TECHNICAL REPORT

ISO/TR 26762

First edition
2008-07-15

Natural gas — Upstream area — Allocation of gas and condensate

Gaz naturel — Zone amont — Allocation du gaz et du condensat

Reference number
ISO/TR 26762:2008(E)

Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 26762 was prepared by Technical Committee ISO/TC 193, *Natural gas*.

Introduction

Hydrocarbon gas and condensate from onshore or offshore concessions is often transported by shared pipelines to shared main treatment facilities. The concessions are often owned by or licensed to a number of oil companies. At the main treatment facilities, the gas and condensate are processed to sales specifications. The gas is sold to shippers in terms of standard volume (standard cubic metres) or combustion energy (joules), and the condensate is sold in terms of standard volume (standard cubic metres) or mass (kilograms or tonnes). All the gas and condensate sold at the main treatment facility and the associated money should be allocated back to the individual concessions and, ultimately, to the individual reservoirs or wells, as illustrated in Figure 1.

When gas from two or more entry sources (e.g. two or more different companies) is commingled and processed in a common pipeline and terminal system and the sources have different ownership and/or operate under different tax regimes, then a gas allocation system is required. It is necessary that the allocation system provide a fair, equitable and auditable means of sharing out the products from the system to the entry sources and to the associated partners, recognizing the specific delivery requirements of each participant.

