

Onsite Gas Production, Bulk Gases, Specialty Gases and Related Services and Products for the Refining Industry

MATHESON Technology, Flexibility, and Experience Help You Maximize
Safety • Reliability • Compliance • Productivity • Profitability



MATHESON

ask. . .The Gas Professionals™

For more than 85 years, **MATHESON** has provided gases, equipment, and expertise to a breadth of industries – including the refining industry.

MATHESON, and its parent, Taiyo Nippon Sanso Corporation, having constructed its first air separation plant in 1935, are today recognized as global leaders in the design, fabrication, and operation of ASUs (air separation units) used for production of nitrogen, oxygen, and argon. Beyond that, as a part of our ongoing business, we have accumulated expertise in plant design and operations for the production of ALL gases.

Access to gases and gas management will impact the operational excellence of any refinery; and to that end, we offer our products and global experience to refineries seeking over-the-fence and onsite gas production. In addition to our own captive expertise, we partner with best of breed technology providers for specialized proficiencies.

Even with our years of experience, we remain inventive and proactively flexible ... always looking for the best solution for each application challenge.

Total Solutions for the Refining Industry



MATHESON Hydrogen Plant at Refinery Customer



MATHESON Air Separation Unit, San Antonio, TX

MATHESON delivers gas, gas handling, application and engineering expertise, plus plant or sub-system construction, maintenance, expansion, and upgrades.

Over-the-Fence Gas Supply:

A wide range of gases -- including hydrogen, oxygen, nitrogen, argon, carbon dioxide, hydrocarbons, and more -- produced on-site or delivered by pipeline. Bulk and cylinder supply also available.

Onsite HYCO (syngas) and Hydrogen Plants:

Services include design, construction, maintenance, and operation of:

- Steam methane reformers (SMR)
- Autothermal reformers (ATR)
- Partial oxidation (POX)
- Gasification

Onsite Air Separation Units (ASUs):

Design, construction, maintenance, and ongoing systems operation for onsite generation of oxygen, nitrogen, and argon.

- Cryogenic air separation for larger volume applications
- Non-cryogenic separation, including selective adsorption (PSA and VSA) and membrane separation

Deep Desulfurization Technology:

NANOCHEM® DDS desulfurization sorbents and systems for sulfur removal to ppm and sub-ppm levels from gas streams and liquid streams – for finished product and feedstocks.

Research and Development:

- Specialty gases
- Calibration mixtures
- High purity gas handling equipment
- Analytical equipment
- Regulatory and environmental compliance

With our Total Solution approach, we work with your plant experts to design the customized package that addresses your specific requirements.

Gases and Applications

Hydrocracking and Hydrotreating:

Hydrogen is a key component in a refinery. Hydrogen is required to remove sulfur and contaminants from gasoline and diesel as well as to convert components of crude oil into useful products. Refinery profitability is often directly correlated with the quantity and quality of hydrogen available.

Refineries often produce their own hydrogen, but frequently may not produce the needed volume and purity. On-site hydrogen plants and pipeline hydrogen can supplement the hydrogen produced by the refinery.

MATHESON's refinery and hydrogen plant experts will work with you toward the ideal solution by assessing your current hydrogen system, examining your needs, and evaluating your options.

FCC Enrichment and NOx Reduction:

Oxygen can be added to the regenerator of a fluid catalytic cracker (FCC) to improve yields, assist with coke burning and heat balance, and to reduce cyclone velocities. This can also reduce NOx and CO emissions. Additionally, oxygen is used to produce ozone, which is required in the LoTOx NOx removal equipment incorporated into many FCC units.

Pressure and Leak Testing, Purging and Blanketing, Emissions Control, Instrumentation and Safety:

An inert gas such as **Nitrogen** finds a multitude of applications in a refinery. Nitrogen can be used to pressurize new, repaired, or modified tanks, pipelines or vessels to check process integrity and leak tightness. Refinery tanks and storage vessels can be purged and blanketed with nitrogen to displace air and flammable vapors for both safety and quality purposes. Nitrogen can be used to maintain an inert atmosphere to prevent product degradation by contaminants, moisture, or oxygen. Nitrogen helps extend the life and reliability of instrumentation and products. **MATHESON** supplies nitrogen in a variety of purities and delivery formats.

