance schedules to bring deficient facilities into compliance, or the potential logistical, financial, and reputational impacts on some companies may undermine attempts to gain widespread adoption of the new Standard. KP supports the use of a consequence-based system to assign design criteria, review and monitoring requirements, and possibly reporting protocols and to effectively prioritize resources to protect human lives, property, the environment, and other community interests. However, we caution about including specific requirements in the Standard as currently proposed. We note that Table 1 appears to be adapted from a draft consequence classification matrix currently being developed by ICOLD, and we support the reliance on ICOLD and other member committees as a source of technical expertise. While the current table is useful to help understand and assess the impact of the Standard on the industry, we believe that reference to an external document—rather than directly incorporating the classification matrix into the Standard itself—will allow future refinement of the matrix to be made without having to directly revise and update the Standard. If the Panel prefers to retain Table 1, we note the following comments that should be considered before Table 1 is finalized: • Infrastructure and Economics – assigning a dollar (monetary) value in this category is challenging, given the wide-ranging cost differentials globally; and the reality that the values will become obsolete as time

passes. We recommend that the financial impacts on infrastructure and economics instead be defined by practitioners on a region-specific basis. • Environment – The CDA Mining Dams Committee has been working towards revising the Environmental Consequence Classification Procedures for Mining Dams over the past decade and issued a Technical Bulletin in May 2019 titled: Revision to Consequence of Failure – Environmental Consequence Classification. We recommend inclusion of the CDA procedures, which has more comprehensive language than currently in Table 1. This is another example of referring to an external technical document rather than incorporating specific technical requirements directly into the Standard. KP also strongly recommends that Table 2 be removed from the body of the Standard and instead a reference be made to an external technical document. While the intent of Table 2 is good, there are a few technical details associated with the design earthquake and design storm scenarios included in the draft that should be worked out with subject matter experts.

Principle 5

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Yes

Which aspects of Principle 5 do your comments relate to?

Your comments on Principle 5

Principle 6

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Yes

Which aspects of Principle 6 do your comments relate to?

Your comments on Principle 6:

Principle 7

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Yes

Which aspects of Principle 7 do your comments relate to?

Your comments on Principle 7

Principle 8

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Yes

Which aspects of Principle 8 do your comments relate to?

Your comments on Principle 8

Topic IV: Management and Governance

Principle 9

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Partially

Which aspects of Principle 9 do your comments relate to?

Your comments on Principle 9

Principle 10

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Partially

Which aspects of Principle 10 do your comments relate to?

Your comments on Principle 10:

Principle 11

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Yes

Which aspects of Principle 11 do your comments relate to?

Your comments on Principle 11:

Principle 12

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Yes

Which aspects of Principle 12 do your comments relate to?
Comments on the Principle itself

Your comments on Principle 12:
KP agrees with and supports Principle 12 (Appoint and Empower an Engineer of Record) and other requirements for the Engineer of Record (EOR) role embedded throughout the draft Standard. We believe that a common element among the recent failures at the Mt. Polley, Samarco, and Feijão tailings dams was the lack of continuity in the EOR, or improper transfer of responsibility and knowledge when a change was made. There are many lessons to be learned from the field of structural engineering in understanding and clarifying the importance of continuity in the EOR

for a tailings dam. The Hyatt Regency disaster in Kansas City, Missouri in 1981 (footnotes 1 & 2), and the L'Ambiance Plaza failure collapse in Bridgeport, Connecticut in 1987 (footnote 3) were found to be caused largely because the "responsibility for structural design of the building was fragmented among a number of different organizations" (footnote 3). In response, building codes, design standards, registration laws and accepted practice in the United States was changed to recognize the importance of maintaining continuity of the Design Engineer through all phases of design and construction. KP believes that a similar process in the global mining industry can lead to the outcome sought by the co-conveners of significant reduction in losses from tailings dam failures. We are pleased to see that Requirement 12.4 states that the Accountable Executive is responsible for the selection of the EOR and potential changes of EOR for a given tailings facility, and the separation of these decisions from owners' procurement/supply departments. We have seen well-intentioned corporate policies undermined by well-meaning procurement departments who focus only on short-term cost reduction. We believe that the supporting documents described in Paragraph 1 above should establish minimum qualifications for EORs, encourage annual performance reviews, and establish procedures for transfer of responsibility when a change is justified. We also believe effort needs to be made to establish reasonable expectations for indemnification and liability of the EOR. We believe that professional organizations can also provide valuable support in developing guidelines that adequately address these matters. 1. Becker, E.P. (1986). Who Should be Responsible for Structural Steel Design?.Journal of Professional Issues in Engineering, Vol. 112, No. 2, American Society of Civil Engineers, April, pp. 134-140. 2. Gillam, J.D. (2000). The Engineer of Record and Design Responsibility. Journal of Performance of Constructed Facilities, Vol. 14 No. 2, American Society of Civil Engineers, May, pp. 67-70 3. Heger, F.J. (1991). Public Safety Issues in Collapse of L'Ambinace Plaza. Journal of Performance of Constructed Facilities, Vol. 5, No. 2, American Society of Civil Engineers, May pp. 92-112.

