MEMO

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SUBJECT: **ABA Analogue and Arsenic Leaching Threshold Springpole Gold Project**

PROJECT NO.: ONS2104

DATE: April 15, 2025

1 INTRODUCTION

WSP Canada (WSP) was retained by First Mining Gold Corp (FMG) to conduct a geochemical characterization program for the Springpole Gold Project (the Project). Baseline geochemical studies for the Project have identified that Project rock has a range of metal leaching and acid rock drainage (ML/ARD) characteristics. The Project rock broadly falls into two categories (Table 1), including:

- Potentially acid generating (PAG) and/or As-leaching rock (Type 1), and
- Non-potentially acid generating (NAG) mine rock that is not arsenic leaching (Type 2)

These characteristics necessitate different management strategies and / or potential uses for these materials which have been integrated into the overall mine plan.

The identification of these materials in the mine volume is supported by the Project ML / ARD block model. This memorandum summarizes the following key geochemical information that was used in the block model including:

- Acid Base Accounting (ABA) analogue: The ABA analogue was supported by relationships between ABA test results and ICP test results. Lag times for PAG rock were estimated based on the results of laboratory humidity cell tests.
- Threshold for arsenic leaching: Baseline geochemical testing programs for the Project (WSP 2024a, WSP 2025a) identified potential risks for arsenic leaching from NAG mine rock samples. A threshold value to identify arsenic-leaching NAG rock and non-arsenic leaching NAG rock was developed based on the results of laboratory column tests.

Table 1: ML/ARD Classification and Management

ML/ARD Classification	Sub-Type	Description	Criteria [A]	Management
Type 1 PAG and/ or As Leaching	Type 1A	Reactive PAG	NPR ≤ 2, NP ≤20 kg/t	Requires management
	Type 1B	PAG	NPR ≤ 2, NP >20 kg/t	
	Type 1C	Arsenic Leaching	NPR > 2, As ≥ 50 ppm	
Type 2 [C] NAG and non-As leaching			NPR > 2, As < 50 ppm	Geochemically suitable for use in construction

[A] Criteria based on industry-standard criteria or Project-specific thresholds (see text).

[B] Management approaches provided for current Project planning.

[C] While geochemically suitable, not all may be geotechnically suitable for engineered fill.

2 ABA ANALOGUE

The approach to analogue relationship development outlined below was supported by relationships between ABA test results and ICP test results, including AP and ICP sulphur and NP and ICP calcium, for 876 drill core samples. These data represent all ML/ARD samples collected for Project mine rock as summarized in Wood (2021).

ABA analogue relationships have been defined for the rock overall. Lithology-specific relationships did not appear to be present in the data.

2.1 ACID POTENTIAL

The relationship between ABA total sulphur (Leco analyzer) and ICP sulphur demonstrated that ICP sulphur was essentially equivalent to the ABA total sulphur for nearly all (i.e., 97%) of the tested samples (Figure 1). This was consistent with ML/ARD test results that show that sulphide sulphur is the dominant source of sulphur in the samples (Wood 2021).

A small subset of samples (n=27, approximately 3% of the data) showed consistently lower ICP sulphur relative to total sulphur by Leco. As such, ICP sulphur may underestimate the AP of these samples. Based on the currently available data, there was no clear geochemical or mineralogical explanation for this discrepancy, and it may be due to analytical variability in a small batch of samples. Given this discrepancy was observed in only 3% of the dataset, it is currently not expected to influence the ability of analogue relationships to estimate AP for the overall mine rock.

2.2 NEUTRALIZATION POTENTIAL

Analogue NP was calculated based on the calcium content of the samples and compared to measured Sobek NP values for the samples (Figure 2). The relationship between Sobek NP and ICP calcium NP demonstrated that while ICP calcium NP was generally consistent with Sobek NP, it slightly underestimated measured Sobek NP values. Therefore, the ICP Ca NP data were fitted to the Sobek data. A 15% increase in ICP calcium values optimized the relationship between ICP calcium and Sobek NP as shown in Figure 2. This improved the ability of the analogue relationship to accurately estimate the NP of each sample and reduced the number of misclassifications based on analogue relationships.