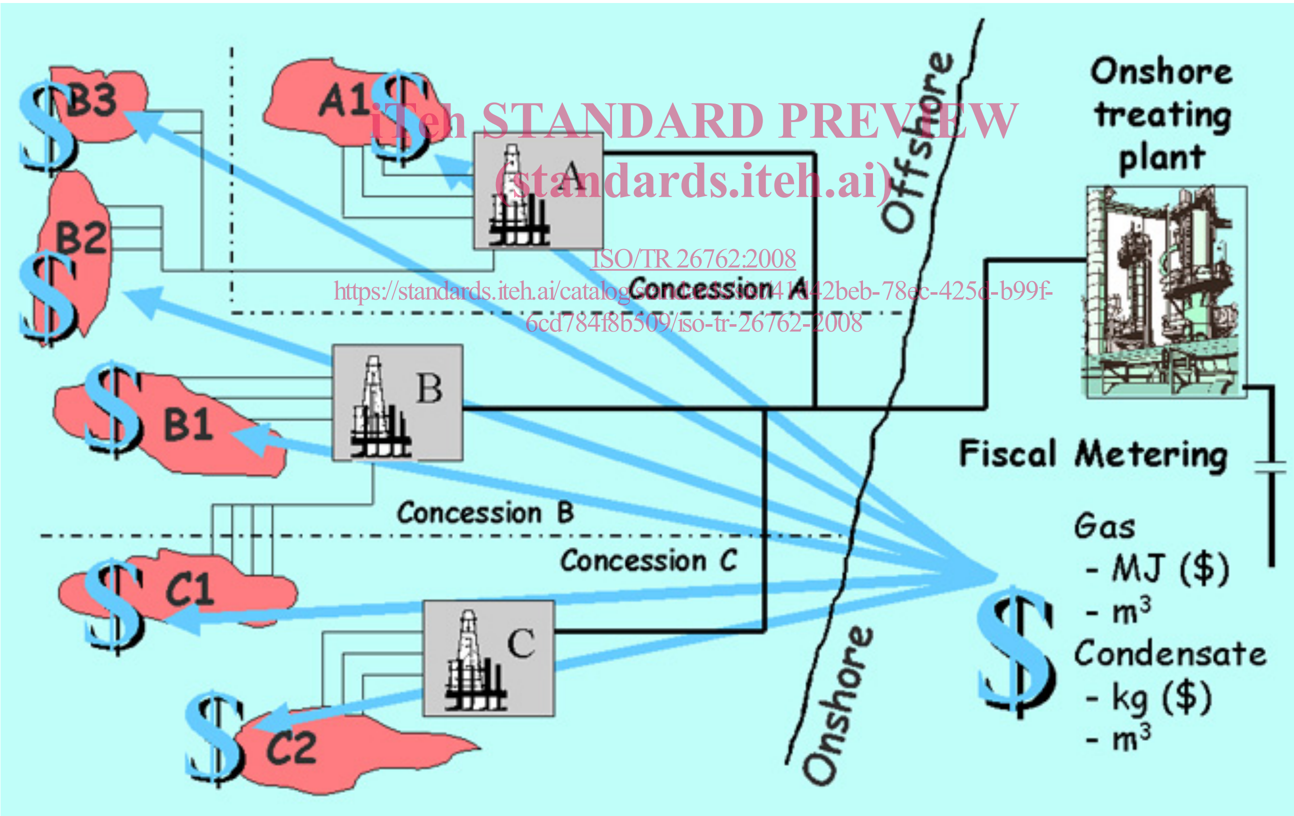

Figure 1 — Offshore gas distributions

Natural gas — Upstream area — Allocation of gas and condensate

1 Scope

This Technical Report describes the production measurements, in terms of both hardware and procedures, that can be used to allocate the gas and condensate back to the individual concessions, reservoirs and wells in a fair and equitable way. The objective is to give an approach that is recognized to be current best practice and that has a wide support in the oil and gas industry.

2 Normative references

ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements*

ISO 5168, *Measurement of fluid flow — Procedures for the evaluation of uncertainties*

ISO 6974 (all parts), *Natural gas — Determination of composition with defined uncertainty by gas chromatography*

ISO 6975, *Natural gas — Extended analysis — Gas-chromatographic method*

ISO 6976:1995, *Natural gas — Calculation of calorific values, density, relative density and Wobbe index from composition*

ISO 9951, *Measurement of gas flow in closed conduits — Turbine meters*

ISO 10715, *Natural gas — Sampling guidelines*

3 Economic aspects

3.1 Overview

3.1.1 General

Production measurements in the upstream area, whether single-phase or multiphase, have an economic impact on the business. The implementation of production measurements costs money, but in return delivers data that can be used in decision-making processes and in measuring the economic returns. Generally, it is necessary to give the three issues described in 3.1.2 to 3.1.4 proper consideration to implement a cost-effective measurement and allocation system.

3.1.2 Value of information

The decision-making processes that use production measurement information are those associated with production optimization or reservoir modelling. Figure 2 indicates, schematically, the effect of measurement accuracy on the uncertainty band of the ultimate recovery from a concession (i.e. total production over field life). With poor accuracy in the measurements, the uncertainty band and associated risk exposure stay relatively large. With better and more accurate measurements, the uncertainty band and associated financial risk are reduced. The assessment of the value of information is the most difficult part of designing an allocation system and it is probably for that reason that it is rarely done properly, if at all. As an example, the difference between production allocation (i.e. allocation of fluids from a production facility to the individual wells) and sales allocation (i.e. allocation of products in a common pipeline) can be mentioned. In the sales allocation, it can be directly calculated what the relation is between uncertainties in fluid flow measurement and risk in money flow between the companies involved. In the production allocation, often within one single company, this is less obvious as complex reservoir modelling and petroleum economics are involved. This is often why, in general, the requirements for sales allocation are higher than the requirements for production allocation.

3.1.3 Hardware costs

Capital expenditures for production facilities, test separators, test lines, multiphase flow meters, etc. can all be assessed relatively easily. It should also be noted that the higher the accuracy requirement for a particular meter, the more expensive the meter hardware. This is the easiest part in the total cost estimate.

