New web-based Concawe water use/ effluent quality survey

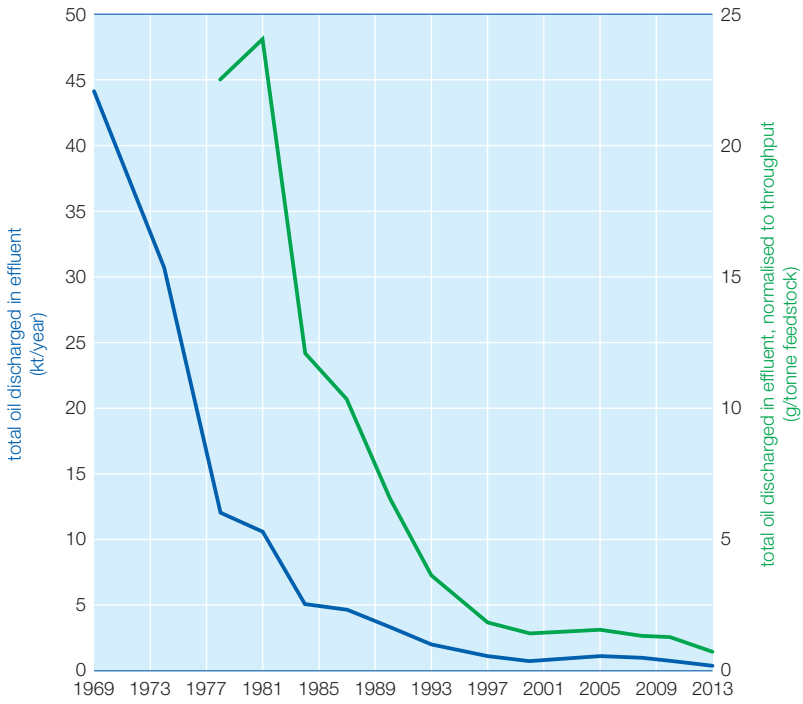
A new water use/ effluent quality survey is launched to efficiently record refinery discharges and address EU initiatives on the sustainable use of water resources.

Background

Since the founding of Concawe in 1963, great progress has been made towards improving water quality in Europe. Refineries have played their part in this, with substantial reductions in discharges and improvements in effluent quality leading to large reductions in the quantities of pollutants discharged to surface waters. This is clearly illustrated by Figure 1 below, which shows a large reduction in the discharge of oil in water from 1969, when the first Concawe survey of refinery effluent discharge was completed, to the most recent survey in 2013.

In recent years the development and implementation of EU legislation, including the Water Framework Directive (2000/60/EC), the Industrial Emissions Directive (2010/75/EC), the European Pollution Release and Transfer Register Regulation (EC 116/2006) and REACH (EC 1907/2006), has led to a growing need for data on refining sector water use and effluent quality. In particular, additional data on water use and consumption is needed to address legislative initiatives under the 2012 Blueprint to Safeguard Europe's Water Resources and the 2016 EU initiative on the circular economy. For example, the latter includes a legislative proposal on water reuse, known as the 'Water is too precious to waste' initiative (EC, 2017), which promotes treated wastewater reuse to build resilience against an anticipated increase in the frequency and severity of drought events. As a result of such initiatives, industrial stakeholders will face increased pressure to maximise water reuse and reduce freshwater consumption, e.g. during the revision of Best Available Techniques (BAT) reference documents (BREFs).

Figure 1 Concawe survey data for effluent discharge from European refineries, 1969 to 2013



While early Concawe surveys primarily addressed the discharge of oil in effluents, the survey has expanded since 2005 to take into account the growing number of substances that are subject to EU-wide discharge limits or environmental quality standards. In addition, the survey has been adapted to capture data on water treatment processes, freshwater consumption and water reuse. With the increased size and complexity of the survey, however, the use of spreadsheets for data entry has become difficult, leading to an increased risk of data entry errors or partial completion.

To address this issue the Concawe refinery effluent Special Task Force (WQ/STF-34) has developed a new web-based data collection system for the 2016 reporting year. The new system will streamline data capture, provide sites with an immediate overview of their water use, and expedite the process of data analysis and reporting. In particular, the new survey will provide additional insight into water reuse, which is likely to become an increasingly important performance metric for refineries in future years given the European Commission focus on sustainable use of water resources.

