Scenario 1 : Power Generation

The Installation :

The installation is a heavy fuel oil (HFO) fired power station generating electricity with export of electricity to the national grid and steam for industrial use. It is regulated as a combustion installation under Annex I of the Directive and produces around 285,300 tonnes CO_2 per year.

The equipment for electricity generation comprises of two main boilers feeding into steam turbines, two smaller gas turbines which provide additional support capacity for industry or grid balancing as required, and three auxiliary boilers that produce steam to support electricity generation and maintaining elevated temperature of the HFO in the bulk fuel tank.

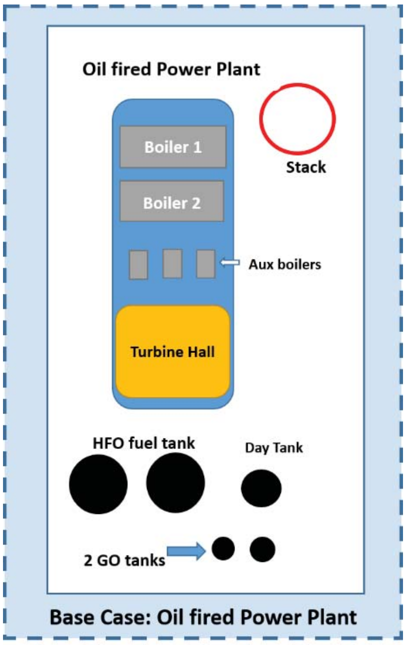
All the boilers burn HFO and use propane as a start-up fuel. The gas turbines are fired on gas oil.

In addition to the equipment for electricity generation there is a propane-fired heating system installed in the workshop area; and three fixed fire-fighting pumps to supplement water pressure and flow in the event of an emergency. These pumps are powered by engines which burn gas oil.

Very small quantities of gas oil and propane are used on site by portable (but not mobile) combustion units used during maintenance.

The HFO is stored in two large bulk tanks with a smaller quantity transferred to a day tank for immediate use; two separate gas oil tanks are in the same storage compound.

The outline and boundary of the Power Plant for Scenario I is provided below



Fuel accounting :

Heavy Fuel Oil (HFO) is delivered to site by ship tanker and transferred to the bulk storage tanks; ship and bulk tank levels are measured before and after deliveries using independent tank dips and accounting for fuel density and temperature using tank tables with a reference temperature of 15°C.

Changes in bulk tank stocks are measured by automatic level & temperature gauges at the end of each month, and cross-checked by manual tank dips.

Representative HFO samples are taken upon delivery into the storage tanks and at the end of each month when the tanks are independently dipped; these are sent for analysis at an external laboratory to determine composition and NCV.

Gas Oil and Propane are delivered by road and consumption is calculated based on delivery notes from the supplier.

Emissions factors and NCV for Gas Oil and Propane are taken from the National Inventory default values.[1]

Consumption (Activity Data) of all fuels is based on a stock balance using the data collected from deliveries and tank level changes.

1. Questions :

a) What questions should a verifier ask itself to determine the depth and scope of verification for this year? What elements are important given the information in the context?

b) What additional information should the verifier ask for to allow it to determine the depth and scope of verification sufficiently?

c) What is the category of the installation and the materiality level to be applied?

d) What role does the materiality level and materiality considerations play in determining the scope and detail of verification? How is this connected to the verifier's risk analysis?

e) Given the context in this case, what inherent and control risks should the verifier identify and on what elements should the verifier focus its verification checks? Please indicate the reasons why the verifier should focus on these elements and indicate what questions the verifier should ask itself when identifying the risks and determining the scope.

f) What would be the scope of the test plan and the data sampling plan in the verification plan[2] to test the fuel accounting data (i.e. what fuels and other issues should be included and how much of the data should the verifier test – and why?)

Additional Information 1.1:

The operator has taken a decision to test fire this year some alternative fuels to determine if these are appropriate fuels in the shorter term going forward (from both a cost effectiveness, carbon reduction and generation efficiency perspective); there are four fuels under consideration – Rape seed oil; Tall Oil; Cashew nut oil; and Reclaimed oil.

Additional Questions under 1.1:

1.1a What questions should the verifier ask itself when confronted with the changes in the operation of the installation that occurred during the reporting year?

1.1b What additional implications does the operator's claim have that these alternative fuels are bioliquids with non-reportable (i.e. zero-rated) emissions for the verification?

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[1] Standard factors used by the Member State for its national inventory submission to the Secretariat of the United Nations Framework Convention on Climate Change

[2] The verification plan consists of a verification programme, a test plan and a data sampling plan (Article 13 AVR)

Scenario 2 : Power Generation is attached to a Refinery

In scenario 2, the Power Plant and a nearby Refinery[3] are part of the same industrial complex under the same holding company.

The Installation

The Power Generation facilities described in Scenario 1 form part of an industrial complex that includes a refinery which produces around 2,409,670 tonnes CO_2 per year. The Power Plant delivers steam to the Utility plant of the refinery. The refinery is located a mile inland from the coast and has an annual crude oil throughput of around 210,000 barrels per day (bbl/day). The refinery receives crude oil by ship, primarily from the North Sea, and exports refined products by ship, road tanker, wagon and pipeline across Europe and to other parts of the world.