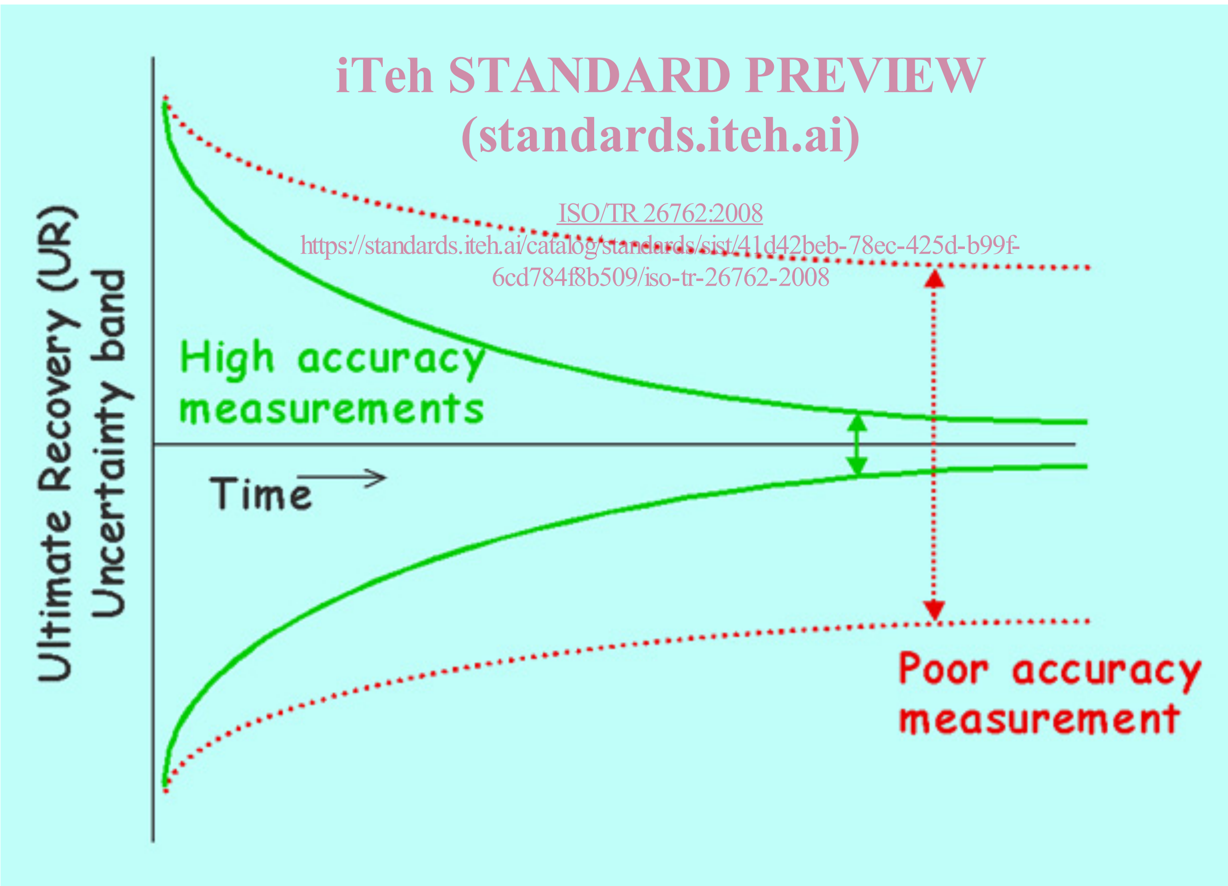

Figure 2 — Cost treatment of metering

3.1.4 Operating costs

Preparation and implementation of procedures and guidelines to keep the production measurement equipment in good shape (maintenance, verification and calibration) and to ensure that readings are reliable and within the original specifications require sufficient and consistent dedication during the operations phase. These costs are often underestimated, especially with new technologies such as multiphase or wet-gas flow metering.

3.2 Uncertainty and costs

With respect to uncertainty and costs, two extreme cases are considered.

— One extreme is a production system with very high accuracy in production measurements. Due to increased hardware costs and intensive operator involvement, the project and operating costs are higher, but with more and better information, better reservoir management and production optimization can be carried out. Consequently, the uncertainty band in the ultimate recovery decreases, giving a lower spread in project and operating risks (see Figure 2). Realizing that the value of the oil in the ground is limited, we can also conclude that at a certain cost level the development becomes economically unattractive.

— The other extreme is a poor accuracy in the production measurements or production is not measured at all. Poor reservoir management, sub-optimal production optimization and potential loss of revenue are the result. Consequently, the uncertainty band in the ultimate recovery stays large. The development can unwittingly become unattractive from an economic and risk point of view.

Somewhere between the above two extremes there is an optimum acceptable uncertainty, with the associated costs for the measurement and allocation processes. This is illustrated in Figure 3, in which costs (in arbitrary units) are plotted against acceptable uncertainty. This optimum can well be different for each individual hydrocarbon development. It can well be the case that, for a particular development, an accuracy of 10 % in gas flow rate is sufficient while in another development a 2 % accuracy is required.