Principle 13

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Yes

Which aspects of Principle 13 do your comments relate to?
No

Your comments on Principle 13:

Principle 14

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Partially

Which aspects of Principle 14 do your comments relate to?

Your comments on Principle 14:

Topic V: Emergency Response and Long-Term Recovery

Principle 15

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Not sure

Which aspects of Principle 15 do your comments relate to?

Your comments on Principle 15:

Principle 16

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Not sure

Which aspects of Principle 16 do your comments relate to?

Your comments on Principle 16:

Topic VI: Public Disclosure and Access to Information

Principle 17

In your view, will compliance with this Principle and its Requirements contribute to the prevention of catastrophic failure of tailings facilities?
Not sure

Which aspects of Principle 17 do your comments relate to?

Your comments on Principle 17:

Part 3: Your views on the Standard

Your view as to whether the content of the Standard meets your expectations

Your view as to whether the content of the Standard meets your expectations (closed question):
2: Falls somewhat below my expectations

Please summarize why you chose this option:

Your view on whether the Standard will create a step change for the industry in the safety and security of tailings facilities

Your view on whether the Standard will create a step change for the industry in the safety and security of tailings facilities (closed question):
3: Will strengthen some but not all aspects of the safety and security of tailings

facilities

Please summarize why you chose this option:

Knight Piésold (KP) is pleased to provide the following comments on the draft Global Tailings Standard issued by the Global Tailings Review panel in November 2019. KP is a global consulting firm that provides specialized engineering and environmental services to the mining industry (and other industries), and is one of the world's recognized leaders in tailings dam design and operational support. KP was founded in 1921 in South Africa; currently maintains offices in North and South America, Europe, Africa, and Australia; and has supported thousands of tailings dams and mining projects in all parts of the world over our nearly 100-year history.

KP applauds the Global Tailings Review initiative made possible by the International Council of Mining and Metals, the Principles for Responsible Investing, and the United Nations Environment Programme. Many of our existing clients have developed internal standards and guidelines to maintain tailings dam safety within their portfolios and responsibly develop the natural resources that are demanded by the people of all nations; but it is clear that too many companies and individuals have come up short, and it is time to raise the standard of performance to avoid future disasters such as we've seen in the past few years. The proposed standard provides a comprehensive framework for responsible tailings management and, if implemented consistently, will go far to reduce risk and hopefully prevent future catastrophic failures.

While the draft Standard represents a significant step forward, KP believes that further work is needed to refine the document. KP's tailings dam experts are actively engaged in several professional organizations and have provided detailed comments through these organizations, which include the following:

- The Australian National Committee on Large Dams (ANCOLD)
- The Canadian Dam Association (CDA)
- The South African National Committee on Large Dams (SANCOLD)
- The United States Society of Dams (USSD)
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- The Canadian Institute of Mining (CIM)
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In addition to the detailed input provided through the professional organizations, KP wishes to provide the following relatively high-level comments, as provided in the following sections.

SUPPORTING DOCUMENTS

KP understands that other supporting documents, providing additional guidance on implementation and likely on enforcement, are in development. We look forward to reviewing those documents at a future time, as well. Although some may criticize the Standard as too broad and non-specific, we believe the broad framework established by the current draft is superior to a very detailed and prescriptive approach, given the complexity of tailings management and the differing site and environmental conditions that are inherent to mining. Most other industries have the ability to build carefully-controlled environments

and manufacturing facilities where optimal conditions can be maintained and where detailed processes produce repeatable outcomes with relatively little variation. The mining process must by necessity go where the materials are located and adapt to natural conditions, frequently in challenging environments that are directly tied to the natural processes that lead to the formation of the ore deposits (e.g., copper, gold, and similar metals are often formed by the magmatic intrusion associated with crustal boundaries and high seismic activity). As a result, the standard should rely on a foundational structure of technical documents prepared by the subject matter experts who best understand how to develop the solutions to these challenges. We believe that reliance on professional organizations like the International Commission on Large Dams (ICOLD) and its member committees, as well as other technically-oriented industry groups and universities, will be key to developing a robust system to enhance tailings dam safety.