The technical units at the refinery consist of; a 210,000 bbl/day Crude Distillation Unit (CDU), 3 Hydro-treaters (HT), Vacuum Distillation Unit (VDU), Visbreaker Unit (VBU), Fluidised Catalytic Cracking Unit (FCCU), Unifiner Unit, Catalytic Reforming Unit (CRU), Isomerisation Unit, Hydrogen Recovery Unit, Merox Units, Utilities Plant, LPG Recovery Unit, Butamer Unit, Alkylation Unit, Amine Regeneration and Sulphur Recovery Unit, Wastewater Treatment Unit, Crude Oil and Product Storage, three flares, two jetties and a road tanker loading facility.

The fuels combusted and materials used within the refinery[4] are : Heavy Fuel Oil (0.3%), Refinery Fuel Gas (51.3%), Natural Gas, Refinery Flared Gas (2.3%)[5]; Gas Oil (0.2%); Acid Gas (<0,0%), LPG (0.1%), FCCU Coke (45.5%) and CRU Regen Coke (0.3%).

Fuel accounting

HFO for use in the Power Plant is stored in a dedicated storage tank and accounted for as is described in Scenario 1 above. HFO used in the refinery is also taken from the dedicated storage tank. Refinery Fuel Gas (RFG) is derived from off gases collected from the various process units that are blended in Vessel 30-V-4809 and put into the gas ring main piping which also allows the intake of Natural Gas for pressure balancing[6]. Gas is measured into consuming units (e.g. heaters) using differential pressure meters comprising Orifice Plates with temperature and pressure compensation; continuous meter readings are transferred via the flow computer to the Plant Information (PI) system from where it can be downloaded into spreadsheets and databases for use. The RFG gas used in the VBU unit amounts to about 2.5% of the total RFG consumption of the refinery.

RFG composition is analysed twice a day from samples taken from Vessel 30-V-4809 and the results are used to generate a monthly average composition. Analysis is undertaken by the on-site lab and the results are uploaded to the Laboratory Information Management System (LIMS) and exported to the PI system. The flow of Refinery Flared gas is measured through ultrasonic meters in the pipelines to the flare stacks. The pilot gas for the flare is refinery fuel gas. Flare gas composition is assumed to be similar to refinery fuel gas during normal refinery operation. During upset conditions the composition of the flare gas is determined depending on the vessel/process that has been blown down to the flare.

Coke make[7] is calculated on the basis of the CO_2 concentration in the FCCU/CRU flue gas stack, which is determined by online analysers (these are installed for operational control reasons and to meet regulatory requirements but are not used specifically for continuous emission measurement of CO_2 via CEMs). The concentration is multiplied by the online air flowrate and the flue gas to air ratio.

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[3] Relevant information concerning refinery processes and technical details can be found via following links:
http://www.exxonmobileurope.com/europe-english/files/simple_guide_to_oil_refining.pdf
http://www2.emersonprocess.com/siteadmincenter/PM%20Articles/OilRefineryWalk-Through_CEP_May2014_Hi-Res.pdf
http://eippcb.jrc.ec.europa.eu/reference/BREF/REF_BREF_2015.pdf

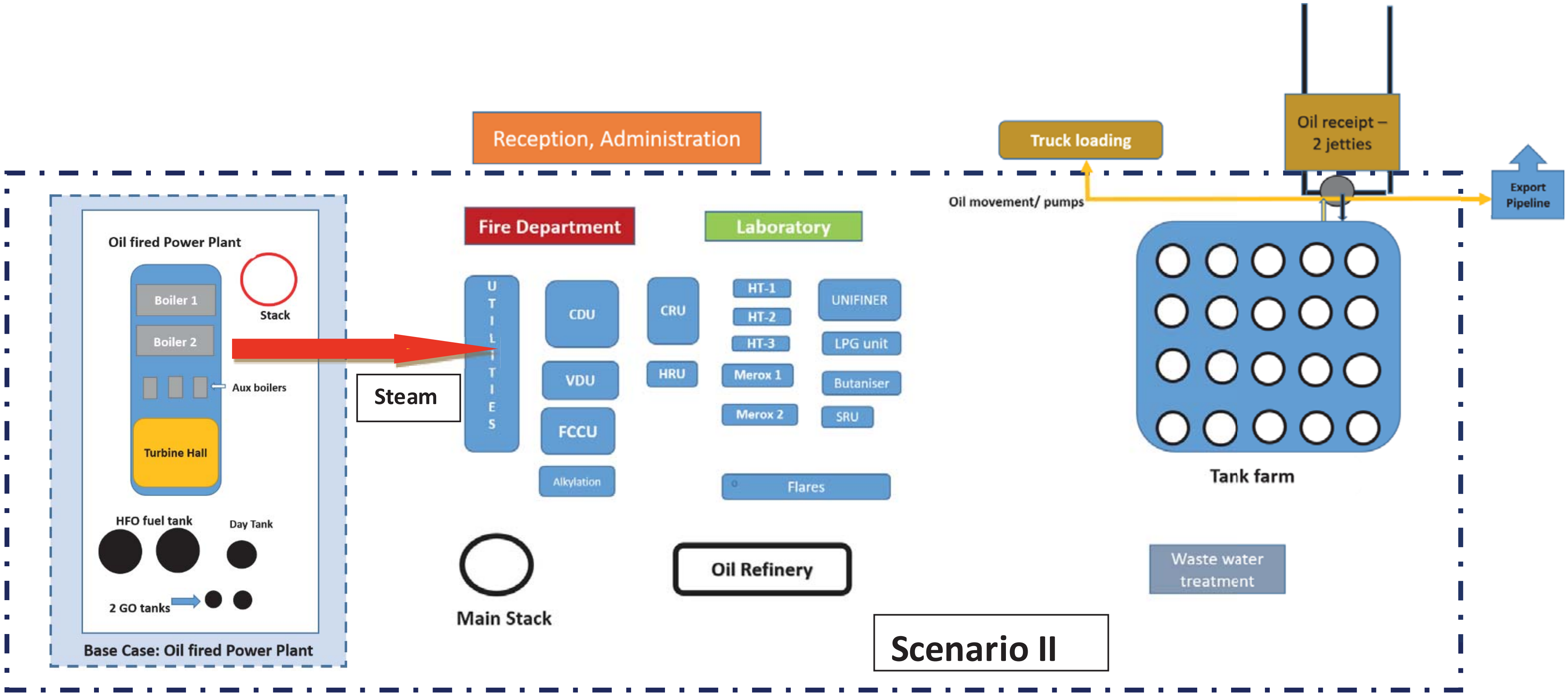
[4] % values indicate the proportion of aggregate emissions arising from each fuel source stream