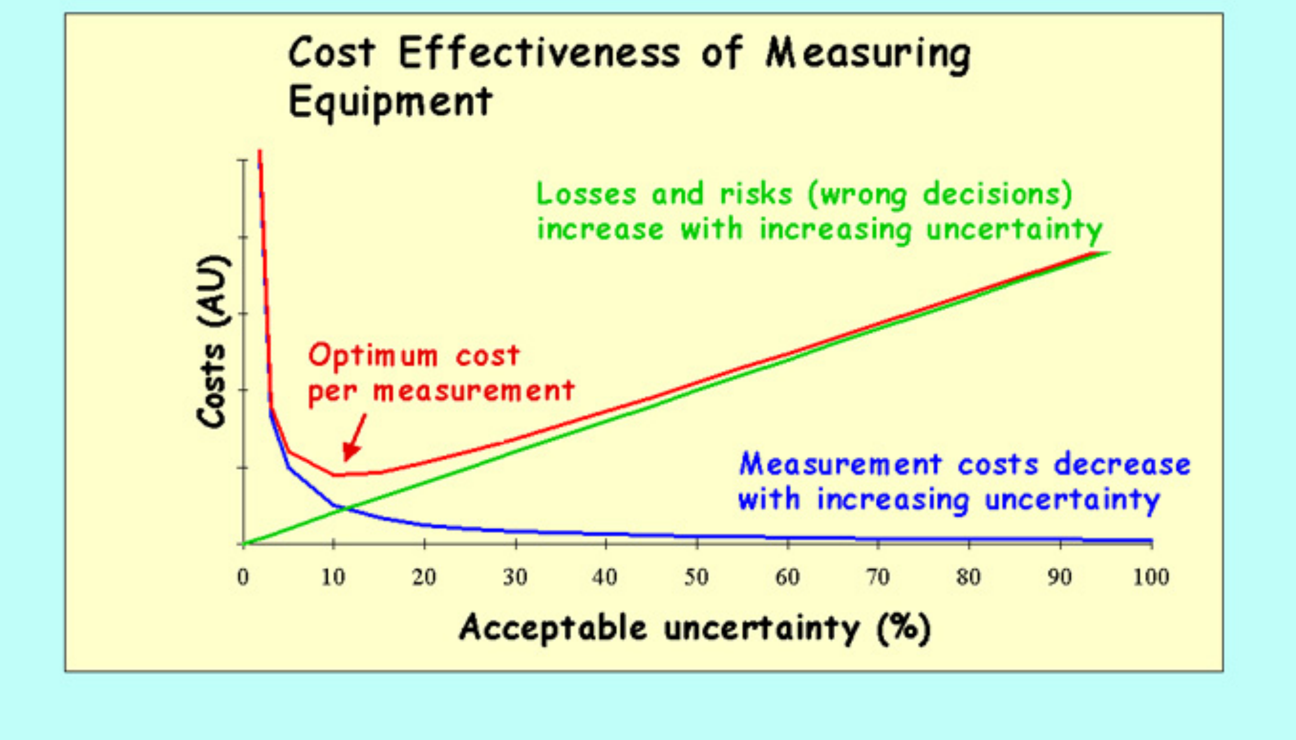

Figure 3 — Costs related to uncertainty

3.3 Allocation system overview

It is not unusual to take between one and two years to negotiate all the terms of a gas and condensate allocation agreement. A wide array of skills is required to understand the diverse topics in the development of an allocation system. To successfully conclude an agreement, it is good practice to form a team with expertise in the following:

— commercial negotiation;

— gas legislation;

— gas marketing;

— measurement and allocation;

— production operation;

— IT.

Besides the preparation of the commercial agreement, it is necessary to develop the business processes to manage the day-to-day operation of the agreement. It is imperative to establish responsibilities and ownership for the following:

— hydrocarbon stream meter data;

— hydrocarbon stream analysis;

— production forecast information;

— allocation system operation.

Development of the business processes requires a review of almost all departments within a gas production organization to ensure that the workload associated with the operation of the allocation system can be performed adequately and to identify whether additional personnel or external resources are required.