ICP calcium NP was also compared to carbonate NP values. While a positive relationship was noted, ICP calcium NP consistently overestimated and underestimated carbonate NP over a range of calcium contents for samples with a lower NP content (e.g. <100 kg $CaCO_3$/t). This was attributed to the presence of non-net neutralizing carbonate minerals in some samples (e.g., siderite) and calcium-bearing non-carbonate NP minerals in some of the lower NP content samples. This was consistent with the comparisons of Sobek NP and carbonate NP in Wood (2021). As such, relationships between ICP Ca NP and Sobek NP were utilized to estimate NP more accurately over the range of measured calcium and NP contents.

2.3 NEUTRALIZATION POTENTIAL RATIO

Using the above analogue AP and NP relationships, an analogue NPR (i.e., analogue NP/analogue AP) can be calculated for a given sample. An NPR threshold of 2 should be used to differentiate between PAG and NAG samples and validated through site-specific testing per industry-standard practice (i.e., MEND 2009). To date, Project kinetic testing results (WSP 2024) are supportive of an NPR threshold of 2 for defining NAG and PAG materials, as follows:

- NPR ≤ 2 is PAG
- NPR > 2 is NAG

2.4 LAG TIMES FOR PAG ROCK

Lag times for PAG rock were based on the results of humidity cell testing, including observed lag times for materials that became net-acid generating during testing. Lag times were estimated for other PAG samples using the humidity cell test results.

The lag time for PAG samples varied depending on the NP content of the samples. Static testing for the Project (Wood 2021) demonstrated that samples generally formed two distinct groups based on their NP content. One group of samples had a low NP content (i.e., ~20 kg $CaCO_3$/t or lower) and the other group of samples had higher NP content (i.e., typically on the order of 100-200 kg $CaCO_3$/t). Samples from both groups were represented in the kinetic testing program (WSP 2024) and the lag times were estimated as described below:

- Samples that had a low NP content (i.e., generally <20 kg $CaCO_3$/t) became acid generating rapidly during humidity cell testing (within several months of laboratory testing; WSP 2024) or were estimated to become acid generating after one to several years of testing. Similar low NP materials became net-acid generating in field kinetic tests (e.g., Field Leach Barrels; WSP 2025b) after approximately one year of testing.
- Samples that had a higher NP content (i.e., >20 kg CaCO3/t and typically on the order of 100-200 kg CaCO3/t) were estimated to become net acid generating after several decades.

Based on the kinetic test results two types of PAG rock were defined for Project planning purposes:

- Reactive PAG (Type 1A) – PAG samples with an NP content <20 kg $CaCO_3$/t. Their lag time to ARD was assumed to be <1 year.
- PAG (Type 1B) – PAG samples with an NP content >20 kg $CaCO_3$/t. Their lag time to ARD was estimated to be >10 years to several decades.

2.5 ABA ANALOGUE PERFORMANCE

The performance of the ABA analogue was assessed by comparing the analogue NPR values (analogue NP / analogue AP) to ABA NPR values (calculated with total sulphur by Leco and Sobek NP). This comparison is presented in Figure 3 for the 876 samples evaluated as part of this assessment.

- Overall analogue NPR values were in good agreement with ABA NPR values for most of the samples. The ABA analogue correctly classified samples as PAG or NAG at a frequency of approximately 93% (820 out of 876 samples).
- The ABA analogue classified PAG samples as NAG at a frequency of <1% (n=2 of 375 PAG samples).
- Approximately 12% of the NAG samples (n=61 of 501 NAG samples) were classified as PAG.

