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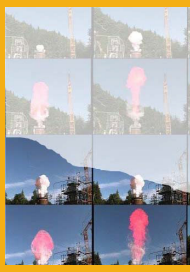

ATEX

Normung im Bereich der Richtlinie 94/9/EG

Standardization pursuant to Directive 94/9/EC

La Normalisation basée sur la directive 94/9/CE

KAN Kommission Arbeitsschutz und Normung

ATEX

Normung im Bereich der Richtlinie 94/9/EG

Standardization pursuant to Directive 94/9/EC

La Normalisation basée sur la directive 94/9/CE

KAN-Bericht 33 / KAN report 33 / Rapport KAN 33

Verein zur
Förderung der
Arbeitssicherheit
in Europa

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The Commission for Occupational Health, Safety and Standardization (KAN) was founded in 1994 to assert German interests in OH&S matters, especially with regard to European standardization. KAN is composed of representatives of the social partners (employers, employees), the state (federal states and Laender), the Federation of institutions for statutory accident insurance and prevention (HVBG) and the German Standards Institute (DIN). One of KAN's tasks is to pool the public interests in the field of occupational health and safety and to exert influence on current and future standardization projects by issuing comments on specific subjects.

KAN procures studies and expert opinions in order to analyze occupational health and safety aspects in standardization and to reveal deficiencies or erroneous developments in standardization work.

This study was based on the following task in hand:

Background

On 30 June 2003, the transitional period expired for transposition of Directive 94/9/EC concerning equipment and protective systems intended for use in potentially explosive atmospheres. Since this date, equipment and protective systems may be placed on the market and put into service only if they meet the essential health and safety requirements set out in Annex II of the directive (in conjunction with the conformity assessment procedures under Article 8). One result of a survey commissioned by KAN in 1998[1)] was that a random analysis revealed deficits in standards and draft standards. A need for systematic analysis from an occupational health and safety perspective was thus perceived.

Objective

The object of the study is the examination of possible deficits in standards pursuant to Directive 94/9/EC of the European Parliament and of the Council on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.

The present study, "Standardization pursuant to Directive 94/9/EC", is based upon a survey of standards conducted by the KAN Secretariat, and considers the following: whether the listed standards, draft standards and working documents

1) Wagner, Rogers: „Stichprobenanalyse zum Stand der europäischen Normung im Explosionsschutz"; INBUREX; December 1998 (not published)

adequately support the essential requirements of the directive; where duplication of provisions, overlap or contradictions exist between documents developed by CEN and by CENELEC; and where, in the view of OH&S experts, a need for further standards exists at European level. The study further examines the extent to which other deficits exist, for example where the existing level of safety in Germany is jeopardized, or the party to whom the standard is addressed is not clearly the manufacturer or distributor of the equipment and protective systems.

The examination was conducted over a period of six months as follows:

- ▷ survey of the current state of European standardization pursuant to Directive 94/9/EC;
- ▷ description of the existing level of safety in Germany;
- ▷ structured interviews with users of standards and with experts;
- ▷ comparison between the essential requirements of Annex II of the directive and the content of standards in their present form;
- ▷ identification of duplicate provisions, overlap and contradictions;
- ▷ comparison of the content of the standards with the existing level of safety in Germany;
- ▷ identification of areas not supported by standards projects;
- ▷ discussion of results in the project support group.

The Contractor's technical and certification departments responsible for electrical and non-electrical explosion protection were able to call upon many years of experience. This experience, enhanced by close contact with equipment manufacturers, operators, and standards committees, formed the basis of the study. Further sources of information were the structured interviews conducted with company, BG and state OH&S representatives and relevant industry institutions responsible for explosion protection, and discussion with members of national and European working groups.

Directive 94/9/EC defines the essential health and safety requirements for the design and manufacture of equipment, components, and protective systems employed in potentially explosive atmospheres. In order to simplify verification that equipment satisfies these requirements, harmonized standards are created at European level. These standards normally detail the requirements formulated in general terms within the directives, in consideration of the state of the art for a defined area of application.

These harmonized standards, which are valid throughout Europe, are drawn up by the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization

(CENELEC) in response to mandates from the European Commission. The standards are developed in dedicated working groups set up by CEN and CENELEC on the basis of the members' knowledge and experience and in consideration of existing good practice as set out in the body of national and international regulations.

