Private Company

In-situ removal of selenium in a groundwater plume

Water treatment(/application/water-treatment) Novel tech(/marketplace/requests?use_case=NOVEL_TECHNOLOGY)

Have questions about this request?

Get them answered by the team at the company.

Ask your question

Background

A leading global mining and materials company is exploring novel, sustainable groundwater remediation strategies across mining and mineral-processing operations, with a focus on reducing selenium concentrations and preventing unintended arsenic mobilization in diffuse contaminant plumes. Selenium is a naturally occurring trace element that can become mobilized at elevated concentrations during mining and mineral-processing operations. When released into groundwater, dissolved selenium, primarily as selenate (SeO_4^{2-}) and selenite (SeO_3^{2-}), poses significant ecological risks due to its tendency to bioaccumulate in aquatic food chains, even at low concentrations.

Share partnering request

Deadline: June 26

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Is this request relevant to you?

Relevant Not relevant

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Regulatory agencies in most mining jurisdictions now enforce stringent groundwater and surface-water selenium limits (commonly 1 to 50 µg/L), making effective remediation a compliance priority. While above-ground treatment plants can remove selenium from extracted water, pump-and-treat approaches are operationally costly and logistically challenging for large, diffuse plumes. A critical additional concern is the interaction between selenium and arsenic in groundwater: treatment approaches that reduce selenium may inadvertently mobilize or resolubilize arsenic, creating a secondary contamination risk that must be accounted for in any proposed solution.

What we're looking for

We are looking for in-situ technologies and management approaches capable of decreasing dissolved selenium (including selenate and selenite species) in a groundwater plume to below applicable regulatory thresholds by enhancing or selectively managing existing attenuation processes, without requiring water extraction or above-ground treatment. Site monitoring indicates that selenium attenuation rates are higher than originally predicted, and in situ biological treatment is an accepted remedial option for this site. Accordingly, we are interested in approaches that can further enhance attenuation rates or improve plume management while accounting for site specific geochemistry, including the co-occurrence of arsenic in the groundwater. An existing treatment plant is available for extracted water but is not the preferred path for this plume. Given the site-specific geochemistry involved, we anticipate that a tailored solution will likely be required.

Solutions of interest include:

- Bioremediation or biostimulation (e.g., microbial selenate/selenite reduction via carbon-source injection)
- Permeable reactive barriers (PRBs) using zero-valent iron, biochar, or other reactive media
- In-situ chemical reduction technologies
- Biogeochemical reactor systems deployed in the subsurface
- Novel sorbent or reactive-media injection techniques

Our must-have requirements are:

- Capable of decreasing total and dissolved selenium (selenate and selenite) concentrations in groundwater under field-relevant conditions
- Does not resolubilize or mobilize arsenic as a consequence of selenium treatment
- Considers selenium and arsenic chemistry in contaminated groundwater systems under site-relevant conditions, and the potential for arsenic mobilization

- Applicable to in-situ deployment within a groundwater plume (not above-ground treatment)

Our nice-to-have's are:

- Existing publications or test work demonstrating selenium attenuation in groundwater
- Experience with selenium-arsenic co-contaminated systems
- Minimal long-term maintenance or reagent replenishment requirements
- Does not generate hazardous secondary waste streams requiring separate disposal

What's out of scope:

- Treatment in an active plant or pumping water to a treatment facility
- Solutions that require continuous above-ground energy or chemical-feed infrastructure

Acceptable technology readiness levels (TRL): Levels 1-9

1. Basic principles observed
2. Concept development
3. Experimental proof of concept
4. Validated in lab conditions
5. Validated in relevant environment
6. Demonstrated in relevant environment
7. Regulatory approval
8. Product in production
9. Product in market

What we can offer you

Eligible partnership models:

Sponsored research

Benefits:

Sponsored Research

Up to $150,000 USD for an initial proof-of-concept study (typically 12–18 months), with

potential for additional funding to support field-scale pilot demonstration upon successful completion. Indirect costs available to academic and nonprofit research institutes at a maximum of 15%.

Q&A with the company

Ask the team at the company any questions you have about this partnering request.

Ask your question

Sort by: Most upvoted

Q. I assume a specific target site exists? What is the groundwater pH at that site, if you can share that info? I have a chemical method that would work best under certain pH conditions. Your response will help assess its feasibility.

4

PC (/profile/pei-chiu-515052)

Pei Chiu, Principal Investigator, University of Delaware (/profile/pei-chiu-515052)
May 6, 2026

A. pH is near neutral ranging from approximately 6 to 8.

Team Member, Reviewer, Private Company
May 21, 2026
()

Is this response helpful? 0 0

Q. We are good in developing in-field biosensors for the detection of different contaminants, like selenium, than to set up technologies for detoxification. If it is still interesting for the company please let me know.

1

(/profile/hajnalka-jankovics-134665)

Hajnalka Jankovics, Principal Investigator, iPASy Technologies (/profile/hajnalka-jankovics-134665)
May 8, 2026

A. Potentially of interest as a supplemental monitoring tool, particularly for high-frequency or real-time data collection in dynamic areas (e.g., wetlands). However, regulatory compliance monitoring would still rely on established analytical methods.

Team Member, Reviewer, Private Company
May 21, 2026
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Is this response helpful? 0 0

Yes, we are aware that the measurement methods currently required by law cannot be replaced by a biosensor that we can develop, but our experience is that interested companies conduct far more testing than required in their own economic interest, and our test is suitable for this purpose. Similarly, if time is a critical factor in preventing harmful consequences (e.g., the spread of contamination over a large area), or if it is necessary to pre-screen a large number of samples to determine which ones should undergo costly laboratory testing, the sensors we have developed offer a good solution for these scenarios. Therefore, if you believe it is worth investing in the development of a field-deployable selenium biosensor, we are open to taking on the task.