As identified in Wood (2021), the ML/ARD dataset comprises approximately 40% PAG and 60% NAG samples. For current purposes, a misclassification frequency of <1% of PAG samples classified as NAG is considered low. Misclassification of 12% of the NAG samples as PAG is considered acceptable given the ability of the analogue to classify PAG samples accurately.

3 ARSENIC LEACHING THRESHOLD FOR NAG ROCK

Baseline testwork for the Project, including static testing and laboratory kinetic testing indicated that arsenic was a potential risk for metal leaching for NAG mine rock. A metal leaching test program including 13 trickle leach laboratory column tests and detailed mineralogical testwork was undertaken to further assess the metal leaching potential of NAG mine rock.

Arsenic leaching appeared to be influenced by the following factors:

- There was a general relationship between arsenic leaching and arsenic content, whereby samples with a higher arsenic content generally leached higher levels of arsenic.
- Arsenic host sulphide mineralogy included arsenopyrite (FeAsS), gersdorffite (NiAsS) and arsenic-bearing pyrite (FeS_2). Column test results showed that the presence of higher proportional concentrations of arsenic sulphides relative to iron sulphides in a sample was an important factor in increased arsenic leaching, whereby samples that contained gersdorffite or arsenopyrite typically leached higher levels of arsenic than samples that contained arsenic-bearing pyrite.

An arsenic threshold was developed to differentiate between arsenic-leaching and non-arsenic leaching NAG mine rock as follows:

- Column tests are designed to simulate drainage quality from mine rock. However, these laboratory tests are typically prepared with crushed rock that is smaller than blast rock which contains a wide variety of particle sizes. Smaller particle sizes have a greater surface area to volume ratio that proportionally increases load release (and consequently leachate concentrations) in the test relative to field conditions. The Project column tests were prepared with drill core crushed to minus 6.4 mm, resulting in a surface area that was approximately ten times that of an equivalent mass of mine rock in the field. Therefore, to obtain a drainage quality estimate more consistent with field-scale conditions, column leachate concentrations were scaled down by a factor of ten for the purposes of this assessment.
- The arsenic content of the test samples and the scaled arsenic concentrations in the column leachates were compared as presented in Figure 4. Scaled leachate concentrations were compared to iPWQO (0.005 mg/L) and PWQO (0.1 mg/L) values for arsenic. Based on this comparison:
  - Samples with an arsenic content of less than 50 mg/kg had a scaled leachable arsenic concentration of less than 0.005 mg/L (Figure 4).
  - Several samples had scaled arsenic concentrations near 0.1 mg/L, however, these samples represented >95th percentile arsenic content among the dataset and therefore are expected to comprise a small volume of the rock.
- This assessment included results from 11 of the 13 column tests. Results for two of the tests (Column 6 and 7) were determined to be anomalous and not representative of conditions expected in the mine rock. This included a high arsenic solid phase, low arsenic leaching sample (Column 7) and a sample (Column 6) containing a unique As:S molar ratio not observed in other samples. Therefore, these results were removed from the data analysis.

Therefore, based on currently available data, an arsenic threshold of 50 mg/kg should be considered to differentiate between arsenic-leaching and non-arsenic leaching NAG mine rock.

Several field tests are in progress with NAG drill core with a solid phase arsenic content < 50 mg/kg (WSP 2025b). The tests have been monitored for two years and have leachate arsenic concentrations below the iPWQO screening value for arsenic. The available field test results are supportive of the 50 mg/kg threshold for arsenic leaching NAG rock.