The methods and procedures employed for gathering information on possible deficits in standards pursuant to Directive 94/9/EC must consider the issues referred to above and the following aspects:

- The great number of harmonized standards and standards projects:
  Of the numerous standards, draft standards and working documents pursuant to Directive 94/9/EC, over 70 documents were to be considered and evaluated by a number of people within a short space of time.

- Progress of standards under development:
  Revisions of draft standards and working documents, and to a lesser degree of standards in force, had to be taken into consideration during production of the study. For this reason, the version to which the final evaluation relates may no longer correspond to the up-to-date status of the standard or draft standard concerned. This applies in particular to CEN standards.

- Differences between electrical (CENELEC) and non-electrical (CEN) standards:
  Whereas a sound body of dedicated standards – which do not always follow the structure of Directive 94/9/EC – has emerged over a number of decades in electrical explosion protection, European standards for the non-electrical sphere have been developed only comparatively recently, in response to publication of this Directive. The latter standards in many cases still have the status of drafts or working documents, and have not been finalized in structure or content. The standards differ in terms of the specialist background knowledge required and their related mode of interpretation , since in the electrical sphere, products must primarily be tested by notified bodies, and standards are therefore primarily applied by such bodies; by contrast, in the non-electrical sphere, products' correspondence with the essential requirements of the directive can generally be tested by manufacturers themselves, and these standards should therefore be directed more towards lay persons in the area of explosion protection.

About this report

KAN thanks the authors for conducting the project and presenting the report, and the experts for their critical support in the evaluation of the results:

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The full text of the study is available in English and German at http://www.kan.de.

Summary of the study

The object of the present study was to examine whether essential requirements formulated in Annex II of Directive 94/9/EC are inadequately supported in the harmonized standards, whether duplicate provisions, overlap and contradictions exist, whether the party to whom the standard is addressed is not clearly identifiable, whether certain areas lack standards, and whether the existing level of safety in Germany is jeopardized by European standardization.

For examination of these potential deficits, over 70 CEN and CENELEC standards (refer to the annex of the study) were evaluated as far as possible against checklists for their compliance with Annex II of Directive 94/9/EC, experts and users of standards were consulted, and literature surveys and database searches were conducted. Certain **procedures** employed proved to be particularly effective:

- Assessment of standards and consultation of experts and users of standards complemented one another: on the one hand, deficits identified during evaluation of standards were confirmed in interviews; on the other, explanations were found in interviews for various deficits identified during the evaluation of individual standards.
- The evaluation of standards against checklists, although time-consuming and laborious, led to the identification of concealed deficits in standards which had previously been considered compliant with the directive.

Overall, the requirements of the directive were found on the whole to have been implemented in the harmonized standards under consideration, and the existing level of safety in Germany to be preserved by European standards. Full implementation of the essential requirements under consideration could not however be confirmed in any of the evaluated standards. Yet it should be pointed out that the deficits resulting in a lower evaluation result for the standards were frequently minor. Of particular note is that certain **requirements** exist which as yet have been **poorly detailed** in standards: examples include the avoidance of misuse, marking, and the aspect of instructions as part of the manufacturer/operator interface, the concept of lifetime (for example the ageing of materials (plastics)), etc.

Furthermore, a whole range of **deficits** exist in individual standards with respect to the directive and between the standards themselves.

Greater attention should therefore be paid to the claim of a harmonized standard to the **presumption of conformity**. A situation must at all costs be avoided in which the essential requirements falling within the scope of a standard but not supported or addressed by it are overlooked or

neglected by the user of the standard; this is to be achieved through reference to the requirements not addressed in the standard by the inclusion of relevant information in the introduction, scope, or appropriate sections of the standard. Annex ZA is favoured for this purpose by the users of standards and by certain experts as an informative supplement to a standard by which the latter can be related correctly to Directive 94/9/EC and implementation of the essential requirements of Annex II 94/9/EC facilitated. Care should however be exercised in the creation of this annex, and the standards committees should be provided with a suitably well prepared model document. This problem is not exclusive to Directive 94/9/EC, however, but probably concerns all New Approach directives.