The new web-based water use/effluent quality survey will be deployed to Concawe member company refineries in the final quarter of 2017 along with training videos to demonstrate the process of data entry. As with previous surveys, the data gathered will be held in secure storage and only communicated outside the secretariat in the form of aggregated statistics, so that data cannot be attributed to individual refineries.

Survey distribution platform

The survey will be hosted on a new Concawe survey platform, which has been developed to efficiently manage multiple surveys of refinery emissions and discharges. The survey operates within a secure (encrypted) browser protocol (https), with different access rights for platform administrators, survey administrators and refinery users. For each reporting refinery, data entry is managed by a focal point nominated by the member company, who is then responsible for coordinating and approving the site response. Where refineries comprise multiple sites (e.g. with separate water supplies and wastewater treatment facilities) the focal point can advise that a separate survey will be returned by each facility. The Concawe science executive responsible for the survey will be able to review the completion status of each survey via a control panel, and also view the data contained in each survey return for quality assurance/quality control (QA/QC) purposes.

Survey design

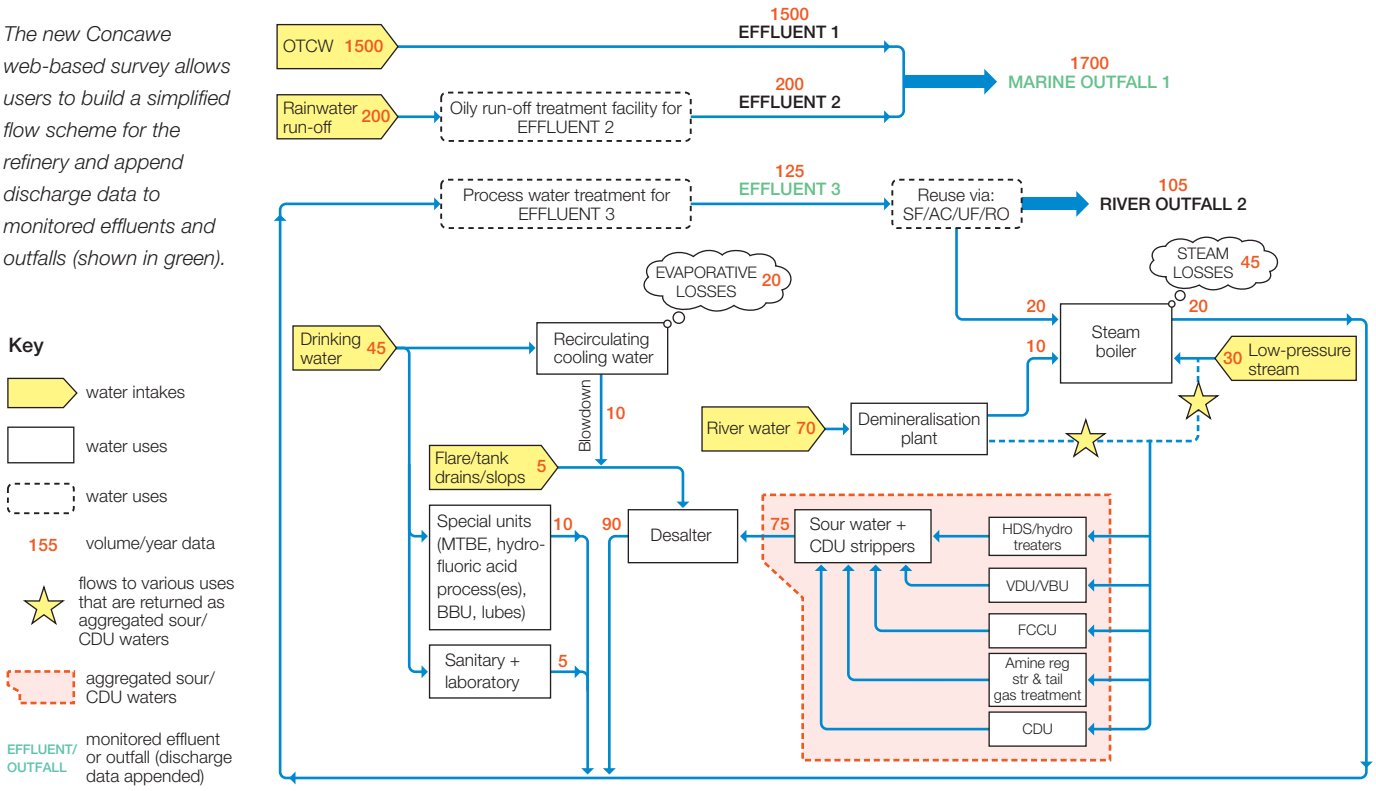
Figure 2 shows the design concept for the new web-based survey. The survey allows users to build a simplified process flow scheme for their refinery, incorporating the major intakes, effluents, outfalls and water uses. A site water balance is calculated based on the reported annual flow data and can be viewed alongside a Sankey[1] diagram to identify any data entry errors. The new survey design also provides users with a summary report of water use and discharge data to facilitate QA/QC prior to survey submission.