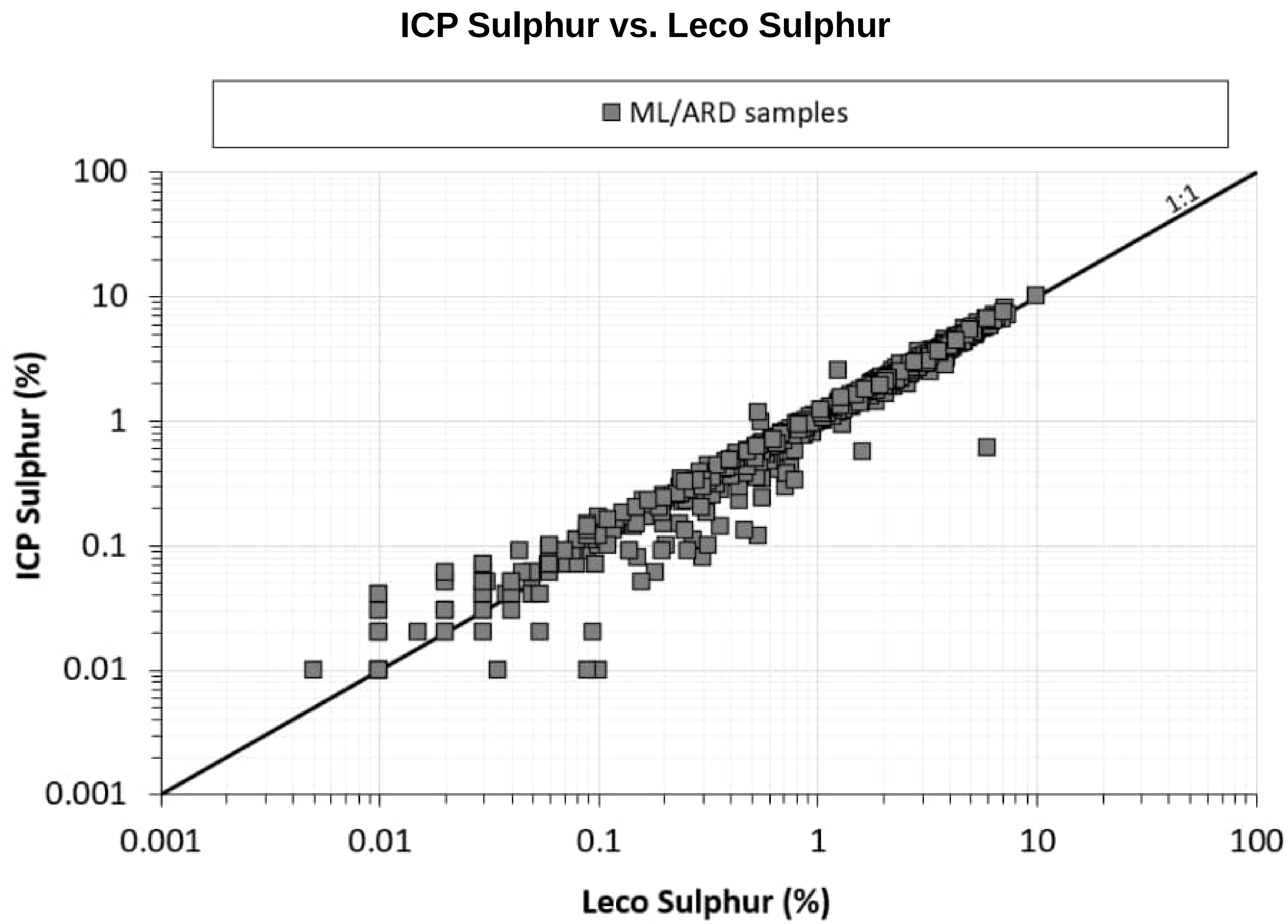
4 REFERENCES

WSP 2024a. Appendix K 1.1 Static Geochemical Testing Baseline Report (Rev 2). ONS2104. Prepared for First Mining Gold Corp. October 2024. *IN: First Mining Gold Corp (FMG). Environmental Impact Statement / Environmental Assessment Summary. October 2024. Submitted to the Impact Assessment Agency of Canada.*

WSP 2025a. Baseline Kinetic Geochemical Testing Report – Kinetic Testing Update Q4 2024. ONS2104. Prepared for First Mining Gold Corp. April 2025.

