

# Sakai Refinery—Endeavoring to Secure Stable Supplies and Safe Operations

The Cosmo Oil Group pursues comprehensive initiatives to secure the stable supply of petroleum that sustains society and day-to-day livelihoods, while placing a strict emphasis on safe operations with the goal of eliminating accidents. The Sakai Refinery recently deployed the Group's first heavy oil cracking facilities and is one of many production sites where employees pursue autonomous initiatives for safety management. In this feature article, frontline employees describe the initiatives that the Group is pursuing to secure stable supplies and safe operations that are eco-friendly by leveraging cutting-edge equipment and each individual's expertise.

## Data for Sakai Refinery

Address: Chikko Shinmachi 3-16, Nishi-ku, Sakai City, Osaka Prefecture

Started Operations: October 1968

Site Area: 1,246,368 m<sup>2</sup>

Crude Oil Refining Capacity: 100,000 barrels/day

Delayed Coker Unit Capacity: 25,000 barrels/day

Coker Naphtha/Distillate Unionfining Unit Capacity: 42,000 barrels/day

ISO 9001 Certification: Acquired February 18, 1997

ISO 14001 Certification: Acquired March 20, 1998

## Launch of Heavy Oil Cracking Facilities to Cope with Shifts in the Composition of Demand

### A Group Mission to Secure the Stable Supply of Petroleum

The business climate that surrounds the petroleum industry is shifting today in significant ways. Demand for petroleum is shrinking in Japan due to factors such as factories and power plants migrating to LNG and other fuels away from heavy fuel oil (heavy oil distillates), which is being driven by high crude oil prices and global warming measures. Meanwhile, there is rising global demand for light oil distillates, such as gasoline, jet fuel, kerosene and diesel fuel, driven by higher living standards in developing countries and other factors.

In July 2008, the Cosmo Oil Group launched the Cosmo Bottom Upgrading (CBU) Project at the Sakai Refinery. The purpose of the project was to enable the refinery to flexibly respond to changes in the composition of demand for petroleum products and fulfill its social responsibility to secure the stable supply of petroleum. Yasuaki Iwata, the Assistant GM at the Sakai Refinery who previously held the position of CBU Project Manager, speaks more about the CBU Project.

### CBU Project Aimed at Developing High-Added-Value Products

#### Q: What was the purpose of the CBU Project?

**Iwata:** The purpose of the CBU Project was to deploy new heavy oil cracking facilities at the Sakai Refinery for the production of high-demand naphtha and diesel fuel. Both naphtha and diesel fuel are produced using heavy oil that is ordinarily turned into products such as heavy fuel oil and asphalt through distillation.



Delayed Coker Unit



Coker Naphtha/Distillate Unionfining Unit



**Yasuaki Iwata**  
Assistant General Manager, Sakai Refinery

The heavy oil cracking facilities comprise a Delayed Coker Unit (coker unit) for the pre-process and a Coker Naphtha/Distillate Unionfining Unit for the post-process. The coker unit conducts thermal cracking of heavy oil to generate oil for processing in the Coker Naphtha/Distillate Unionfining Unit. This process removes the sulfur components to produce light naphtha, heavy naphtha, jet fuel or diesel fuel according to the product specifications. The facilities effectively convert heavy fuel oil—for which there is shrinking demand—into high-added-value light oil distillates.

The heavy oil cracking facilities at the Sakai Refinery went on line in fiscal 2010. The new facilities have positioned the Cosmo Oil Group to effectively utilize heavy oil and secure the stable supply of petroleum to cope with changes in the composition of demand for petroleum products.

