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Quinn Process Equipment Company (QPEC)

Mixer Settler Systems for Solvent Extraction & Recycling Applications

At Quinn Process Equipment Company (QPEC), we have over 45 years of expertise in designing and manufacturing process equipment for pilot and small commercial plants in the minerals industry. Our advanced Mixer-Settler units are integral to efficient mineral extraction and recycling processes, handling a broad range of materials from copper and uranium to lithium and rare earth elements.

What sets us apart is QPEC mixer-settlers feature specially designed impellers that mix and pump feed streams at the mixer eye, eliminating the need for interstage pumps and simplifying system control. Only external feed pumps and associated components are needed. Available in various configurations and materials, these units maintain equal liquid levels in both mixer and settler for easy startup and shutdown without surge tanks.

We apply the same advanced technologies and processes to both mineral extraction from mining and material recovery through recycling, ensuring sustainable practices and maximum resource efficiency across both operations.

Our Mixer-Settler units are tailored to meet the unique needs of your project, offering a range of sizes and materials to suit various applications. With installations worldwide, QPEC has built a reputation for delivering reliable, high-performance equipment that meets the rigorous demands of the industry.

For more details or to discuss your specific needs, please visit www.quinnprocess.com or contact us directly at quinnproc@quinnprocess.com.

We look forward to the opportunity to support your current and future projects.

Best regards,
Eric Smeltzer
Quinn Process Equipment Co.

The following is a description of our history, installations, personnel of operating plants that you are free to contact (some of these plants are confidential and the client will probably be hesitant to discuss the exact process).

These units have always included the mixer and settler tank(s) and also the complete mixer mechanism(s).

Quinn Process Equipment Company
Selected Installations Featuring QPEC Mixer-Settler Units

The following is a partial list of QPEC Mixer-Settler installations. Our installations, as indicated, cover a wide range of minerals such as copper, molybdenum, indium, germanium, gallium, boron, yttrium, uranium, vanadium, etc.

Company	Location	Process/Project Description
Noranda	Agnew Lake	Uranium
Freeport Chemical	Uncle Sam, LA	Uranium from phosphoric acid
Wyoming Minerals	Bingham Canyon, UT	Uranium from copper leach tails
Hecla Mining	Arizona	Copper from leach solution
Greenback Industries	Arizona	Copper from leach solution
United Chemical	Arizona	Copper from leach solution
Ranchers Exploration	Naturita, CO	Uranium-vanadium from leach tails
Brush Wellman	Utah	Uranium from leach solution
Bokum	New Mexico	2000 ton uranium mill
Anaconda	Arizona	Uranium from copper leach solution
AMOK, Ltd.	Saskatchewan	Pilot plant for uranium ore
Kerr McGee	Idaho	Pilot plant Uranium-Vanadium from phosphoric acid
Mono Power	Idaho	Pilot plant Uranium-Vanadium from phosphoric acid
Energy Fuels	Blanding, UT	2500 tpd uranium-vanadium plant
Plateau Resources	Utah	800 tpd uranium-vanadium plant
AMAX	Iowa	Paratungstate plant
Earth Sciences Ext.	Calgary, Alberta	Uranium from phosphoric acid
Cerro Copper Prod.	Illinois	Copper from leach liquors
Dennison Mines, Ltd.	Canada	Yttrium recovery from uranium
Sociedad Chilena de Litio, Ltd.	Chile	Lithium plant - boron recovery
Hecla Mining	Utah	Copper, gallium, germanium recovery
Cominco, Ltd.	British Columbia	Indium recovery
P.T. Petrokujang	Indonesia	Uranium from phosphoric acid
CODELCO	Chile	Rhenium, molybdenum recovery

BHP-Utah Intl.	California	Copper recovery
East Penn Mfg.	Pennsylvania	Cleaning spent battery acid
Egypt	Egypt	Mineral pilot plant
COGNIS	California	Hazardous waste metal recovery
United Engineers	New York	Remove sulfates from stack residues
Proler Intl. / Western States Engineering	Arizona	Copper recovery from waste material
Placer Dome, Inc.	British Columbia	Copper pilot plant
Ivanhoe Myanmar / KD Engineers	Burma	Copper pilot plant
Cabot Corp.	Pennsylvania	30 stage SX for exotic metal recovery
BHP/Bateman Eng.	Zimbabwe	9 stage unit for cobalt recovery
BHP Minerals	California	10 stage pilot unit for confidential plant
AMAX Metals	Louisiana	6 stage pilot unit for confidential plant
Copper Range Mining / Davy International	Michigan	4 stage unit for copper recovery
Phibrotech	Texas	2 stages replacement FRP units
American Microtrace	Nebraska	4 stages for proprietary process
BHP Minerals	—	4 stages for general application
Thai Copper Ind. / Kvaerner Metals	Thailand	2 stages 316LSS for copper recovery
US Filter	California	9 stages for confidential process
Inco	Newfoundland	22 stages for a confidential process
Alkane Exploration	Australia	15 stages for confidential process
Premier Technologies	Idaho	20 stages 316LSS units for confidential process
Premier Technologies	Idaho	20 stages borosilicate glass units confidential process
Molycorp	California	75 stages of retrofit mixer mechanisms for rare earths
Molycorp	California	86 stages of duplex mixers and settlers for rare earths
Turkey AEA	Turkey	10 stages laboratory units for confidential process
Ferro Corp	Ohio	4 stages laboratory units
Kennametal	Alabama	Replaced mixer tanks to improve performance
Confidential	California	7 stage expansion of existing circuit for rare earths
Confidential	California	7 stage expansion of existing circuit for rare earths
Confidential	Indonesia	Confidential process for precious metal

As illustrated by the list above, QPEC has supplied numerous mixer-settler units to a broad range of both new and repeat clients worldwide. Our systems are in operation across Canada, Southeast Asia, the United States, Chile, and beyond.