3.3.1 Overall scope of an allocation agreement

Figure 4 gives an overview of the major issues that feature in a gas and condensate allocation agreement. These issues are discussed separately in the following subclauses. One party or department should be charged with overall responsibility for producing the agreement, but the party or department may vary from company to company. It is of utmost importance that all parties or departments involved in the agreement ensure that the issues affecting them are properly and adequately dealt with in the agreement.

3.3.2 Reservoir performance

Reservoir performance data are required to assist in the forecasting of production to the operator of the gas treatment facilities. Long-term forecasts issued are likely based partly on the technical view of the reservoir potential and partly on the commercial view of possible future business. Shorter-term forecasts likely have a more technical focus and are likely developed in conjunction with operations staff to incorporate planned shutdowns, etc.

In addition, reservoir engineers provide an overview of the differences in composition of the fluids from the reservoirs covered by the allocation agreement. Reservoir engineering departments are normally responsible for the initial sampling and associated fluid analyses. Specific analytical requirements regarding gas quality should be discussed with the reservoir engineering departments to ensure provision of the appropriate data.

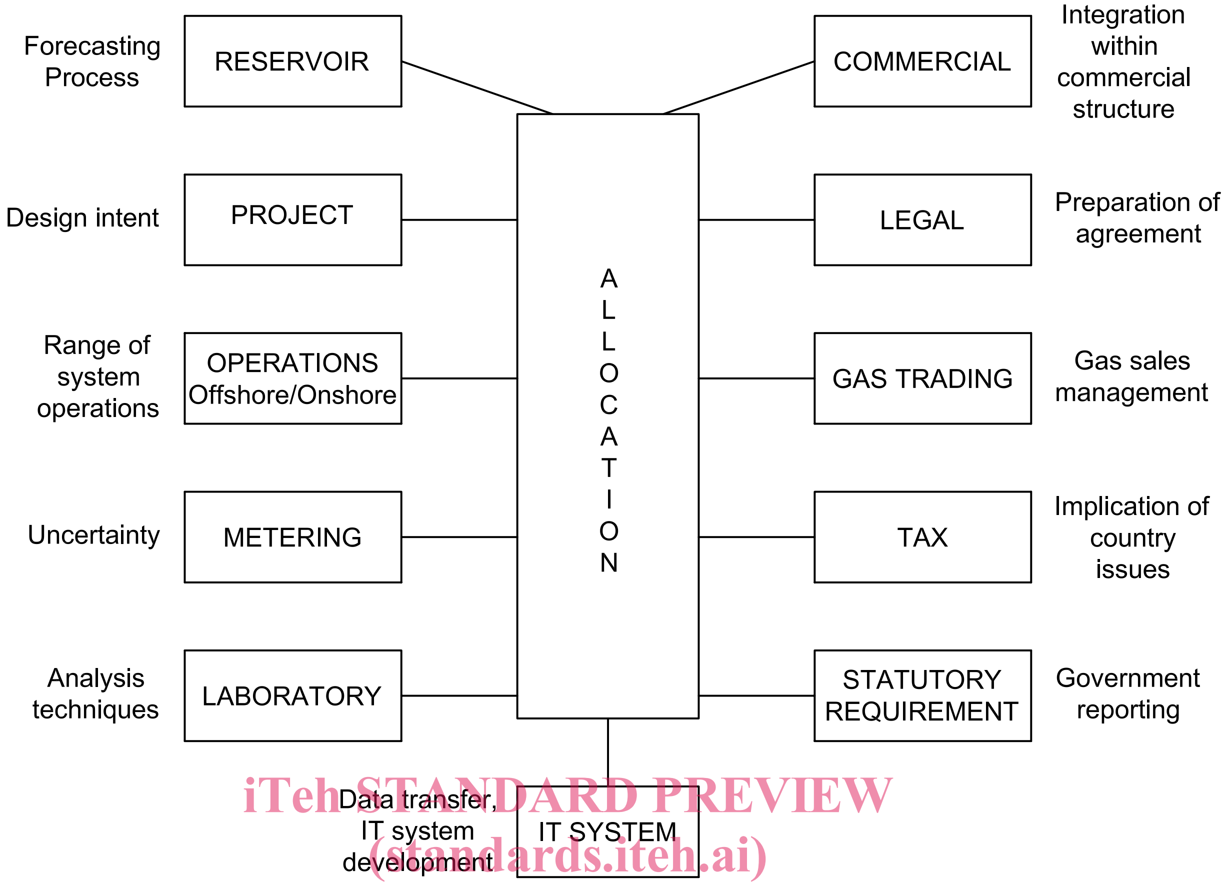

Figure 4 — Issues that feature in a gas and condensate allocation agreement

3.3.3 Project specifications

Discussions are required with the project team to ensure that

— the necessary metering devices are provided to the specified uncertainty levels,