Standards frequently appear at first sight not to correspond to the first essential requirement under Annex II No. 1.0.1. of the directive concerning observance of the ranking of explosion protection principles. This aspect in fact frequently lies outside the scope of a standard, as for example in the case of standards governing the avoidance of explosion hazards. At the same time, standards are expected to detail the ranking of protective measures according to the principle of integrated explosion safety. This deficit could at least be alleviated by a suitable comment, as with the claim of a harmonized standard to give rise to the presumption of conformity.

Altogether, the body of standards in the non-electrical sphere is incomplete, and detailed examination reveals contradictions or errors. Considerable standardization activity (development of standards and first revision) thus remains to be completed in this area. The interviews repeatedly revealed that an insufficient number of experts (in particular manufacturers) are involved in the drafting of standards. For this reason, and owing to its novelty and complexity, the body of standards in the non–electrical sphere is considered very poorly structured. This is the view not only of manufacturers, but also of test bodies.

The standards governing protective systems are in some cases not yet suitable for evaluation (e.g. decoupling systems), or fail to reflect the philosophy of the directive (explosion suppression). Correspondingly large deficits may be found in this area. Autonomous protective systems are however already being certified by the test bodies, with the result that protective systems are on the market which have been subjected to different means or depths of testing or which, if subjected to lax testing, may even constitute an actual safety risk. In particular, installation in a plant of a protective system (location of detectors, shutters, fire extinguishing cylinders) is not described with adequate precision in the standards governing Group II equipment; it is however debatable how well this requirement can be specified at all as a product

characteristic without entering the realm of detailed technical specifications. In the past, explosion suppression or decoupling systems were assessed, or were approved by an independent institute, following installation within the plant. Under the specified conformity assessment procedure, this practice has been eliminated without substitute. CE marking in this context thus implies an apparent level of safety which in fact may not be present or even possible.

The **body of standards in the electrical sphere** exhibits far fewer contradictions or detail errors. With the exception of the absence of requirements for safety devices for example of pressurized apparatus or protective motor switches, the provisions correspond very closely to the requirements of Directive 94/9/EC. The majority of electrical standards have a long history, through which they have acquired a safety status which is broadly accepted. Since precursory arrangements to Directive 94/9/EC exhibit comparable provisions for many areas of electrical explosion protection, for example regarding obligatory testing by notified bodies, the continuity to Directive 94/9/EC in the sphere of electrical explosion protection is high. The new requirements formulated by the directive concerning quality assurance further assure a high quality standard among manufacturers and should for this reason be regarded as progress.

Greater consideration should be given to the **manufacturer-operator interface**. Although zoning is governed by Directive 1999/92/EC, national transposition may give rise to differences in zoning between countries which, by imposing requirements upon equipment selection, could also lead to differences in the equipment categories employed. This could result in a lack of clarity at European level.

Results of evaluation against the checklists

The study of harmonized standards and standards projects by means of checklists encompasses the documents which were available in a form suitable for evaluation during the course of the study. Unpublished draft standards available only as rudimentary working documents in the form of draft or revision comments and standards or draft standards which do not primarily support the essential requirements of Annex II of the directive were not evaluated against the checklists, but were addressed more closely in the interviews. These standards and standards projects specifically include the following:

- ▷ draft standards governing requirements for quality management systems, terminology, and measurement of parameters:
  EN 13980, prEN 13237, prEN 1839, prEN 13673–1/–2, prEN 13821, prEN 14522, EN 50281–2–1;

▷ working documents from standards projects at a rudimentary state of progress: WI 00305071, WI 00305041, WI 00305051, WI 00305055, WI 00305057, WI 00305062, prEN 60079–26.

From the evaluation of the remaining standards, the table below provides an overview of examples of deficits identified in standards with regard to the support of various requirements of the directive. The cross-references refer to the grounds for the rating and to individual examples of standards in Chapter 6.1 of the **full text of the study (http://www.kan.de)**. The full titles and dates of issue of the standards can be found in Annex B of the full text; owing to space constraints, only the numbers of the standards are indicated in the table.

