

# Particle Separation for Oil and Gas Drilling Fluids



PNNL's Mesofluidic Separator has the potential to recover, recycle, and concentrate high-value and challenging constituents from drilling fluids, offering a small process footprint and no moving parts to improve return on investment.





Full-scale tests using simulants successfully demonstrated 300-micron and larger particles separated out of a slurry mixture. The Mesofluidic Separator was tested in early 2019 in PNNL's Process Development Laboratory high bay. U.S. and international patents are pending. The Mesofluidic Separator is currently being licensed for waste management applications, and is being explored for applications in the oil and gas industry.

## Patent-Pending Particle Separation Technology Holds Oil & Gas Potential

Pacific Northwest National Laboratory has created a particle separator with potential to recover and concentrate drilling fluids, at reduced costs relative to existing processes. This innovative technology is engineered using fluid mechanics to separate out large particles from a mixed fluid stream—reducing or eliminating the need for screens and settling tanks. And, because the Mesofluidic Separation technology can be deployed within existing pipe, it offers operators the potential to eliminate stand-alone, capital-intensive processes without significant investments in new piping systems.

For offshore operations, Mesofluidic Separator technology offers in-pipe processing to replace one or more mud handling unit operations. Separating cuttings and concentrating fluids and particulate additives could help minimize transportation, waste processing, and disposal expenses, while having the added benefit of reducing overall environmental impact. The system's small footprint and lack of moving parts could also simplify current mud handling processes and improve safety.



## Recover High-Value Constituents

- Mesofluidic Separators could selectively recover high-density muds for reuse.
- Systems can be designed to selectively separate and recovery proppant in-pipe.

## Concentrate Drilling Muds

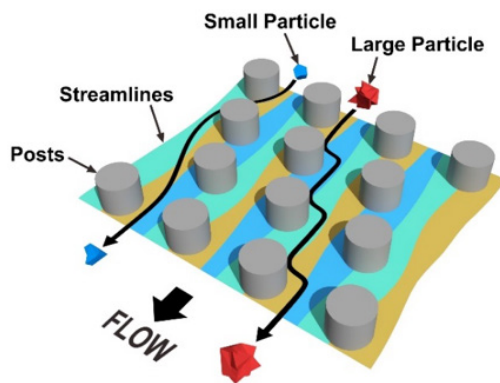
- Mesofluidic Separation technology could be used to streamline on-site mud processing.
- For offshore operations, it could be used to concentrate drilling fluids to minimize the number of tankers needed to transport cuttings and waste muds.

## Simplify Mud Circulation Systems

- Mud processing systems, composed of multiple unit operations (e.g., shakers, desanders, desilters, cyclones, and centrifuges) occupy a significant footprint.
- Mesofluidic Separators could combine multiple unit operations to decrease offshore platform load.
- These systems are engineered to function as in-pipe inserts for ease of integration.

## The Technology

- Mesofluidic Separators remove large particles from process streams by leveraging microfluidic principles while operating at industrially meaningful flow rates (e.g., hundreds to thousands of gallons per minute).



## How it Works

- Pin arrays are engineered to create flow channels.
- Particles smaller than the flow channels simply slalom from entrance to exit.
- Particles larger than the flow channels bump consecutively in one direction.
- Large particles enter an express lane where they are swept out.

## Benefits of Mesofluidic Separations

- Particle size range is tunable and tailored by design.
- Passive design leverages fluid mechanics to tune pin spacing and flow channel widths.
- Capable of flow rates from hundreds of gallons per minute in concentrated solids environments.
- As inserts, the separators fit snugly within pipes to minimize process footprint and facilitate ease of integration.
- Separates both spherical and non-spherical particles.
- Multiple flow channels fit between pins to prevent particle jamming.
- No moving parts to break down.

## Promising Opportunities

- Mesofluidic Separations technology may enable innovation across a range of oil and gas applications:
  - Reduce mud processing and transportation costs
  - Recover high-density, high-cost drilling muds for reuse
  - Separate high-value constituents
  - Reduce the footprint of separations systems
  - Decrease platform load



## **About PNNL**

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**Located in southeastern Washington State, Pacific Northwest National Laboratory advances scientific discovery and drives innovations that improve energy resiliency and enhance national security.**

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