— sampling systems are installed to obtain adequately representative gas and condensate samples,

— acceptable and appropriate analyses of the gas and condensate samples are performed,

— the required data are captured and transferred to a central IT system and an adequate production-measurement management system is in place (see ISO 10012).

Parties involved in these discussions include the metering and IT departments and, where appropriate, the operator of the gas treatment facilities.

3.3.4 Operations/gas-trading and coordinating group

A review of the allocation agreement should be made with the parties involved with the agreement to ensure that they understand and appreciate the implications of the agreement on their day-to-day duties and to ensure they have the opportunity to feed back potential problems or conflicts with existing agreements and associated operations.

The gas-trading group should ensure that the allocation agreement complies with gas marketing and reporting requirements for entry to the gas distribution network from the gas treatment facilities.

3.3.5 Metering requirements

Appropriately qualified and experienced metering engineers should be responsible for specifying and selecting the individual meters and associated equipment. When operations start, they should be responsible for the validation of metering data.

The validated meter data should be made available to the hydrocarbon accountants to run the allocation calculations and generate the allocation reports. It is necessary that the validation process for the metered data be performed independently of the allocation calculations. There is a tendency to use allocation processes as a check on the quality of the metering process. Balance factors or reconciliation factors can be used, with care, to highlight possible metering problems. Ideally, limits to these factors should be set based on sensitivity studies with the intrinsic uncertainties of the individual meters as input.

3.3.6 Laboratory requirements

Pressurized samples of gas and condensate are sent to a laboratory that has been selected for the shared pipeline system. The selected laboratory should have appropriate, acceptable accreditation.

Procedures should be developed for

— control and maintenance of the sample vessels,

— transportation of pressurized sample vessels between the production facilities and the laboratory,

— receipt and validation of the sample fluids,

— conducting and reporting of the analyses.

3.3.7 Commercial issues

The commercial group should review the allocation agreement for consistency with other agreements.

3.3.8 Legal issues

In general, the allocation agreement is written by the responsible allocation personnel, with the metering section of the agreement produced by the metering engineer and the commercial issues dealt with by the commercial department. A review by the legal department is required to check for consistency with other agreements and that the liability clauses are appropriate and acceptable.

3.3.9 Tax issues

In some jurisdictions, the tax and royalty implications associated with a field and/or a party can have the most dominant impact on the revenue from an allocation system. A review is essential at the early stages of a development to ascertain any tax implications and incorporate the appropriate mechanisms within the allocation procedure.

Customs duties can be particularly relevant when gas and condensate from a development is produced into a shared pipeline in one country and entitlement to blended gas and condensate is received in another country.

3.3.10 Statutory requirements

It is essential at an early stage in a development to undertake a review of the statutory requirements and seek the necessary approvals from the appropriate governing bodies.

3.3.11 IT systems

The development of an IT system to perform the allocation procedure can take a significant period of time to implement, test and hand over to the responsible department. Because of tight development deadlines, it can be necessary to start the IT system design before the commercial agreement is finalized and strict project management is required to control the IT vendor and minimize change requests.

The software should be developed in a structure suitable to the application, with particular attention paid to the ability to modify/expand the system whilst maintaining the capability to revert to rerunning a pre-modification allocation.

3.3.12 Overall metering system

The entire process of metering and allocation (the metering hardware, the algorithms used, the data transmission and storage systems) should be covered by an adequate management process (see ISO 10012).

4 Allocation from different viewpoints and terminology

4.1 Physical system

This Technical Report is intended for use in the measurement and allocation of natural gas and condensate in multi-user pipeline transportation systems.

Such a system is typically comprised of production facilities, pipelines, reception facilities, processing facilities and sales points. Each of these elements can be represented in the allocation system described in 4.2 to 4.5 (see Figure 5 for an example of a typical system).