The party to whom the standards are addressed was evaluated by distinction between manufacturers (M) and operators (O). Within the overall evaluation, each standard was assessed in terms of the

Table: Overview of examples of deficits in standards as per Chapter 6.1 of the study

Standard	Overall rating	Examples of general discrepancies arising from requirements in the directive which are missing from or inadequately detailed in a number of standards	Examples of specific discrepancies resulting from deviation from the requirements of the directive in the details of provisions
EN 1127–1	3	A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9, A.10, A.13	B.3.1
EN 1127–2	3	A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9, A.13	B.3.1
prEN 1710	2	A.4, A.5, A.6, A.9	–
EN 1755	2	A.1, A.2, A.3, A.4, A.5, A.9	B.2.1, B.3.2
EN 1834–1	2	A.4, A.5, A.6, A.8., A.9, A.12	B.1.1
EN 1834–2	2	A.1, A.2, A.4, A.5, A.6, A.8, A.11	–
EN 1834–3	2	A.1, A.2, A.4, A.5, A.6, A.8, A.12	B.1.3
EN 12874	3	A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9, A.12, A.13	–
EN 13012	2	A.2, A.3	–
prEN 13237	–	–	B.1.4
EN 13463–1	3	A.1, A.2, A.3, A.4, A.5, A.6, A.7	B.1.2, B.1.5
prEN 13463–2	3	A.7	–
prEN 13463–3	2	A.7	–
prEN 13463–5	3	A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.10	–
prEN 13463–6	2	A.4, A.7, A.8, A.9	–

Standard	Overall rating	Examples of general discrepancies arising from requirements in the directive which are missing from or inadequately detailed in a number of standards	Examples of specific discrepancies resulting from deviation from the requirements of the directive in the details of provisions
prEN 13463–8	2	A.7, A.8, A.9	B.2.2
prEN 14034–1	2	–	B.1.6
prEN 14034–2	2	–	B.1.6
prEN 14034–3	2	–	B.1.6
prEN 14034–4	2	–	B.1.6
prEN 14373	4	A.1, A.2, A.3, A.4, A.5, A.6, A.8, A.9, A.10, A.11, A.12, A.13	B.1.7, B.3.3
prEN 14460	2	A.3, A.6, A.7, A.9, A.10	–
prEN 14491	2	A.3, A.4, A.5	B.1.8, B.3.4
prEN 14591–1	3	A.1, A.2, A.3, A.5, A.8	B.1.9
WI 00305058	3	–	B.1.10
WI 00305070	2	A.5	–
WI 00305072	2	A.2, A.3, A.5, A.9	–
WI 00305066	2	A.2, A.3, A.6, A.8, A.9, A.10	B.2.3
EN 50015	2	A.3	–
EN 50016	3	A.1, A.3, A.5, A.8, A.9	B.1.11
EN 50017	2	A.3, A.5	–
EN 50018	2	A.3, A.5	–
EN 50019	2	A.3, A.5, A.9	–
EN 50020	2	A.3, A.5	–
EN 50021	2	A.3, A.5	–
prEN 50039	2	A.3, A.5, A.9	–
EN 50104	2	A.2, A.3	–
EN 50050	2	A.3, A.4, A.5, A.6	–
EN 50241–1	2	A.2, A.3	–
EN 50241–2	2	A.2, A.3	–
EN 50281–1–1	2	A.3, A.5, A.9	B.3.5
EN 50281–1–2	2	A.5, A.9	–
EN 50284	2	A.5	–
EN 50303	2	A.3, A.5, A.8	–
prEN 50381	3	A.1, A.3, A.8, A.9	B.1.11
prEN 50394–1	2	A.3, A.5, A.6	–
prEN50402	2	A.3	–
prEN 60079–18	2	A.3, A.5	–
prEN 61241–1	2	A.2, A.3, A.5, A.9	–
prEN 61241–18	2	A.3, A.5	–
IEC 61241–4	3	A.1, A.2, A.3, A.8, A.9, A.14	B.1.11
EN 61779–1–2	2	A.2, A.3	–
EN 61779–1–3	2	A.2, A.3	–
EN 61779–1–4	2	A.2, A.3	–
EN 61779–1–5	2	A.2, A.3	–
EN 62013–1	2	A.2, A.3, A.5	–
IEC 62086–1	2	A.2, A.3, A.5, A.9, A.14	–

frequency and significance of its deficits with respect to the directive as follows:

1: Requirements in correspondence with Annex II of Directive 94/9/EC

2: Requirements largely in correspondence with Annex II of Directive 94/9/EC

3: Requirements only partly in correspondence with Annex II of Directive 94/9/EC

4: Requirements not in correspondence with Annex II of Directive 94/9/EC

Reference to further results in the full text of the study (http://www.kan.de)

The results of checklist evaluation are shown in full in Annex A, Tables A.1–3 in the full text of the study. These results include the evaluation mark assigned to each document studied against the numbering of the examined requirements of Annex II of the directive.