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(/profile/hajnalka-jankovics-134665)

Hajnalka Jankovics, Principal Investigator, iPASy Technologies
May 22, 2026

(/profile/hajnalka-jankovics-134665)

We do see potential value in this type of technology as a supplemental monitoring tool, particularly in our wetlands systems where conditions may be more dynamic and there is benefit to higher-frequency and more spatially distributed data. For our application, things I would be especially interested in would be: Detection limits in the low µg/L range (aligned with our decision thresholds). Measurement frequency / response time for capturing temporal variability. Repeatability and signal stability over multi-day or longer deployments. Performance in complex wetland matrices (e.g., elevated organics, variable redox conditions). Maintenance and fouling characteristics for field deployment. Happy to chat more!

Team Member, Reviewer, Private Company
May 22, 2026

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Is this response helpful? 0 0

Q. Could you share any further site physical / geochemical details, particularly the plume depth?

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MH

(/profile/michael-harbottle-3830)

Michael Harbottle, Principal Investigator, Cardiff University (/profile/michael-harbottle-3830)

May 7, 2026

A. A large impacted area contains three distinct groundwater plumes. The largest plume is dominated by selenium. The second plume is primarily arsenic, with lesser selenium. The smallest plume contains both selenium and arsenic. Primary Selenium Plume pH is near neutral, typically ranging from approximately 6 to 8. Oxidation-reduction conditions are generally oxic near the surface throughout most of the plume, except in wetland areas. At depth, redox conditions are generally suboxic to sulfidic. The maximum dissolved selenium concentration in groundwater at the source has fluctuated between approximately 5,000 and 24,000 µg/L. At the source, dissolved arsenic is generally immobile. It is present in groundwater at depth, but current transport is limited, likely due to oxidizing conditions. Historically, transport of arsenic to depth was likely driven by dense, acidic solutions. Dissolved arsenic concentrations at the source typically range from 600 to 1,000 µg/L. Downward hydraulic gradients and pumping from deep wells have driven both lateral and vertical migration of the selenium plume. Recent measurements show dissolved selenium concentrations above action levels at elevations as low as approximately 3,600 ft amsl, with concentrations of about 150 to 400 µg/L. At elevations between 3,750 and 3,800 ft amsl, concentrations range from approximately 900 to 1,200 µg/L. At elevations between 3,900 and 4,000 ft amsl, concentrations range from about 400 to 3,000 µg/L. Dissolved arsenic concentrations exceeding action levels have also been detected at depths corresponding to approximately 3,600 ft amsl beneath the source area. Ground surface elevation in the source area is approximately 4,350 ft amsl, decreasing to approximately 4,200 ft amsl toward the downgradient extent of the plume. Primary Arsenic Plume Current groundwater pH is near neutral, generally between 6 and 7. Historically, the central portion of the plume may have had pH values below 6. Since the early 1990s, pH has increased in select monitoring wells. Redox conditions are not well characterized. Dissolved arsenic concentrations in groundwater have steadily declined since the early 1990s. Peak concentrations were as high as approximately 20,000 µg/L. Active groundwater extraction began around 2000. Current maximum arsenic concentrations are typically between 1,000 and 2,000 µg/L. This plume is generally shallow. Source material is likely present as solid-phase contamination, and transport to groundwater appears to occur primarily through leaching rather than migration of aqueous

solutions. Groundwater extraction has likely induced deeper migration than would have occurred under natural conditions. The extraction well is screened to approximately 130 ft below ground surface (bgs). In most areas, elevated arsenic concentrations are observed between about 40 and 60 ft bgs. At one location, elevated arsenic has been detected at approximately 160 ft bgs. Within this plume, dissolved selenium concentrations are generally much lower, typically ranging from 50 to 100 µg/L. However, near the extraction well, selenium concentrations have increased in recent years to between approximately 1,000 and 2,000 µg/L. Mixed Selenium and Arsenic Plume Releases of acidic solutions have resulted in transport of both selenium and arsenic to groundwater. Current pH conditions are near neutral (approximately 6 to 7). Historically, localized zones of acidic groundwater have occurred, particularly following release events. pH values below 1 were measured in multiple wells in the past. In one area following a release, pH was measured at approximately 3.5. In both cases, pH returned to near-neutral conditions over a period of roughly 10 years. Redox conditions are not well defined. Groundwater with elevated dissolved selenium is typically found within approximately 50 ft bgs, while groundwater with elevated dissolved arsenic is generally present within about 80 ft bgs. Recent dissolved selenium concentrations range from approximately 50 to 300 µg/L, while dissolved arsenic concentrations range from approximately 10 to 30 µg/L.

Team Member, Reviewer, Private Company
May 21, 2026
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Is this response helpful? 0 0

Q. Are molecular modeling techniques that can screen selenium-sorbent complexes, while only being specific to selenium and not arsenic, of interest?

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(/profile/jose-gascon-267582)

Jose Gascon, Principal Investigator, University of Connecticut
May 13, 2026

(/profile/jose-gascon-267582)

A. Regarding molecular modeling of selenium-selective sorbents, this is conceptually interesting given the co-occurrence of selenium and arsenic. However, from our perspective, interest would depend on how directly the work translates into field-deployable and demonstrably effective treatment media under site-relevant conditions (e.g., near-neutral pH, variable redox, and elevated concentrations). At present, our focus is on technologies

with established performance in similar settings. We would be open to learning more if you have examples of applied or field-demonstrated outcomes.

Team Member, Reviewer, Private Company
May 21, 2026
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Is this response helpful? 0 0

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