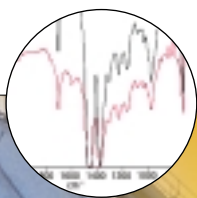


# petrochemical analysis



from **sample to analysis,**

we've got you covered

  
**PerkinElmer**<sup>®</sup>  
precisely.

# the technology, **knowledge,** service and support

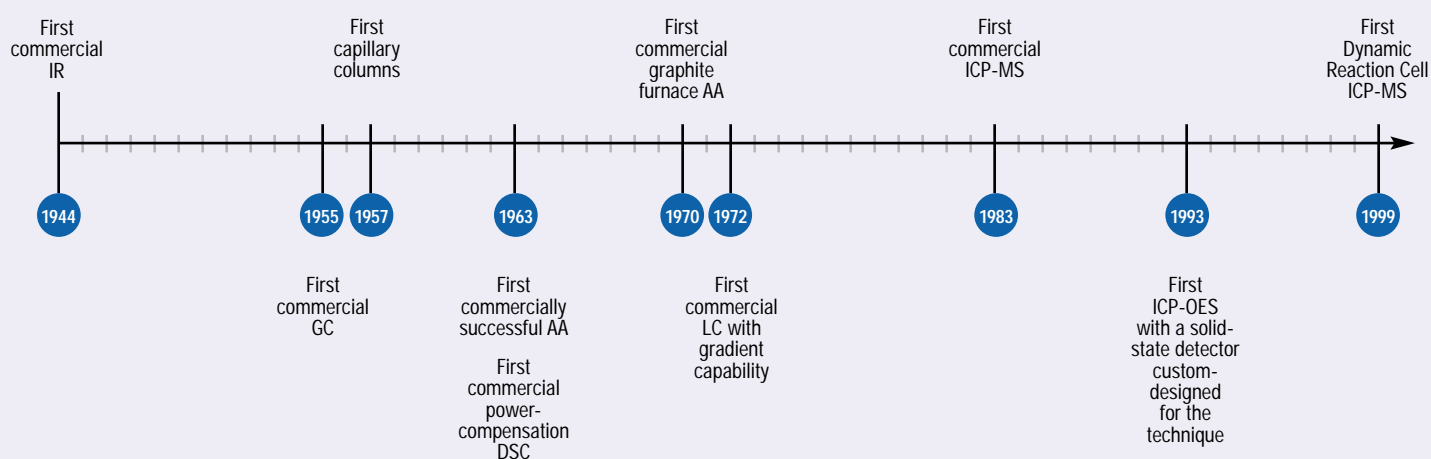


Figure 1. PerkinElmer has been a pioneer in the analytical-measurements business for more than 60 years.

## Who is PerkinElmer?

With proven leadership in product innovation, including the introduction of the first commercial instruments in Infrared Spectroscopy (IR), Gas Chromatography (GC), and Graphite Furnace Atomic Absorption (GFAA) Spectroscopy, PerkinElmer continues to make advances in systems, providing improved analytical capabilities and ease-of-use. Other innovations, from the use of capillary columns for GC and a solid-state detector designed specifically for Inductively Coupled Plasma (ICP-OES), to our latest systems that operate via touch-screen control in multiple languages, demonstrate our continued commitment to providing state-of-the-art analytical capabilities. Coupled with the business acumen of a global company, PerkinElmer has the knowledge to facilitate your business processes.

## What do you need in today's petrochemical or process monitoring laboratory?

- Analytical capability to perform the required methods
- Cost-effective packages covering the full range of laboratory needs
- Delivery of a guaranteed system and after-sale support

It sums up to the comfort of knowing your laboratory needs will be met and your business will run smoothly.