In order for the results of the present study to be considered during **future standardization activity**, such activity should be based upon Annex A, which contains the discrepancies between a standard and Directive 94/9/EC with regard to specific requirements. The deficits are explained in further detail in Chapter 6.1. Duplicate provisions, overlap and contradictions between a standard and other harmonized standards can be found in the assessment in Chapter 6.2. Accordingly, the focus in future standards projects should initially be placed upon revision and updating of existing standards and draft standards. New standards projects should particularly support requirements for safety devices (cf. Chapter 6.4).

Chapter 6.5 contains a comprehensive presentation of **discrepancies within Directive 94/9/EC** itself. These discrepancies influence its use by manufacturers and test bodies, and also lead to problems for the standards committees.

1. Recommendations to DIN/DKE

DIN and DKE are requested:

- ▷ to make this study available to the working groups concerned, and where necessary to encourage CEN and CENELEC to revise the standards in order to eliminate the identified deficits; particular attention should be paid in this regard to deficits concerning the requirements for instructions;
- ▷ to focus future standardization activity on the revision and updating of existing standards under Directive 94/9/EC rather than upon new standards; in general, „criteria and benchmarks" such as protection concepts and test specifications should be standardized rather than design specifications; only in the area of safety devices should additional product standards be developed;
- ▷ to integrate an Annex ZA into each standard; it is important that care be exercised in the drafting of this annex as misunderstandings and misinterpretation may otherwise result;
- ▷ to agree to closer co-ordination between the standards committees within CEN and IEC/CENELEC;
- ▷ to ensure during use of the parallel enquiry process that standards originating at international level are adopted without any changes only if they adequately support the requirements of the directive;
- ▷ to ensure that the party to whom the standard is directed is defined unambiguously.

2. Recommendations to manufacturers

The manufacturers of devices and protective systems in the non-electrical sphere are requested to participate more actively in standardization, in order to improve the quality of the requirements.

3. Recommendations to the KAN Secretariat

The KAN Secretariat is instructed to discuss the results of the study on communications platforms such as EUROSHNET, in order for OH&S positions to be introduced in a concerted manner into the European and international standardization process.

Standardization pursuant to Directive 94/9/EC

-Full text-

Study commissioned by KAN (Commission for Occupational Health and Safety and Standardization)

Final report

***EX*AM BBG Prüf- und Zertifizier GmbH**

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February 2004

Contents

1 Object of and parties to the study

The object of the study is the examination of possible deficits in standards pursuant to Directive 94/9/EC[2] of the European Parliament and the Council on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.

The Contractor is:

***EX*AM BBG Prüf- und Zertifizier GmbH**

Dinnendahlstrasse 9

D-44809 Bochum.

Beside the results of evaluation of over 70 CEN and CENELEC standards, draft standards and working documents, numerous comments by experts within various companies and organizations in the area of explosion protection were included in the study.

[2] Directive 94/9/EC, Official Journal of the European Communities L 100 of 19 April 1994, Latest amendment: Official Journal L 021, 26/01/2000

2 Summary

The objective of the present study was to examine the following: whether essential requirements of Annex II of Directive 94/9/EC are inadequately supported in harmonized standards; whether duplicate provisions, overlap and contradictions exist; whether the party to whom the standard is addressed is not clearly identifiable; whether areas not supported by standards exist; whether the existing level of protection in Germany is jeopardized by European standardization.