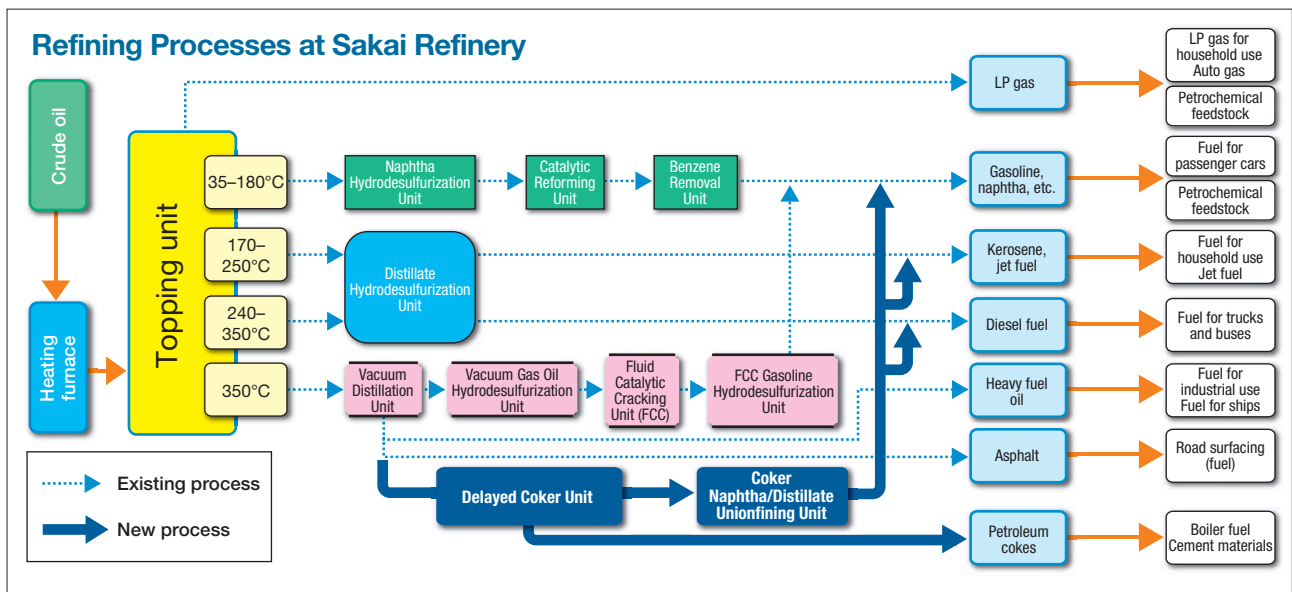
**Four-and-a-Half Year Project Necessitated Environmental Initiatives and Comprehensive Safety Management**

**Q: The whole process from launching the CBU Project until the completion of the facilities took four and a half years, including the preparations. How was the project carried out?**

**Iwata:** The coker unit at the Sakai Refinery is the fourth in Japan, while the Coker Naphtha/Distillate Unionfining Unit is the first in Japan. Since we didn't have any expertise with this kind of unit, we had to start from the ground up.

First, we worked with an American licensor who holds a process license for thermal cracking and light oil distillate production. We spent the initial 18 months on drawing up the basic plan and an additional 18 months on the detailed design. The remainder of the project duration was devoted to construction of the facilities. It was a huge project involving a total of 520,000 people to build the facilities.

One of the major challenges in advancing the project was dealing with the environmental assessments. We had to calculate the volume of expected CO<sub>2</sub> emissions from the heating furnace of the coker unit, and repeatedly coordinated with government authorities to devise methods for offsetting the expected increase in emissions through the overall business operations of the Cosmo Oil Group. For nitrogen oxide (NOx) emissions, we made improvements to our existing machinery and reduced the overall environmental impact of the refinery. We also placed an emphasis on dialogue with local residents. We held community meetings







and conducted public hearings to brief the community on our environmental and safety initiatives, which helped contribute to their understanding.

**Aiming for Top-Notch Performance in Japan**

**Q: What kind of cutting edge**

**safety technologies is the Sakai Refinery using for the heavy oil cracking facilities, and what is the future vision for the facilities?**

**Iwata:** We have taken steps to increase the sophistication of the safety instrumentation. For example, we are using sensors and other safety mechanisms in redundancy to thoroughly eliminate risks and deploying more sophisticated

communications systems between the production floor and control center. We have also incorporated self-analysis features into our instrumentation.

Moving forward, the Sakai Refinery will endeavor to deliver top-notch production from the heavy cracking facilities at an unsurpassed level in Japan. We will achieve this by collecting diverse production floor expertise and organizing the information so that it can be shared throughout the Group. Our aim is to achieve high added-value that is No. 1 in Japan.

The Cosmo Oil Group will continue to secure stable supplies regardless of how the composition of demand for petroleum products changes by leveraging cutting-edge technology and the expertise of its employees. That is the kind of commitment that the Group has embraced for the heavy oil cracking facilities at the Sakai Refinery.



**Hiroki Yamamoto**  
Engineer, No. 2 Refining Section, Sakai Refinery

## Each Person Striving to Enhance Safety, to Achieve and Maintain a Zero Accident Record

**Change 21 Activities Aimed at Rebuilding the Framework for Safety Management**

The Cosmo Oil Group engages in Group-wide initiatives from the production floor that aim to enhance safety from various angles in order to achieve and maintain a zero accident record.

The Group launched a major push to enhance safety in response to an explosion and fire that occurred at the Chiba Refinery in April 2006. The Group organized the Change 21 activities in order to rebuild the framework for safety management through the combined efforts of all members at refineries, the head office, Group companies and business partners. Under the program, the Group is implementing initiatives to enhance safety by leveraging input from the production floor. The Group has since revealed the Cosmo Oil Safety Reinforcement Declaration in 2008, and is presently implementing a zero-accident campaign. This campaign is aimed at raising safety awareness throughout the Group and

implementing autonomous safety initiatives at refineries, with a focus on encouraging behavior and verification that pays strict attention to safety.

An important cornerstone of the Change 21 Activities is the autonomous safety initiatives that are driven by each individual working at the refineries. We spoke with Hiroki Yamamoto, Engineer of the No. 2 Refining Section at the Sakai Refinery, who is responsible for overseeing the autonomous safety initiatives implemented by the production side at the Sakai Refinery.