to **guarantee** success

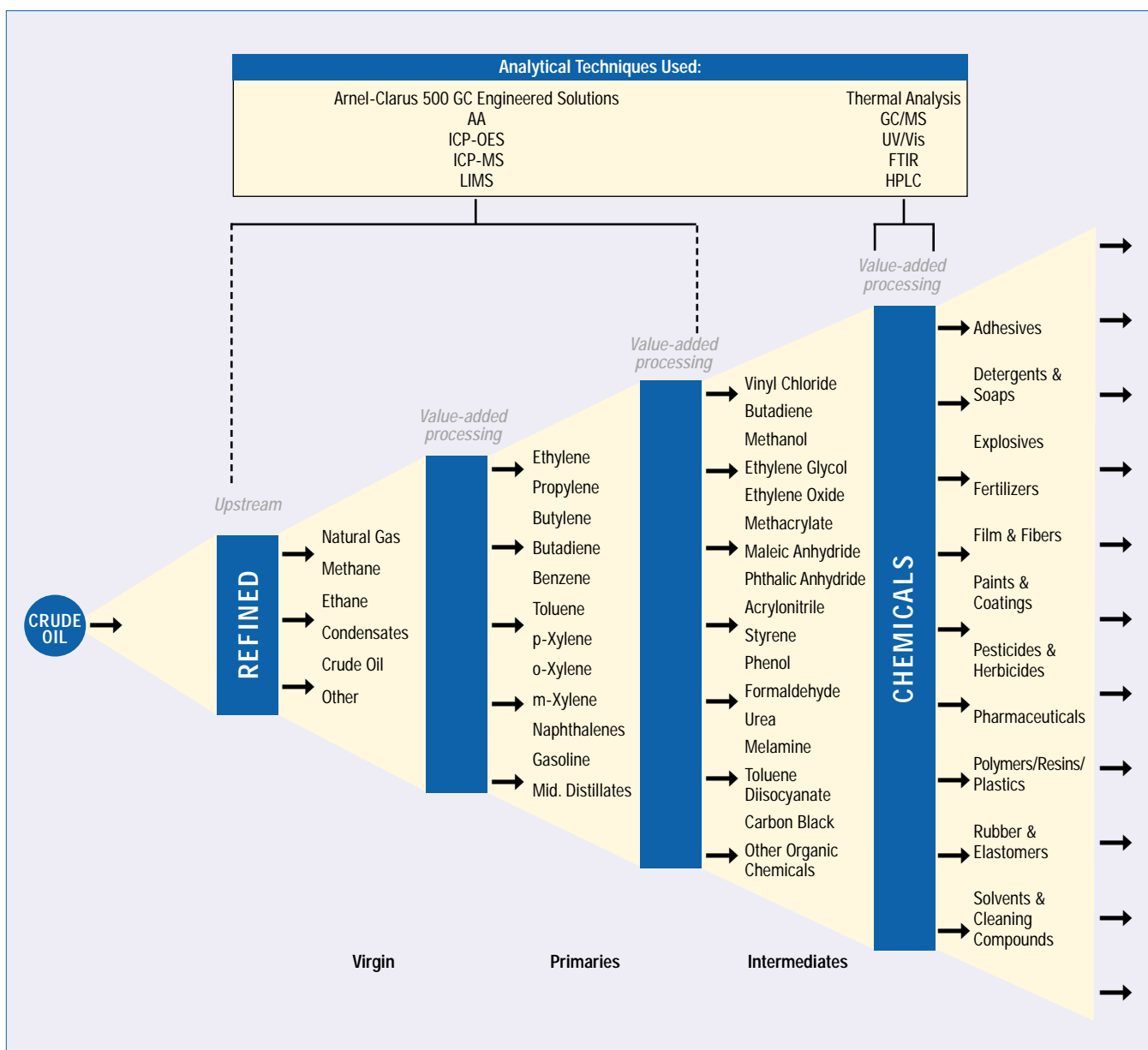


Figure 2. PerkinElmer provides instrumentation for all stages of the refinery process.

# analytical capabilities for petrochemical analyses

The measurement of volatile, semivolatile and metals components in petrochemicals is important in laboratory, quality control and process monitoring. Instrument configurations meeting the needs of ASTM and other specialized methods are required. PerkinElmer offers a full range of instruments to measure these basic parameters.

## Semivolatiles and volatiles analyses

The measurement of semivolatile and volatile components can be easily accomplished with turnkey systems designed and proven for each method. In addition to our standard Clarus® 500 Gas Chromatography systems, PerkinElmer has a long-standing relationship with Arnel™, a market leader in customized chromatography

solutions, to provide, install and support proven, dedicated systems. Systems are available for a wide range of applications and standard methods, including light-gas analysis through transformer-oil gas analysis, simulated distillation and detailed hydrocarbon analyses. Table 1 shows method compliance of established Refinery Gas Analyzer (RGA) systems and Table 2 shows similar information for Natural Gas Analyzer (NGA) systems. We work with consensus groups, such as ASTM, to promote method development with new technology and to ensure all perspectives are represented. Over 100 different turnkey systems are available, ensuring that consultation with a PerkinElmer representative will deliver the system that matches your needs, from hydrogen to asphalt.

## Hydrogen to Asphalt

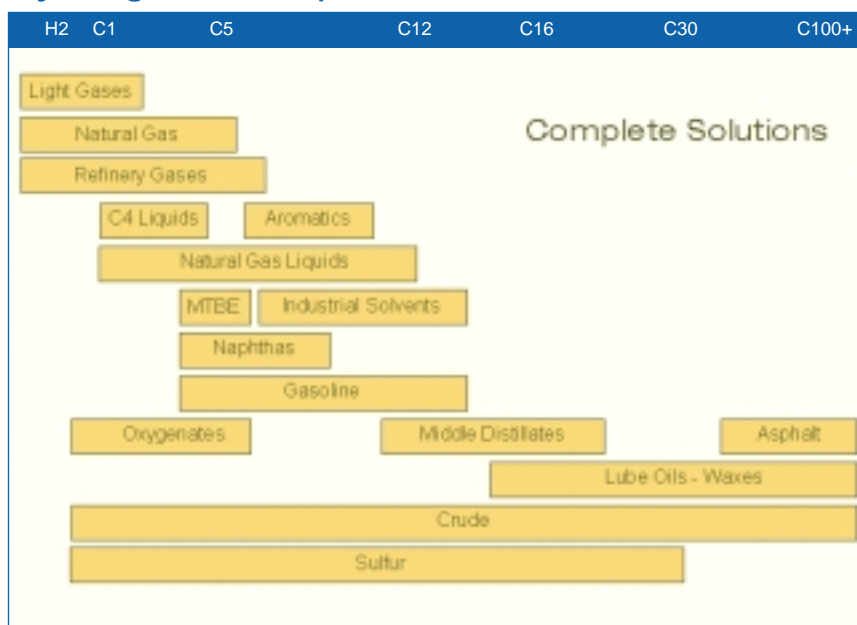


Table 1. Method Compliance for Refinery Gas Analyzer Turnkey Systems.

ASTM Method	Universal Oil Products (UOP) Method	Application Overview	PerkinElmer-Arnel RGA Model
D1945, D1946, D2597	539	H <sub>2</sub> ; O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; CO; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>5</sub> =, C <sub>6</sub> +, H <sub>2</sub> O, NH <sub>3</sub> composite peak	1001
D1945, D1946, D2597	539	He; H <sub>2</sub> ; O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; CO; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>5</sub> =, C <sub>6</sub> +, H <sub>2</sub> O, NH <sub>3</sub> composite peak	1101
D1945, D1946, D2597	539	H <sub>2</sub> ; O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; CO; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>5</sub> =, C <sub>6</sub> +, H <sub>2</sub> O, NH <sub>3</sub> composite peak	1201
D1945, D1946, D2597	539	He; H <sub>2</sub> ; O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; CO; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>5</sub> =, C <sub>6</sub> +, H <sub>2</sub> O, NH <sub>3</sub> composite peak	1301
D1945, D1946, D2597	539, 709	H <sub>2</sub> ; O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; CO; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>5</sub> =, C <sub>6</sub> + composite peak	1015, 1016
D1945, D1946, D2597	539, 709	He; H <sub>2</sub> ; O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; CO; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>5</sub> =, C <sub>6</sub> + composite peak	1115, 1116
D1945, D1946, D2597	539, 709	H <sub>2</sub> ; O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; CO; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>5</sub> =, C <sub>6</sub> + composite peak	1215, 1216
D1945, D1946, D2597	539, 709	He; H <sub>2</sub> ; O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; CO; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>5</sub> =, C <sub>6</sub> + composite peak	1315, 1316

C<sub>5</sub>= : Pentenes

C<sub>6</sub>+ : C<sub>6</sub> hydrocarbons and higher

Table 2. Method Compliance for Natural Gas Analyzer Turnkey Systems.

ASTM Method	Gas Processors Association (GPA) Method	ISO Method	Institute of Petroleum (IP) Method	Application Overview (Analytes listed for the first model)	PerkinElmer-Arnel NGA Model
D1945, D1946, D2597	2261	6568, 6974-5	None	O <sub>2</sub> /N <sub>2</sub> composite; CO <sub>2</sub> ; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>6</sub> + composite peak	2001, 2101
D1945	2177, 2261	6568, 6974-5	None	O <sub>2</sub> /N <sub>2</sub> composite; CO <sub>2</sub> ; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>6</sub> + composite peak	2201, 2301
D1945	2261	6974-5	None	Ar; O <sub>2</sub> /N <sub>2</sub> composite; CO <sub>2</sub> ; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>6</sub> + composite peak	2002, 2102, 2202, 2302
D1945, D1946	2261	None	None	O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>6</sub> + composite peak	2003, 2103, 2203, 2303
None	2165, 2177, 2186	None	None	O <sub>2</sub> /N <sub>2</sub> composite; CO <sub>2</sub> ; H <sub>2</sub> S; C <sub>1</sub> through C <sub>10</sub> ; C <sub>6</sub> + composite peak	2206, 2306
D1946	2286	6975	345	O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; H <sub>2</sub> S; C <sub>1</sub> through C <sub>10</sub> ; C <sub>6</sub> + composite peak	2008
D1946	2286	6974E, 6974-3, 6975	345	He; H <sub>2</sub> ; O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; H <sub>2</sub> S; C <sub>1</sub> through C <sub>10</sub> ; C <sub>6</sub> + composite peak	2108
D1946	2165, 2186, 2286	6974E, 6974-3, 6975	345	O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; H <sub>2</sub> S; C <sub>1</sub> through C <sub>10</sub> ; C <sub>6</sub> + composite peak	2208
D1946	2286	6975	345	O <sub>2</sub> ; N <sub>2</sub> ; CO <sub>2</sub> ; H <sub>2</sub> S; C <sub>1</sub> through C <sub>10</sub>	2009, 2109, 2209
D1945, D1946	None	None	None	C <sub>1</sub> through C <sub>5</sub> ; C <sub>6</sub> + composite peak	2000, 2100, 2200, 2300
D1945, D1946	None	None	None	O <sub>2</sub> /N <sub>2</sub> composite; CO <sub>2</sub> ; H <sub>2</sub> S; C <sub>1</sub> through C <sub>10</sub> ; C <sub>6</sub> + composite peak	2006, 2106
D1945	2261	6974-5	None	O <sub>2</sub> /N <sub>2</sub> composite; CO <sub>2</sub> ; H <sub>2</sub> S; C <sub>1</sub> through C <sub>5</sub> ; C <sub>6</sub> + composite peak	2010, 2110, 2210
D5504, D5623, D6021	None	None	None	H <sub>2</sub> S, SO <sub>2</sub> , COS, mercaptans, aromatic sulfur compounds, sulfides	4025, 4425

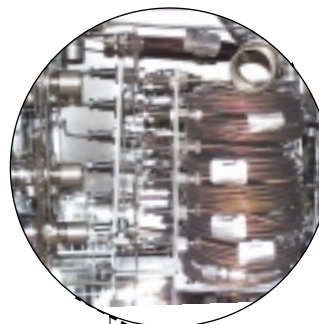
C<sub>5</sub>= : Pentenes

C<sub>6</sub>+ : C<sub>6</sub> hydrocarbons and higher

## Arnel and PerkinElmer

have worked together for more than 10 years to provide proven turnkey and customized solutions for this market. We have more than 1200 successful installations in place.

— Clarence Wentzel,  
President, Arnel, Inc.



RGA-system column assembly.

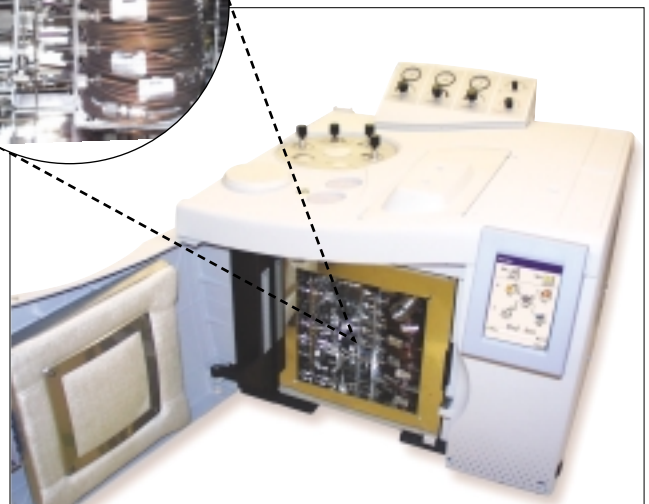


Figure 3. In partnership with Arnel, dedicated systems are available for the petrochemical industry.

# metals analysis from the **leader** in **inorganic** analysis

Inorganic measurements are also part of the analysis picture. Meeting product specifications is critical to efficient and profitable plant operation. The presence of the wrong metal or too high a concentration can poison a catalyst or cause unintentional releases to the atmosphere that can be harmful. PerkinElmer offers a wide range of inorganic measurement techniques covering the full range of metals, concentrations and matrices that might need to be evaluated. As the market leader in inorganic analysis, we are proud of our experience. We can help – from the initial instrument selection to providing delivery, support, consumables and service globally.

## Atomic Absorption with the capabilities you need

Atomic Absorption (AA) spectroscopy is a moderately priced technique, suitable for routine measurements in laboratories measuring a few samples for a few elements. PerkinElmer has a complete line of AAnalyst™ Atomic Absorption spectrometers to fit your needs from simple, manually-operated flame systems, to sophisticated, automated graphite furnace systems with quality-control software.



*Figure 4.* The AAnalyst 200 is the perfect choice for a simple, low-cost solution for metals analysis.

### Turnkey Petrochemical Solutions

- Refinery/Natural Gas Analyzers
- Simulated Distillation Analyzers
- Metals Analyzers for Petrochemicals and Lubricants
- Contaminants and Breakdown Products Analyzer for Lubricants
- Fuel Diluent Analyzers for Used Oils
- Advanced Data and Business System Handling through LABWORKS ES LIMS

## Optima ICP-OES systems maximize productivity

For laboratories requiring measurement of more than eight elements per sample or measuring large numbers of samples, ICP-OES (Inductively Coupled Plasma Optical Emission Spectroscopy) is often the better choice and has become standard in many petrochemical laboratories. Our complete line of Optima™ ICP-OES systems can provide the productivity that fits your needs and budget.

Table 3 shows the recoveries of a 10-ng/L spike for a variety of elements in a naphtha sample. The naphtha sample was run directly on the Optima 5300 ICP-OES and shows excellent results at very low concentrations.

Table 3. Inorganic Recoveries of 10-ng/L Spike in Naphtha.

Element	Spike Recovery (%)
As	100
Se	100
Hg	90
Pb	90
P	80

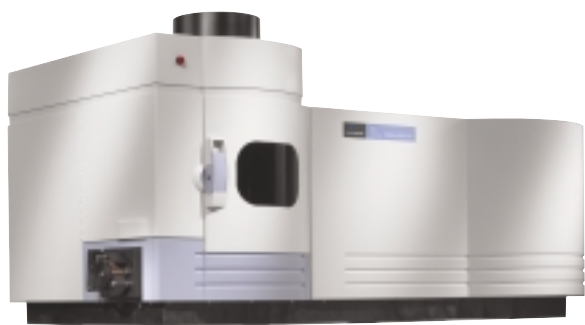


Figure 5. The Optima 5300 ICP-OES offers the performance required to maximize productivity.

## ELAN provides the ultimate in metals detection capabilities

For ultratrace measurements, ICP coupled with Mass Spectrometry (ICP-MS) is an option. Our market-leading ELAN® ICP-MS systems provide flexible solutions for ultratrace metals analysis. The popular ELAN 9000 ICP-MS system provides basic ICP-MS capabilities, while the ELAN DRC-e and ELAN DRC II systems provide freedom from common interferences with ground-breaking Dynamic Reaction Cell™ (DRC™) technology and the lowest achievable detection limits in any matrix.



Figure 6. The ELAN DRC II offers interference removal capabilities.

PerkinElmer will consult with you to provide the right instrument with capabilities specifically matched to your needs.