For study of these potential deficits, over 70 CEN and CENELEC standards (refer to the Annex of the study) were evaluated as closely as possible against checklists for their compliance with Annex II of Directive 94/9/EC, experts and users of standards consulted, and literature surveys and database searches conducted. Certain **procedures** employed proved to be particularly effective:

- Assessment of standards and consultation of experts and users of standards were of mutual benefit: on the one hand, deficits identified during evaluation of standards were confirmed in interviews; on the other, explanations were found in interviews for various deficits identified during the evaluation of individual standards.
- The evaluation of standards against checklists, although time-consuming and laborious, led to the identification of concealed deficits in standards which had previously been considered compliant with the directive.

Overall, the requirements of the directive were found on the whole to have been implemented in the harmonized standards under consideration, and the existing level of safety in Germany to be preserved by European standards (cf. Chapter 6.3). Full implementation of the essential requirements under consideration could not however be confirmed in any of the evaluated standards. It should however be pointed out that the deficits resulting in a lower evaluation result for the standards were frequently minor. Of particular note is that certain **requirements** exist which as yet have been **poorly detailed** in standards (cf. Chapter 6.1 A): examples are the avoidance of misuse, marking, and the aspect of instructions as part of the manufacturer/operator interface, the concept of lifetime (for example the ageing of materials (plastics)), etc.

Furthermore, a whole range of **inconsistencies** exist between individual standards and the directive, and also between the standards themselves (see Chapters 6.1 B and 6.2).

Greater attention should therefore be paid to the claim to **presumption of conformity** of a harmonized standard. It is of paramount importance that the basic requirements should not be overlooked or neglected by the user of a standard where such requirements fall within the scope of the standard but are not supported or addressed. This objective can be reached through reference to such neglected requirements by the inclusion of corresponding information in the introduction, scope, or appropriate sections of the standards. For this purpose, users of standards and also certain experts favour the use of **Annex ZA** as an informative supplement to a standard by which the latter can be placed in proper relationship to the directive, and implementation of the basic requirements under Annex II of Directive 94/9/EC facilitated. Care should however be exercised in the creation of this annex, and the standards committees should be provided with a suitably well prepared model document. This problem does not solely affect Directive 94/9/EC, however, but probably all New Approach directives.

Standards frequently appear at first sight not to correspond to the essential **requirements under Annex II No. 1.0.1.** of the directive with regard to observance of the ranking of explosion protection principles. This aspect in fact frequently lies outside the scope of a standard, as for example in the case of standards governing the prevention of explosion hazards. At the same time, standards are expected to detail the ranking of protective measures according to the principle of integrated explosion safety. A contribution could at least be made by a suitable comment, as with the claim of a harmonized standard to give rise to the presumption of conformity.

Altogether, the **body of standards in the non-electrical sphere** is incomplete, and detailed examination reveals contradictions or errors. Considerable standardization activity (development of standards and first revision) thus remains to be completed in this area (see Chapter 6). The interviews repeatedly revealed that an insufficient number of experts (in particular manufacturers) are involved in the drafting of standards. For this reason, and owing to its novelty and complexity, the body of standards in the non-electrical sphere is considered very confusing. This is the view not only of manufacturers, but also of test bodies.

The standards governing **protective systems** are in some cases not yet in a form suitable for evaluation (e.g. decoupling systems), or fail to reflect the philosophy of the directive (explosion suppression). Correspondingly large deficits may be found in this area. Autonomous protective systems are however already being certified by the test bodies, with the result that protective systems are on the market which have been subjected to different means or depths of

testing or which, if subjected to lax testing, may even constitute an actual safety risk. In particular, installation in a plant of a protective system (location of detectors, shutters, fire extinguishing cylinders) is not described with adequate precision in the standards governing Group II equipment; it is however debatable how well this requirement can be specified at all as a product characteristic without entering the realm of detailed technical specifications. In the past, explosion suppression or decoupling systems were assessed, or were approved by an independent institute, following installation within the plant. Under the specified conformity assessment procedure, this practice has been eliminated without substitute. CE marking in this context thus implies a level of safety which in fact may not be present or even possible.

The **body of standards in the electrical sphere** exhibits far fewer contradictions or detail errors. With the exception of the absence of requirements for safety devices for example of pressurized apparatus or protective motor switches, the provisions correspond very closely to the requirements of Directive 94/9/EC. The majority of electrical standards have a long history, through which they have acquired a safety status which is broadly accepted. Since precursory arrangements to Directive 94/9/EC exhibit comparable provisions for many areas of electrical explosion protection, for example regarding obligatory testing by notified bodies, the continuity to Directive 94/9/EC in the sphere of electrical explosion protection is high. The requirements newly formulated by the directive concerning quality assurance further assure a high quality standard among manufacturers and should for this reason be regarded as progress.