We have provided units with settlers as large as 25' x 62' and 32' x 62', complete with mixers, for clients such as Chevron's Pana Maria plant and Energy Fuels in Blanding, Utah. QPEC systems are capable of treating negative pH levels and handling flow rates ranging from 100 ml/min to 2000 gpm.

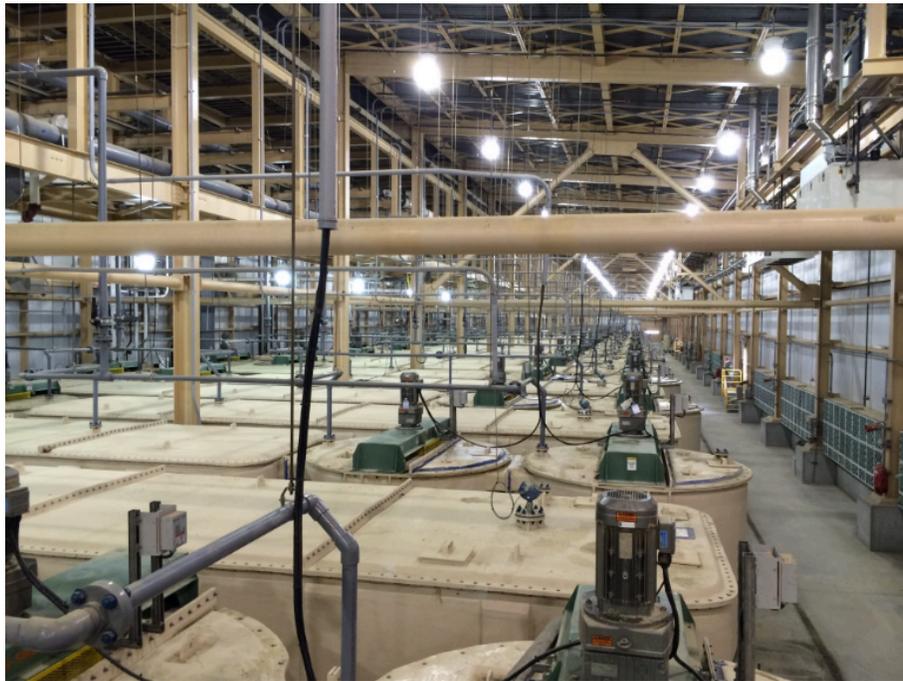
Our pilot plant units are fully integrated package systems. They include all interstage piping and recycle provisions, mounted on a common structural steel frame. Each comes equipped with explosion-proof electric drive motors and VFD speed controls (shipped separately for customer installation).

All companies listed above purchased complete mixer-settler systems from Quinn Process Equipment Company. Each installation started up quickly, without complications or failures, and performed reliably to the client's full satisfaction.

Key Design Advantage:

QPEC mixer-settlers utilize impellers in the mix tanks specifically engineered to both advance (pump) and thoroughly mix the incoming feed streams—aqueous, organic, and recycle—at the mixer eye. This eliminates the need for interstage pumps, significantly simplifying system control and operation. Only external feed pumps (for aqueous and organic feeds) and their associated tanks, flowmeters, and valves are required. Mixers are available in simplex, duplex, or triplex configurations, including auxiliary axial flow mixers if needed.

Units can be constructed from a wide variety of materials to suit specific applications. All QPEC mixer-settlers are designed with equal liquid levels in both the mixer and settler to allow for straightforward startup and shutdown, with no need for surge tanks to handle backflow. For larger systems, a pad or support under the settler may be required to align the liquid levels between the mixer and settler.



To submit our recommendations for a solvent extraction (SX) mixer-settler system, we require the following information. This data is typically developed through test work and a completed process flow sheet.

For each set of SX mixer-settlers, please provide:

1. **Circuits Involved**
(e.g., extraction, wash, scrub, strip, etc.)
2. **Number of Stages**
Specify the number of stages in each circuit.
3. **Flowrates**
Indicate flowrates for organic, aqueous, and recycle streams (specify whether recycle is organic or aqueous) for each circuit. Please also provide the specific gravity for each stream. Alternatively, you may provide the desired organic-to-aqueous (O:A) mixer ratio.
4. **Mixer Retention Time**
State the required mixer retention time for each circuit.
5. **Settler Area Requirements**
Typically given in gallons per minute per square foot (gpm/ft²) or cubic meters per square meter per hour (m³/m²/hr).
6. **Settler Flow Velocity or Aspect Ratio**
Provide the maximum allowable velocity through the settler or, if available, the desired aspect ratio (length to width) of the effective settler area.
7. **Stream Characteristics and Construction Materials**
Describe the nature and concentration of all process streams involved. If known, also provide the desired materials of construction.
8. **Electrical Requirements**
Specify voltage and the type of motor enclosures required.
9. **Site-Specific Considerations**
Note any special requirements such as venting, physical space constraints (e.g., doorways), indoor or outdoor installation, and any seismic or loading specifications for settler covers, if applicable.
10. **Operating Temperature**
State the expected operating temperature of the system.

If a flow sheet and sizing data are not available, please let us know. If needed, we can recommend consultants familiar with developing this information.

We sincerely appreciate the opportunity to submit our recommendations for this and any future projects in which you may be involved.

Regards,

Eric Smeltzer