WSP 2025b. 2024 Field Leachate Barrel Update – Springpole Gold Project. Prepared for First Mining Gold Corp. April 2025.

Figures



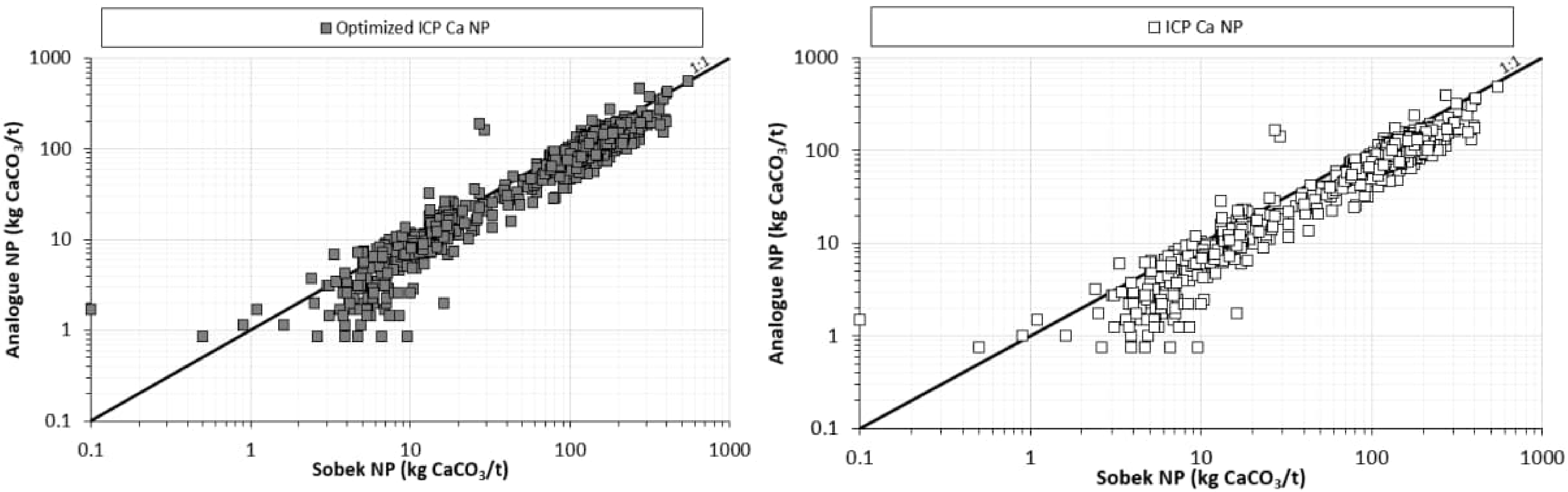
Notes:
Samples shown reflect the 876 samples included in the baseline static report (Wood 2021).

Springpole Gold Project
Ear Falls, ON

ABA Analogue and Arsenic Leaching Threshold

wsp	April 2025	ONS2014
	Drawn: AK, KG	Figure 1

NP and Analogue NP



Notes:
Samples shown reflect the 876 samples included in the baseline static report (Wood 2021).