CONSEQUENCE CLASSIFICATION

KP supports the use of a consequence-based system to assign design criteria, review and monitoring requirements, and possibly reporting protocols and to effectively prioritize resources to protect human lives, property, the environment, and other community interests. However, we caution about including specific requirements in the Standard as currently proposed. We note that Table 1 appears to be adapted from a draft consequence classification matrix currently being developed by ICOLD, and we support the reliance on ICOLD and other member committees as a source of technical expertise. While the current table is useful to help understand and assess the impact of the Standard on the industry, we believe that reference to an external document—rather than directly incorporating the classification matrix into the Standard itself—will allow future refinement of the matrix to be made without having to directly revise and update the Standard. If the Panel prefers to retain Table 1, we note the following comments that should be considered before Table 1 is finalized.

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the design earthquake and design storm scenarios included in the draft that should be worked out with subject matter experts.

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We are pleased to see that Requirement 12.4 states that the Accountable Executive is responsible for the selection of the EOR and potential changes of EOR for a given tailings facility, and the separation of these decisions from owners' procurement/supply departments. We have seen well-intentioned corporate policies undermined by well-meaning procurement departments who focus only on short-term cost reduction. We believe that the supporting documents described in Paragraph 1 above should establish minimum qualifications for EORs, encourage annual performance reviews, and establish procedures for transfer of responsibility when a change is justified. We also believe effort needs to be made to establish reasonable expectations for indemnification and liability of the EOR. We believe that professional organizations can also provide valuable support in developing guidelines that adequately address these matters.

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The assumption of Extreme Consequence Classification for new facilities, unless rebutted by evidence to the contrary, is a paradigm shift, but is similar to approaches currently employed by KP, many mining companies, and other tailings designers with similar dedication to safety. The application of this concept to existing facilities will present challenges to the mining industry, the consulting engineers who will support these efforts, and regulatory agencies, all of whom have limited resources. We encourage the use of risk-based methods, such as the Failure Modes and Effects Analysis (FMEA), to consistently evaluate the global portfolio of existing tailings facilities and prioritize the limited resources available. It will be important to develop reasonable compliance schedules to bring deficient facilities into compliance, or the potentiallogistical, financial, and reputational impacts on some companies may undermine attempts to gain widespread

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AVAILABILITY OF RESOURCES

Our final comment relates to the availability of personnel resources to put the new Standard into effect.Implementation of these principles will increase the required number of qualified engineers to provide enough Independent Technical Review Board members, Engineers of Record, Responsible Tailings Facility Engineers, auditors, regulators, and other supporting roles. This increase in demand comes at a time when many of our most senior, experienced practitioners are moving into their retirement years. The imbalance of supply and demand will put a strain on the industry, which will likely require an influx of talent into the mining industry. As new practitioners enter the market, there is a risk of decreased quality due to lack of experience or pressures to balance workloads. We recommend the co-convenors consider commissioning a strategic plan to attract talent into this industry and consider a certification program to verify current and new entrants are properly qualified to perform the work that needs to be done.

CLOSING

On behalf of the Board of Directors of Knight Piésold and the many tailings dam practitioners within our company ranks, we thank you for the opportunity to comment on the draft Global Tailings Standard. The Panel has had a monumental task to perform in a short amount of time. Given the amount of interest generated in the draft Standard, we are certain there is much work to integrate reasonable comments into the next version. We look forward to seeing a revised version in the near future

Does the content of the Standard address all aspects of tailings facility management adequately?

Does the content of the Standard address all aspects of tailings facility management adequately (closed question)?

No

Please explain why and/or what is missing:

Part 4: Suggestions for topics to be included in the accompanying Recommendations Report

On which topics would you expect to have further clarification or guidance in this document?

Other information

Non-fitting response text (text submitted which did was not in response to one of the questions above)

Attachment 1 reference (if applicable)

ref:0000001055:Q83

Attachment 2 reference (if applicable)

Knight Piésold CONSULTING

December 31, 2019

Professor Oberle and Expert Panel Members
Global Tailings Review

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www.knightpiesold.com
Project No.: DV108-00240/03
Doc. No.: DV-19-1499

Re: Comments on Draft Global Tailings Standard

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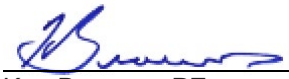
Yours truly,
Knight Piésold

Greg Smyth, B. Sc.
Associate

Paul W. Ridlen, P.E.
President, U.S. Operations



Ken Brouwer, PEng
Director

Copy To: Devin Field, Thomas Kerr, David Morgan, Leon Furstenburg, Mario Villavisencio, Sam Mottram

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