4.2 Gas/condensate system overview

4.2.1 System diagram

The physical system can be represented as a single-line nodal diagram, representing all the (production) sources, sinks (gas used for fuel, flare, vent, gas lift, injection gas, etc.), as well as flow paths of product. See Figure 5.

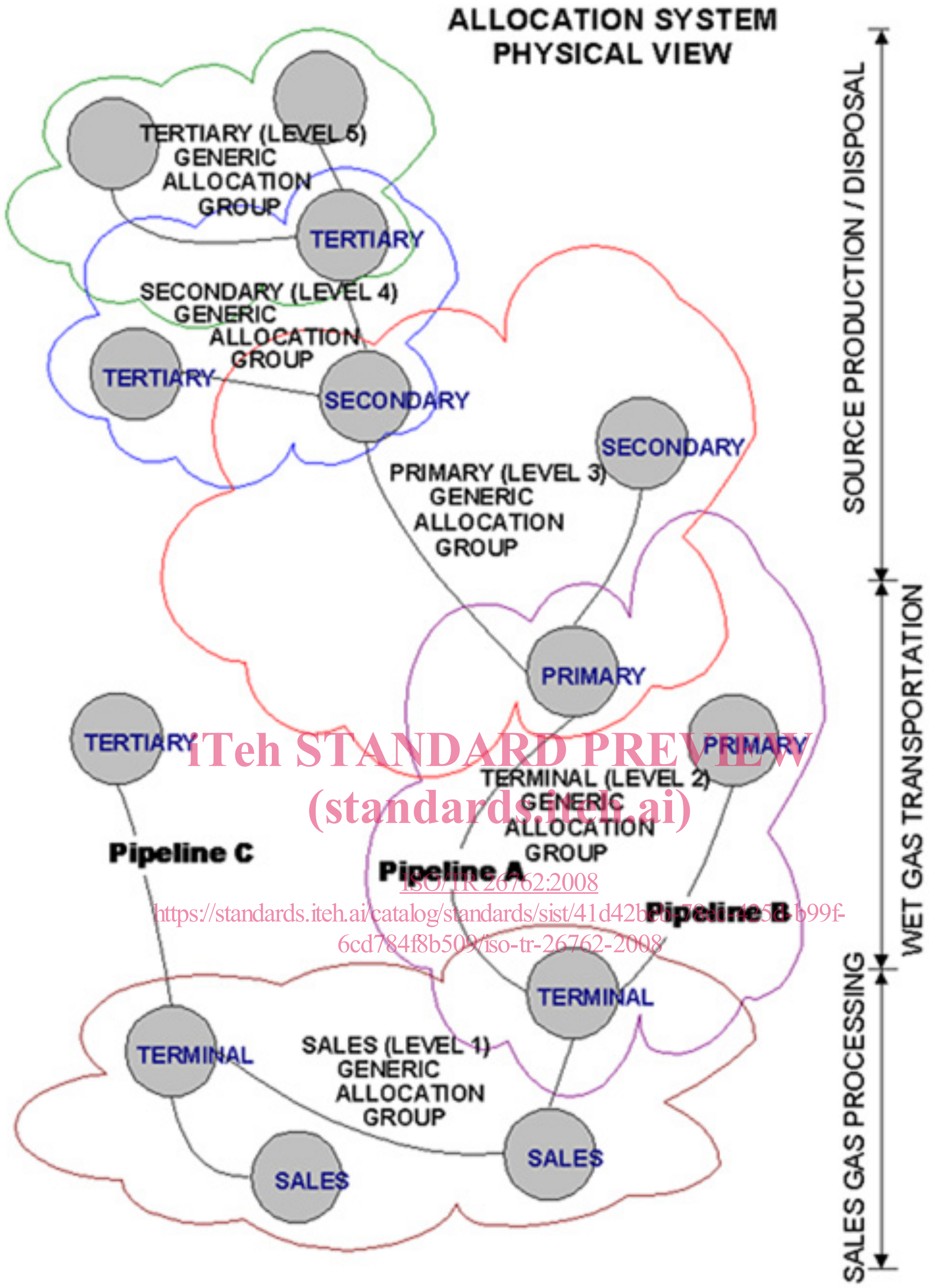

Figure 5 — Physical system

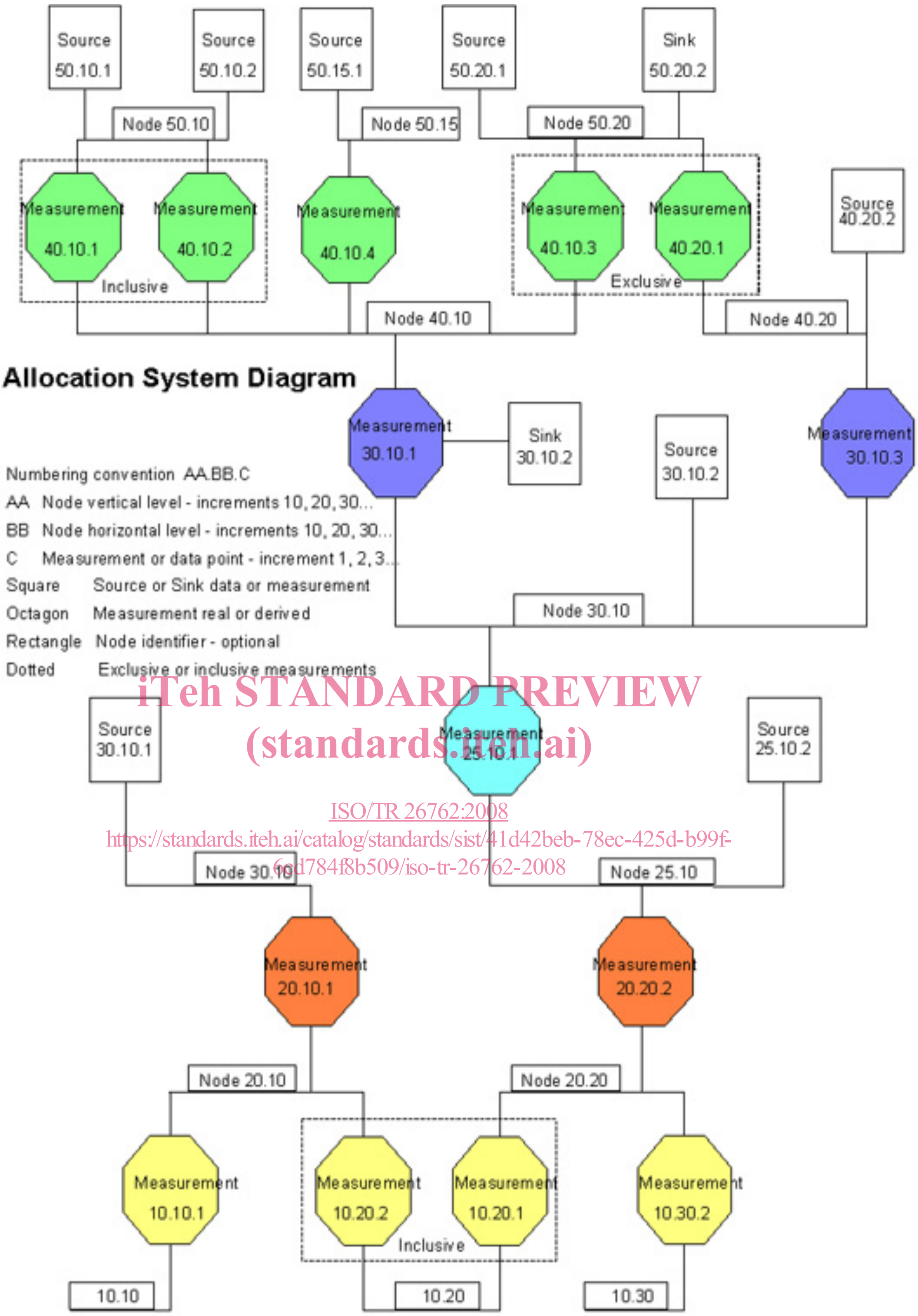

Figure 6 — Allocation system diagram

A supporting table (Table 1) developed from the system diagram (see Figure 6) describes what each node in the system represents, what the name of the producing field asset can be, the equity ownership interests, etc. It can further describe any product processing, calculations, simulations, yield factors, etc., as well as the allocation protocol for the node concerned.

The system description table (diagram) can look something like Table 1: