Technologies, Solutions, and Applications

Continuous Level Coke Drum Measurement System
Refiners are processing heavier crude, which increases the amount of resid required for batch processing by the coke drums. A continuous level signal over the entire coke drum cycle is critical for operators to optimize the performance of the coke drums. This optimization results in higher throughputs and maximizes the profits from selling the resultant coke related to this critical operation in the refinery.

Advanced Design & Development

The VEGA Continuous Level Coke Drum Measurement System provides increasing process information to operators. The information provided permits the optimization of the coking cycle while reducing the negative impact on other functions in the refinery. With the experience of over 170 coke drums worldwide, VEGA’s gamma-based continuous level coke drum technology has revolutionized the coking industry. Patented, flexible, continuous level detectors have enabled VEGA to become the leader in the supply of level measuring systems for coke drums and other critical applications in the refinery.

Why Use The Coke Drum System?

VEGA has been the leader in the development of a modern continuous level system for coke drums for over ten years, which has led to a new model for coke drum control. The system is fully configurable to meet customer needs:

- Increases operator confidence by seeing a continuous level
- Optimizes antifoam savings which, reduces catalyst bed poisoning
- Decreases outage by increasing throughput with lower risks of foam overs
- Enables minimization of cycle time
- Indicates fill rate early for advanced control
- Enables quench water control
Components Overview

System Components
Selection of these various components is dependent upon each application and the customer’s measurement need. Vessel size, measurement span of interest, ambient and process temperatures, and other application variables determine the number and specification of the individual components of the system.

Main Components
1–4: FiberFlex continuous level detectors (quantity to match the desired span)
5: DSG vapor density compensation detector
6: DSG auto zero calibration detector
7: DSG x-ray interference detector
8: DSG redundant drum switch detector
9–11: SHLG source holders
Coking units require extreme heat during operation, making radiation-based measurement the ideal solution for tracking level. SHLG source holders are paired with FiberFlex® detectors for continuous measurement of the coke drum level. The SHLG is a plunger-type source holder, safely retracting the potentially large source into the container when not in use.

Principle of Operation

The VEGA Continuous Level Coke Drum Measurement System uses a series of gamma radiation sources, FiberFlex continuous detectors, and DSG point level detectors to make an accurate, continuous level measurement. The source holders and detectors are mounted externally, on opposite sides of the drum. A focused beam of radiation from the source holders passes through the drum insulation, vapor space above the process, and the walls to the detectors on the other side. As the process rises, the amount of radiation detected is reduced, thereby causing the detector to increase its output. The VEGA system uses a long-life cesium-137 source, and can provide level measurement for all or part of the drum.
Monitoring View

This view provides the operator with the overall continuous level of the process in the coke drum. The overall level 4…20 mA DC output of the VEGA system is represented as 0–100% versus time on the customer’s DCS system. Operators can visually monitor the level throughout the coking cycle. This view also tracks the vapor density detector output. This shows that as the operator raises the level in the drum, there is a level elevation where the detector senses an increase in the carryover of particulate matter. Using the VEGA system to monitor carryover of particulate matter and antifoam can decrease the chances of overhead line buildup and downstream catalyst poisoning.

Troubleshooting View

This second DCS view provides the operators and maintenance technicians with the 4…20 output, represented as 0–100%, of each continuous level detector. Technicians can quickly troubleshoot problems on any detector that can not be seen on the Monitoring View.
Benefits of the Continuous Level Coke Drum System

The patented FiberFlex radiation-based continuous level detector has many benefits over traditional level measurement technologies. For refinery applications requiring long measurements lengths such as the coke drum, the FiberFlex reduces the need for multiple rigid detectors, making it an ideal retrofit for older technologies. The powerful GEN2000 Electronics processor provides the computer capability for complex functionality without the requirement of an additional remote computer.

Complete Drum Monitoring
With the VEGA Continuous Level Coke Drum System, users can continuously measure and monitor all parts of the process cycle, including filling, foaming, antifoam use, drum switching, quenching, and draining. With increased knowledge and confidence of the process level, significant throughput increases are achievable. In addition, optimizing antifoam injection reduces downstream poisoning of catalyst beds.

Certifications
Level instrumentation is designed for certification compliance with the following programs:

- ATEX Standard
- CSA
- FM Standard
- GOST-R Standard
- CCoE
- IECEx
- Cepel
- JIS
- KTL
- RTN
Key Benefits of the System:

1. Permits continuous monitoring of the coke drum level, or leading edge of the process, throughout the entire coking cycle. The coke drum switch out point can be safely raised, increasing production efficiency and value.

2. Monitors antifoam injection effectiveness to reduce costs of the injection. This reduces foam overs and helps minimize poisoning of downstream catalyst beds. The VEGA system lowers antifoam usage and significant cost savings is achievable by reducing the change-out frequency of catalyst beds.

3. Allows re-zeroing of the system before each cycle begins for highest accuracy of each cycle. This re-zeroing helps maintain system accuracy for each cycle, regardless of crude slate variations.

4. Provides monitoring of drum carryover into the fractionator and other downstream equipment, resulting in considerable cost savings in catalyst beds and cleaning of piping systems.

5. Uses the internal RS-485 gauge-to-gauge communication network for extensive diagnostics, increasing uptime and reducing time spent troubleshooting problems in the field.

FiberFlex and DSG on Coke Drums

Patented, highly sensitive scintillation fiber and crystal technology coupled with advanced electronics provide the ability to make very long and accurate measurements.

- Lightweight construction eliminates need for cranes of special rigging for mounting
- No moving parts, external mounting, and conduit mounting system reduce maintenance and installation costs
- Long detector length eliminates the need for multiple rigid detectors and minimizes the need for additional platform construction
- Standard product design for fast availability
- Low weight enhances personnel safety and reduces shipping costs
System Components

The FiberFlex is a flexible, radiation-based level detector featuring GEN2000® electronics. With its patented fiber-optic scintillation bundle, the FiberFlex has significant advantages over both solid scintillators and traditional ion chamber detectors.

**FiberFlex**

<table>
<thead>
<tr>
<th>Flexible continuous level radiation detector</th>
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<tbody>
<tr>
<td>• High-sensitivity scintillation bundle</td>
</tr>
<tr>
<td>• Powerful GEN2000 electronics permits a wide range of setup and compensation options</td>
</tr>
<tr>
<td>• 4 … 20 mA/HART output signal with internal RS-485 permits flexible communication and troubleshooting capabilities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measuring Range:</th>
<th>Up to 23 ft (7 m) per detector; multiple detectors can be combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature:</td>
<td>-4° ... +122°F (-20 ... +50°C)</td>
</tr>
<tr>
<td>Measuring Precision:</td>
<td>± 1% of span</td>
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The DSG is a compact radiation-based point level and density detector. It utilizes a highly sensitive scintillation crystal and features GEN2000 electronics.

**DSG**

<table>
<thead>
<tr>
<th>Radiation detector measures vapor density, x-ray interference, and provides advanced functionality</th>
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<tbody>
<tr>
<td>• Non-contact measurement</td>
</tr>
<tr>
<td>• 4 … 20 mA/HART output signal with internal RS-485</td>
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<table>
<thead>
<tr>
<th>Measuring Range:</th>
<th>Fixed point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient Temperature:</td>
<td>-4° ... +122°F (-20 ... +50°C)</td>
</tr>
<tr>
<td>Measuring Precision:</td>
<td>± 1% of span</td>
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The SHLG safely handles large activity sources for demanding applications in refining. Fabricated from structural steel, the SHLG provides shielding for applications requiring up to 10 Curies (370 GBq) of cesium-137. The SHLG is used in point and continuous level applications, especially large diameter and average wall thickness vessels.

**SHLG**

**Structural steel source holder**
- 316 stainless steel housing material
- Convenient, integral lifting eyes
- Three configurations optimize size and weight for the required source activity

<table>
<thead>
<tr>
<th>Housing Material:</th>
<th>Lead filled 316 stainless steel</th>
</tr>
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<tbody>
<tr>
<td>Shielding Material:</td>
<td>Lead</td>
</tr>
<tr>
<td>Handle/Shutter:</td>
<td>Push/pull handle, Lockable in the closed position</td>
</tr>
<tr>
<td>Max. Source Activity:</td>
<td>Cs-137: 10,000 mCi (370 GBq), Co-60: 500 mCi (18.5 GBq)</td>
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<tr>
<td>Collimation Angle:</td>
<td>0°, 30°, 45°</td>
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“With the VEGA ReSource® Program, VEGA provides a responsible method of source life cycle management. Field Service engineers offer assistance from installation through final transfer at decommissioning. At the end of the source’s useful life, VEGA will accept ownership of the source.”
Radiation Safety and Product Training

VEGA Americas offers a variety of classes specifically designed to meet the technical, safety, and training needs of our customers. There are a variety of different Radiation Safety classes designed specifically for those who use radiation-based products, including:

- Radiation Safety Officer Certification
- Radiation Safety Officer Review
- Introduction to Radiation Safety
- Radiation Safety for Gauge Users
- Intermediate Radiation Safety

World Class Nuclear Services

The VEGA team is trained to provide superior customer service by telephone or e-mail for source and detector systems and outputs. In addition, on-site assessments can be performed at the customer’s location, anywhere in the world. The team assists the customer with nearly every aspect of radiation-based measurement systems, including:

- Nuclear Setup and Commissioning
- Meter Calibration
- Maintenance and Repairs
- Logistics
- Licensing
- Radiation Safety Program Auditing
- Source Reuse and Recycling with ReSource®

With over sixty years of experience, VEGA Americas provides a variety of radiation-based services and training. VEGA Field Service staff provide unsurpassed expertise in fulfilling mandated radiological surveys and inspections. Radiation Safety and product training classes are held year-round at VEGA Americas’ office in Cincinnati, Ohio.