Intakes, effluents, outfalls and discharges

When completing the water use/effluent quality survey users first enter data on feedstock capacity and throughput, which is used to normalise substance discharge data. They then define the site intakes, effluents and outfalls. In accordance with previous surveys,

Figure 2 Simplified flow scheme for refinery water use illustrating the design concept for the new web-based survey

The new Concawe web-based survey allows users to build a simplified flow scheme for the refinery and append discharge data to monitored effluents and outfalls (shown in green).



[1] A Sankey diagram is a specific type of flow diagram, in which the width of the arrows is shown proportionally to the flow quantity.

effluents are defined as treated wastewaters or flows that do not require further treatment prior to discharge. Outfalls are the actual points of discharge to the water body, and may comprise more than one effluent stream if these are merged prior to discharge. When the effluents and outfalls have been defined the user can add details of the treatment processes applied to effluents, as well as discharge data for monitored effluents and outfalls.

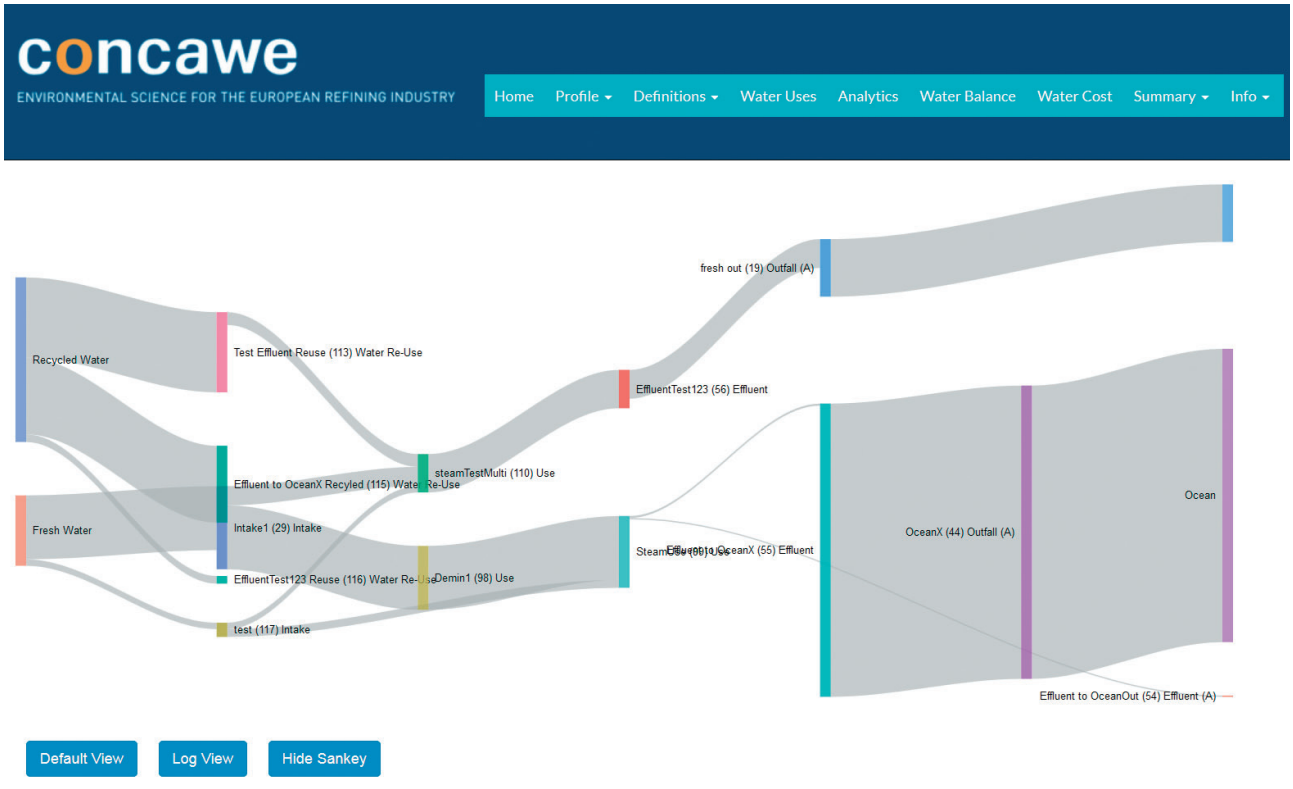
Water use and reuse

When the intakes, effluents and outfalls have been defined, users can add the major water uses to each intake to describe the routing of water through the refinery. A standard list of uses has been developed, containing water uses for which it is considered that annual use volume data may be available. Water can be routed through one or more uses before being assigned to one of the effluent streams. As data is entered, a Sankey diagram is built, which describes the flow of water through the refinery (see Figure 3). The Sankey diagram makes it easier for the user to identify incomplete data entries, for example where an intake has been defined but is not linked to any effluent.

In addition to the standard intake types, the new survey allows the following special intake types to be defined, which provide data on the **efficiency of site water use**:

- **Rainwater intake:** used to specify whether the annual rainfall volume is known, whether rainfall is included in the reported effluent volume data, and whether captured rainwater is used on-site.
- **General reuse intake:** used to show where water is recovered from an effluent stream for reuse.
- **Sour/crude distillation unit (CDU) water intake:** used to report the annual volume returned to the sour/CDU water stripper (comprising aggregated flows from production units not reported individually in the survey).

Figure 3 Example Sankey diagram from the new web-based survey, showing water flows for a hypothetical refinery



Water intake, treatment and discharge costs