[5] Refinery had a major shut down for maintenance and depressurising the whole plant and also process upsets during start up.

[6] Natural Gas is only used for pressure balancing in the RFG ring main and does not constitute a source stream on its own.

[7] Coke made refers to the process whereby during the cracking of the oil in the FFCU carbon is formed on the surface of the catalyst, quickly de-activating the catalyst. The catalyst is "regenerated" in the regenerator vessel of the FFCU, whereby steam is led over the hot catalyst and the carbon is burnt off.

Outline of the industrial complex in scenario 2, i.e. the power plant and the refinery, is outlined below. The questions listed below refer to the shown situation.



2. Questions :

a) What consequences do the changes in the context of Scenario 2 have for the required competences of the verifier?

b) Given the context in this scenario, what inherent and control risks should the verifier identify and on what elements would the verifier focus its verification checks? Please indicate the reasons for focusing on these elements and indicate what questions the verifier should ask itself when identifying the risks and consequently determining the scope and detail of verification.

c) How would the verifier check on whether the industrial complex is one installation or multiple installations on one site? If the industrial complex contains two installations, can a single verification be carried out and what questions would be relevant?

d) In recognition of the more complex installation boundaries compared to Scenario 1, what additional checks are likely to be necessary in relation to the MP?

e) On the basis of the information provided, how should the verifier expect the operator to have classified its source streams in terms of major – minor – de-minimis? How should the verifier go about checking that this is correct?

f) What information would the verifier need to determine its approach to testing internal controls over the data accounting process? What sources of evidence would the verifier need? And how would the verifier decide where to focus its attention?

g) What information would the verifier need to determine its approach to data sampling for the installation described? What sources of evidence would the verifier seek?

h) Also in view of the high volume of gas flaring during the year, how would the verifier check the appropriateness of the flare gas quantity and quality determination, and how and what would the verifier need to check the quantity of the purge[8] gas used?

Additional information 2.1

During the first stage of the verification conducted in Quarter 3 of the reporting year, the verifier has identified that the meter to the heater in the VBU had not been working properly since the shutdown in April (the plant came back on line in the first week of May). This had not been identified by the operator.

The following fuel consumption data was provided by the operator :

Month	Fuel Gas consumption (t)		
January	1010		
February	1011		
March	1073		
April	174	< Shutdown	
May	808	< Restart	
June	738		
July	857		
August	878		
September	943		
October	762	< Verifier's visit	
November	872		
December	902		
Total Consumed	10028		

[8] Purge gas: all flare systems are susceptible to flashback and explosion if not properly purged to keep air (oxygen) from entering the flare stack downward through the flare burner. To prevent air from entering the system during normal operation, a continuous purge is required.

Additional Questions 2.1

2.1a What impact might this have on the declared emissions and the conclusion of the verifier?

2.1b What checks should the verifier carry out to identify the likely cause of this?

2.1c What action should the verifier take to establish the level of the potential error; and what further information might the verifier need to do that?

2.1d Is this a data gap? If yes, how might this be addressed by the operator and what checks should the verifier carry out to determine if this is reasonable?

Additional information 2.2

During the physical inspection of the process units and their instruments, the verifier also identified that the calibration gas bottle for one of the online analysers was outside its validity date.

Questions 2.2

2.2a Would this constitute a data gap?

2.2b What recommendations might the verifier make?

2.2c What impact might this have on the declared emissions and the conclusion of the verifier?