Advanced Sulfur Removal Technology:

The NANOCEM® DDS Series of Deep De-Sulfurization purifiers is a lineup of high performance purifiers specifically targeting **Sulfur Removal** ... to ppm, sub ppm, and even sub-0.1 ppm levels. NANOCEM® DDS can be used with gas and liquid streams such as: natural gas, liquid hydrocarbons (natural gas liquids, iC4 / iC5

feedstock), fuels (diesel, jet fuel, logistic fuel, bioethanol), LPG, olefins, refinery off-gases. NANOCEM® DDS sorbents offer high capacity, are regenerable, and can be used for removal of difficult sulfur-containing species such as COS, thiophenes and disulfides.

Sulfur Recovery and Acid Gas Plants:

The use of **Oxygen** in a sulfur recovery unit (SRU) can increase plant capacity and help with contaminants and low hydrogen sulfide streams. Oxygen can also be used to boost temperature. Oxygen use can be intermittent or continuous. **Hydrogen** can also be added to the tail gas treating unit (TGTU) of a sulfur plant when the streams to be treated are leaner (i.e., less H₂S).

Plant Expansion and Gas Clean-up:

MATHESON has the expertise to help meet your expansion and gas clean-up needs. We can provide technology solutions to increase the capacity of your existing hydrogen plants without additional greenhouse gas emissions. We can also provide equipment to help increase the hydrogen content and remove contaminants from refinery and gas streams.

Turnaround Services:

MATHESON can arrange to provide Nitrogen and turnaround services to help your refinery get back up and running as quickly as possible. Using state-of-the-art equipment and **MATHESON** gases, we can provide cooling, heating and purging services on a short-term or intermittent basis.



MATHESON Hydrogen Plant at a Biofuels Refinery

About **MATHESON**

MATHESON is a single source for industrial, medical, specialty and electronic gases, gas handling equipment, high performance purification systems, engineering and gas management services, and on-site gas generation. Our mission is to deliver innovative solutions for global customer requirements.

MATHESON (founded in 1927) is the largest subsidiary of the Taiyo Nippon Sanso Corporation Group (founded in 1910). Taiyo Nippon Sanso Corporation (TNSC) is the largest supplier of industrial gases in Japan, and one of the five largest suppliers of industrial, specialty, and electronics gases in the world. MATHESON became a subsidiary of TNSC in 1984.

We have a depth of technology and resources that can come only from a global enterprise.

MATHESON and Safety

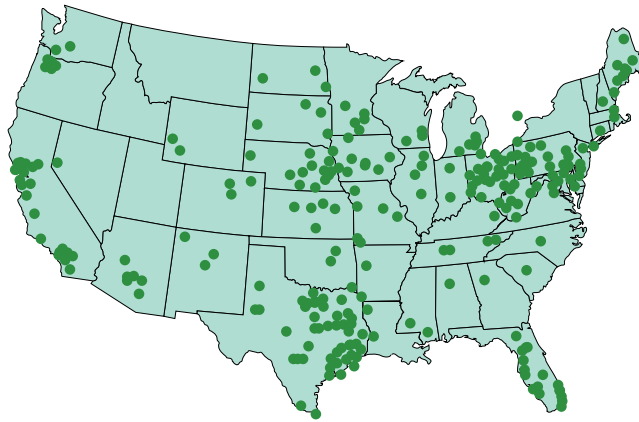
MATHESON places the highest value on Safety – every day. We value our safety record, and we've received many industry awards for our safe operations. All of our employees are thoroughly trained on an ongoing basis to deliver MATHESON's safety standards.

MATHESON and Quality

MATHESON also places the highest value on Quality. Our plants are certified to ISO 9001 standards, and we employ Lean Six Sigma (LSS) principles to measure and improve our quality results on a basis of continuous improvement

MATHESON and Sustainability

MATHESON is committed, at all levels, and in all locations, to principles of Sustainability and Corporate Responsibility. Our principles embrace Environmental Sensitivity, Community Support, and Financial Performance. Our aim is to ensure uninterrupted access to our products and services.



Our **Mission:**

Our core competency is the supply, delivery, and management of gases and gas production sub-systems and plants. Your core competency is putting those gases to work to make your process safer, more efficient, and more profitable.

Our Mission is to focus on our core competency so you can focus on yours.

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