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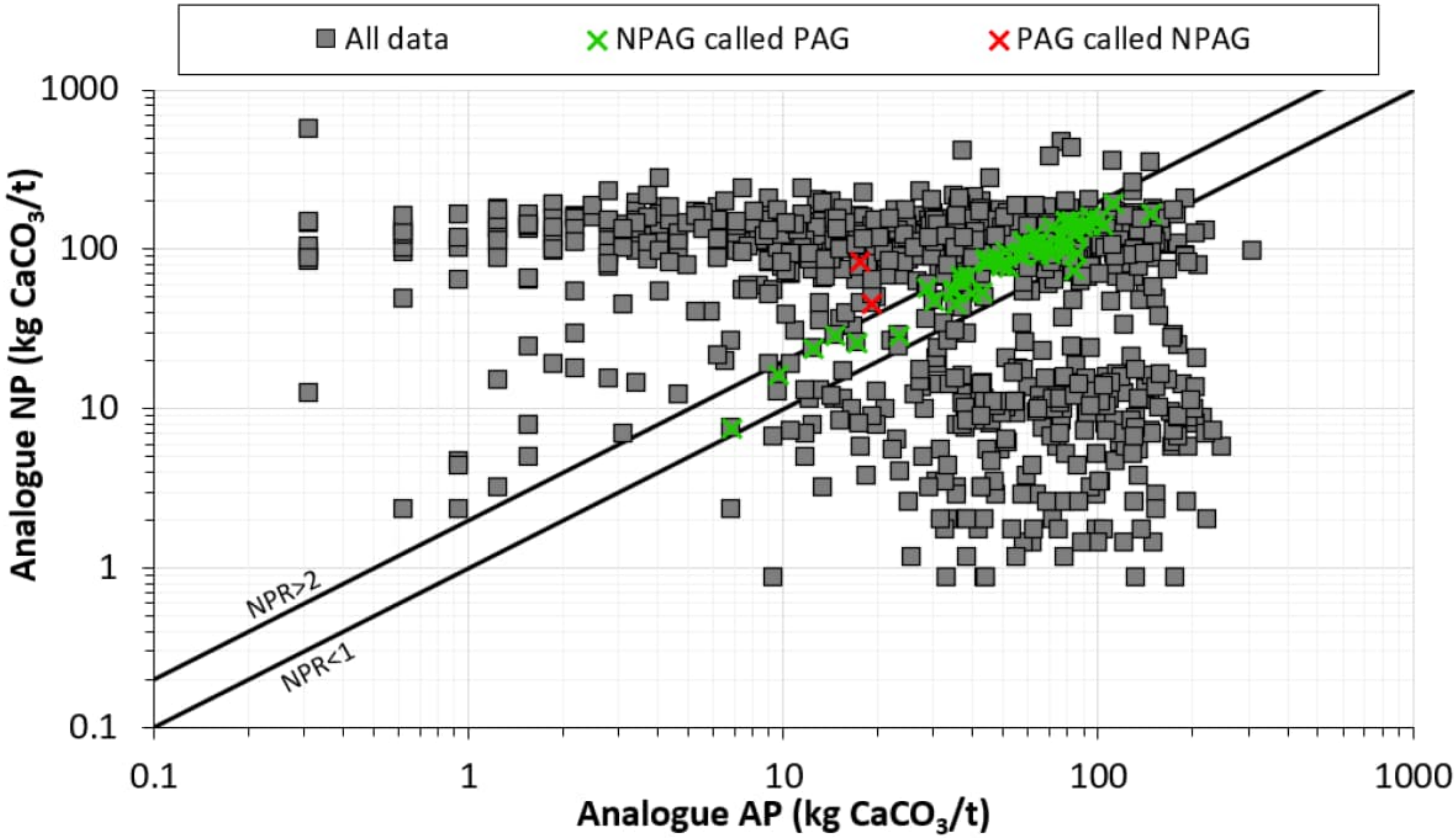
ABA Analogue and Arsenic Leaching Threshold

wsp	**April 2025**	**ONS2014**
	Drawn: AK, KG	**Figure 2**

Analogue NPR



Notes:
Samples shown reflect the 876 samples included in the baseline static report (Wood 2021).