**Four Areas of Autonomous Safety Initiatives, Implemented through the Efforts of Each Individual**

**Q: Could you give us a concrete description of the autonomous safety initiatives?**

**Yamamoto:** The autonomous safety initiatives at the Sakai Refinery center around four main areas of activities: on-stream

inspection (OSI) recommendation, risk assessment, My Area activities, and skills enhancement.

OSI recommendation is an initiative under which our equipment operators conduct inspections and verification by themselves during the operation of the equipment. This enables the operators to identify irregularities such as corrosion in pipes and wastage, so that they can recommend that repair and maintenance staff take action. We carry out routine inspections and patrols six times a day together with critical inspection patrols conducted several times a month. These inspections have become a critical part of the operators' work.

Under our risk assessment initiatives, each employee endeavors to identify potential risks attached to their equipment and work, and share this information to prevent accidents. My Area activities encourage strict adherence to the three principles of tidiness, orderliness and cleanliness, in order to build an environment that facilitates the early identification of predictive factors for malfunctions. Our skills enhancement initiatives are currently focused on teaching younger employees how to deal with defects or irregularities that occur with the equipment that they oversee during night shifts or on weekends when repair and maintenance staff may not be available.

The Cosmo Oil Safety Reinforcement Declaration clearly outlines the responsibilities and authorities of departments and individuals for enhancing safety, encouraging each production floor employee to take action to enhance safety. This approach is at the heart of the autonomous safety initiatives that we implement at the refinery.

#### Pursuing a Group-Wide Zero-Accident Campaign

**Q: Could you describe the production floor initiatives that are being carried out under the zero-accident campaign?**

**Yamamoto:** We are pursuing a Group-wide zero-accident campaign as part of our risk assessment initiatives to raise awareness of zero-accident goals and encourage action, from senior management through to the production floor. The most important activity under the zero-accident campaign is risk prediction. On the production side, we conduct training for the prediction of human risks, together with regular training for predicting equipment risks, which are effectively enhancing each employee's ability to predict risks. We are also encouraging the comprehensive use of point-and-call procedures in situations where there are probable risks.

Many accidents occur when unsafe circumstances overlap with unsafe actions. By pointing and calling to alert other employees to risks, we can prevent most accidents from occurring.



**Q: What kind of results have you achieved from implementing the zero-accident campaign?**

**Yamamoto:** As a result of encouraging each production floor employee to focus on safety and thoroughly verify their work, we are seeing a decrease in problems and malfunctions that can develop into accidents when not properly dealt with. By implementing Group-wide initiatives to ensure that employees engage in safe actions as a force of habit on the production floor, we are endeavoring to eliminate risks at the source, to achieve and maintain a zero-accident record.

#### Integrating Environmental Management Initiatives with Safety Management

**Q: Restricting emissions of environmentally hazardous substances is another important area of activity for refineries. Could you tell us what the Sakai Refinery is doing in this area?**

**Yamamoto:** The refineries of the Cosmo Oil Group place a strong emphasis on their impact on air and water quality, focusing on facility management to reduce emissions of environmentally hazardous substances. At the Sakai Refinery, we conduct regular inspection patrols as part of our autonomous safety initiatives, which also benefit our environmental management. We conduct six patrols per day that include inspecting NOx and sulfur oxide (SOx) analyzers to ensure that they are functioning properly, and we constantly monitor water quality. Safety management and environmental management initiatives are fully integrated at the production floor level.

The Cosmo Oil Group is pursuing both safety and environmental performance by raising the awareness of each production floor employee. These activities will evolve together with employees.

## Securing a Stable Supply and Safe Operations at the Forefront of the Cosmo Oil Group



**Hiroaki Fujioka**  
Senior Executive Officer  
and GM of Sakai Refinery

The Sakai Refinery is fulfilling its responsibilities to secure a stable supply and safe operations through the construction of the heavy oil cracking facilities, which are a first for the Cosmo Oil Group.

The deployment of heavy oil cracking facilities to produce high-demand diesel fuel and jet fuels enables us to fulfill our mission to secure stable supplies of petroleum on a global basis. We succeeded in constructing the facilities with no major accidents through comprehensive safety management. Looking ahead, I am personally committed to further spreading the message of safety, and continuing to engage in dialogue with each of our employees.

We have also reexamined our environmental equipment together with the construction of the heavy oil cracking facilities. We made upgrades to our existing equipment in order to reduce the overall environmental impact of the refinery, enabling the refinery to keep NOx emission levels the same despite bringing the heavy oil cracking facilities on line.

The diverse activities implemented at the Sakai Refinery are a snapshot of the initiatives that are being pursued throughout the Cosmo Oil Group. The Sakai Refinery will continue endeavoring to secure stable supplies and safe operations that are environmentally friendly, at the forefront of the Group.