To address the growing regulatory focus on water pricing (e.g. WWAP, 2017), the 2016 survey captures the total cost of water intakes, the total cost of water treatment and the total cost of discharges. Users are also requested to specify which costs are included in these totals to allow for meaningful aggregation of the data. The cost data will be analysed to provide an improved understanding of how changes in water supply costs could impact the European refining sector.

Survey outputs

When the survey has been completed, a printable summary report of water use and discharge data can be viewed. The summary includes standard Carbon Disclosure Project (CDP), Global Reporting Initiative (GRI) and IPIECA sustainability metrics for water use, as shown in Table 1. The summary also includes mass loadings for all reported substances and the complete water balance Sankey diagram.

Analysis and reporting of 2016 survey data

A statistical analysis of the data returns will be completed to provide an improved understanding of how European refineries manage water resources. The data will also be used to assess trends in discharge quality over time, and the performance of different water treatment technologies. As with previous surveys, Concawe reports and publications will be published to highlight key findings and provide the scientific understanding needed for effective decision making.

References

EC (2017). *Water is too precious to waste.* European Commission, DG Environment (online). http://ec.europa.eu/environment/water/reuse.htm

WWAP (2017). *The United Nations World Water Development Report 2017. Wastewater: The Untapped Resource*. United Nations World Water Assessment Programme. Paris, UNESCO. www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/2017-wastewater-the-untapped-resource

Table 1 Standard CDP, GRI and IPIECA sustainability metrics for water use

Note that the GRI metric GRI EN10 is also used within CDP and IPIECA reporting metrics.

	Metric	Unit
GRI water use metrics	Total Water Withdrawal (GRI EN8)	m^3/year
	Total Water Discharged (GRI EN21)	m^3/year
	Total Water Recycled + Reused (GRI EN10)	m^3/year
	Percent Recycled + Reused / Total Withdrawal (GRI EN10)	%
CDP water use metrics	Water Consumption by Barrel of Oil Equivalent (BOE)	m^3/metric tonne
	Water Withdrawal Volume by Source	m^3/year
	Water Discharge Volume by Body	m^3/year
	Total Water Withdrawal (GRI EN8)	m^3/year
	Total Water Recycled + Reused (GRI EN10)	m^3/year
	Percent Recycled + Reused / Total Withdrawal (GRI EN10)	%
IPIECA water use metrics	Total Freshwater Withdrawals	m^3/year
	Total Freshwater Discharged	m^3/year
	Total Freshwater Consumed	m^3/year
	Total Freshwater Consumed per unit of production	m^3/unit production
	Total Water Recycled + Reused (GRI EN10)	m^3/year
	Total Petroleum Hydrocarbons Discharged	metric tonne/year