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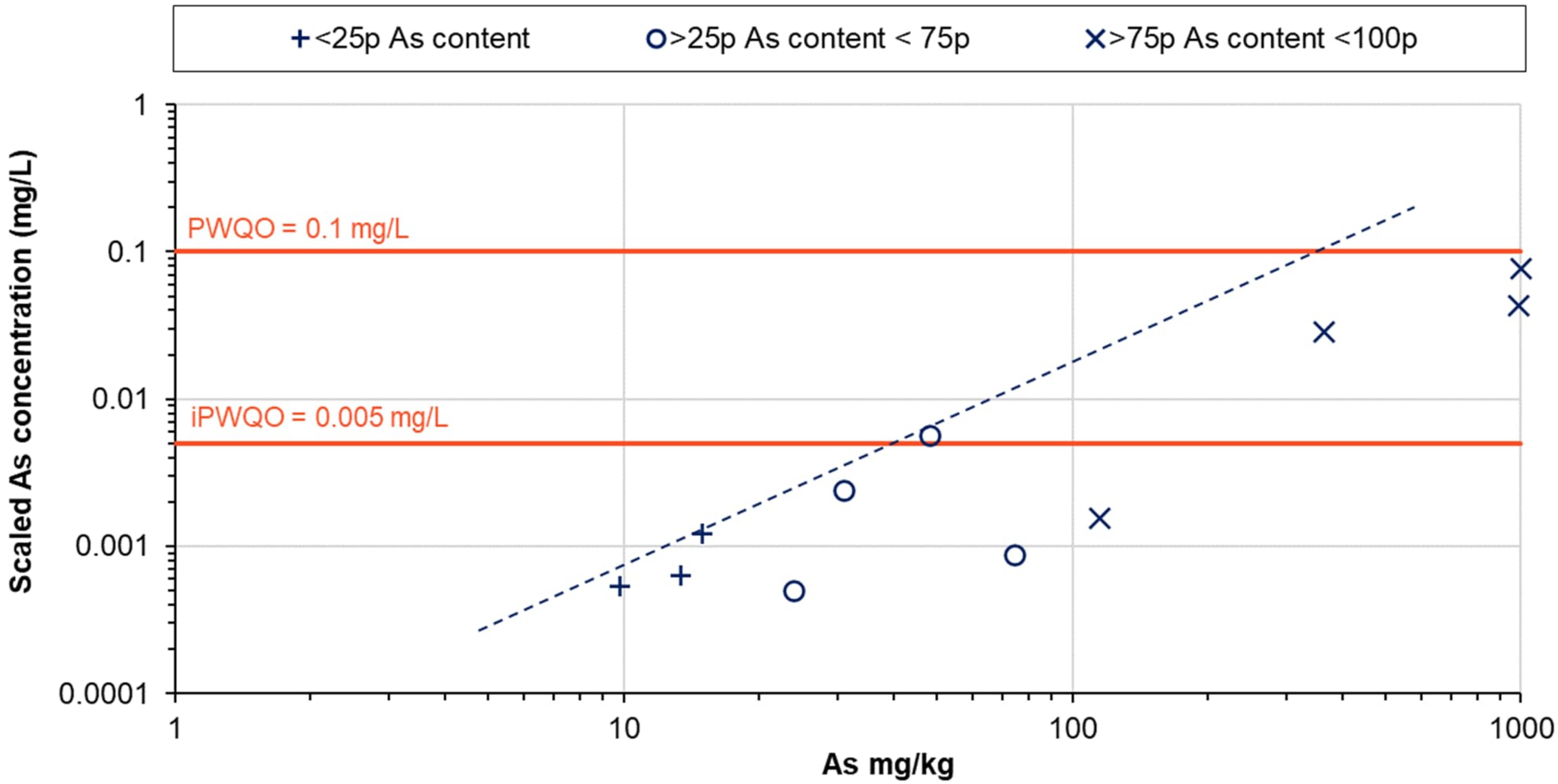
ABA Analogue and Arsenic Leaching Threshold

wsp	**April 2025**	**ONS2014**
	Drawn: AK, KG	**Figure 3**

Scaled Arsenic (As) Leaching Results for Selected Trickle Leach Column Tests



Note:
Percentile information is shown relative to ML/ARD database (876 samples).

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ABA Analogue and Arsenic Leaching Threshold

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	Drawn: AK, KG	Figure 4