# total solutions to automate your lab

LABWORKS™ ES LIMS offers total solutions for petrochemical and chemical laboratories. The system's Process Scheduler functionality allows petrochemical organizations to schedule routine sampling and monitor sample statuses throughout the facility. The system is ideal for production laboratories with multiple sample-generating processes. Plant supervisors and other personnel working outside the lab have secure data access, without the need for additional training.

The module saves time and reduces errors by offering sample-oriented workflow and barcode entry of login information. The software allows sample scheduling on either a recurring, time-based or ad-hoc basis using a color-coded system. The Process Scheduler program can also be used to set up hand-held devices for field data entry.

Instrument data may also be entered using the LABWORKS Multicomponent Results Entry function. When it is necessary to capture supplementary analysis information with the samples and the results, the information can be stored as a binary large object (BLOB) file to the sample or analysis result. It can then be used for

comparisons between other samples, exporting results and chromatogram or raw-data output to a report. Calculations can be performed using either LABWORKS or Excel® Calculator.

Another key function of LABWORKS LIMS is the review of the analysis results history or trending. LABWORKS gives the analyst on-screen displays of up to 100 previous analysis results per analysis of a particular sample.

## Key Benefits of LABWORKS LIMS

- Save time with sample-oriented work flow and barcode entry
- View timed samples in monthly displays and daily listings with the Calendar View
- Organize work orders for regularly repeated tests
- Easily determine sample statuses with the Process Scheduler's color-coded system

Sample	Schedule	Priority	Status	Department
		Low	Not Ready	LAB
		Low	Ready to Collect	LAB
		Low	Ready to Collect	LAB
		High	Ready to Collect	Option3
		High	Ready to Collect	ALL
		High	Ready to Collect	ALL
		High	Ready to Collect	ALL
		High	Collected	ALL
		High	Collected	ALL
		High	Waiting Analysis	Option3
		High	Waiting Analysis	Option3
		High	Waiting Analysis	Option3

- Monitor lab performance by tracking all sample status changes
- Specify different sets of analyses for a given sample point based on the time of day or day of week collected



# supporting your laboratory

— comprehensive service and support

With over 60 years of experience, and as a world leader in analytical instrumentation, PerkinElmer is the right partner for the petrochemical industry. In concert with global distribution of instruments, turnkey systems, and consumables, we provide factory-trained global service and support.

PerkinElmer's OneSource<sup>SM</sup> Laboratory Services provides you with a comprehensive worldwide service that allows you to take care of business and set your sights on what matters most — results. With over 1000 factory-trained professionals serving more than 125 countries worldwide, PerkinElmer is your single source for instrument care and repair, validation services, software and hardware upgrades, education and more.

Our customers feel  
**secure,**  
knowing our support is available  
**worldwide.**

— *Arun Kanchanawat,*  
*Country Manager and*  
*Petrochemical Specialist, Thailand*



# related industries also benefit

PerkinElmer also provides analytical instruments to industries downstream from petrochemical processes, for example, lubricants, polymers, fine chemicals and beverages. **Beverage-grade CO<sub>2</sub>** must be analyzed for a variety of contaminants and the Arnel analyzers provide turnkey systems for carbon monoxide, methane, sulfur and other contaminants at levels meeting the requirements of International Society of Beverage Technologists (ISBT). Our newest member of the Optima family, the Optima 5300V ICP-OES, was designed for and with the input of our leading heavy-equipment customers, requiring exacting **lubricant metals analyses**. This vertical torch, radial-view system provides high productivity and low maintenance, meeting the requirements of high-productivity oils labs. Fourier Transform Infrared (FTIR) analyzers can provide information on **contaminants and breakdown products** in lubricants, or characterize material composition and purity. Other techniques, such as the PerkinElmer line of Thermal Analysis instrumentation, provide characterization information for **monomers, polymers and other materials**. High Performance Liquid Chromatography (HPLC) and UV systems add additional analysis capabilities to the laboratory.

## Whatever you're looking for, we've got it

PerkinElmer is a leading provider of scientific instruments, consumables and services to the petrochemical, pharmaceutical, biomedical, environmental testing, forensics and general industrial markets, providing integrated solutions, from sample handling and analysis to communication of test results.

So, if you are designing a new refinery or updating an existing facility, look to partner with PerkinElmer to provide a full range of analytical solutions for your business, for the long term.



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