Greater consideration should be given to the **manufacturer-operator interface**. Although zoning is governed by Directive 1999/92/EC[3], national transposition may give rise to differences in zoning between countries which, by imposing requirements upon equipment selection, could also lead to different equipment categories being used. This in turn could result in a lack of clarity at European level.

In order for the results of the present study to be considered during **future standardization activity**, such activity should be based upon Annex A, which contains the discrepancies between a standard and Directive 94/9/EC (rating marks "b", "d" and "e") with regard to specific requirements. The deficits are explained in further detail in Chapter 6.1. Duplicate provisions, overlap and contradictions between a standard and other harmonized standards can be found in the assessment in Chapter 6.2. Accordingly, the focus in future standards projects should be

[3] Directive 1999/92/EC, Official Journal L 023 , 28/01/2000

placed in the first instance upon the revision and updating of existing standards and draft standards. New standards projects should particularly support requirements for safety devices (cf. Chapter 6.4).

3 Introduction

On 30 June 2003, the transitional period expired for transposition of Directive 94/9/EC concerning equipment and protective systems intended for use in potentially explosive atmospheres. Since this date, equipment and protective systems may be placed on the market and put into service only if they meet the essential health and safety requirements set out in Annex II of the directive (in conjunction with the conformity assessment procedures under Article 8). One result of a survey commissioned by KAN in 1998[4] was that a random analysis revealed deficits in standards and draft standards. A need for systematic analysis from an occupational health and safety perspective was thus perceived.

The present study, "Standards pursuant to Directive 94/9/EC", is based upon a survey of standards conducted by the KAN Secretariat (see Annex B), and considers the following: whether the listed standards, draft standards and working documents adequately support the essential requirements of the directive; where duplication of provisions, overlap or contradictions exist between documents developed by CEN and by CENELEC; and where, in the view of OH&S experts, a need for further standards at European level remains. The study also examines the extent to which other deficits exist, for example where the existing level of safety in Germany is jeopardized, or the party to whom the standard is directed is not clearly the manufacturer or distributor of the equipment and protective systems.

The examination was conducted within a period of six months as follows:

- survey of the current state of European standardization pursuant to Directive 94/9/EC;
- description of the existing level of safety in Germany;
- structured interviews with users of standards and with experts;
- comparison between the essential requirements of Annex II of the directive and the content of standards in their present form;
- identification of duplicate provisions, overlap and contradictions;

[4] Wagner, Rogers: "Stichprobenanalyse zum Stand der europäischen Normung im Explosionsschutz"; INBUREX; December 1998 (not published)

- comparison of the content of the standards with the existing level of safety in Germany;
- description of areas not supported by standards projects;
- discussion of results in the project support group.

The Contractor's technical and certification departments responsible for electrical and non-electrical explosion protection were able to call upon many years of experience. This experience, enhanced by close contact with equipment manufacturers, operators, and standards committees, formed the basis of the study. Further sources of information were the structured interviews conducted with company, BG and state OH&S representatives and relevant industry institutions responsible for explosion protection, and discussion with members of national and European working groups, for example of VDI/VDE, CEN, CENELEC, IEC.

4 Gathering of information

Directive 94/9/EC defines the essential health and safety requirements for the design and manufacture of equipment, components, and protective systems employed in potentially explosive atmospheres. In order to simplify verification that equipment satisfies these requirements, harmonized standards are created at European level. These standards normally detail the requirements formulated in general terms within the directives, in consideration of the state of the art for a defined area of application.

These harmonized standards, which are valid throughout Europe, are drawn up by the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC) in response to mandates from the European Commission. The standards are developed in dedicated working groups set up by CEN and CENELEC on the basis of the members' knowledge and experience and in consideration of existing good practice as set out in the body of national and international regulations.

The methods and procedures employed for gathering information on possible deficits in standards pursuant to Directive 94/9/EC must consider the issues referred to above and the following aspects:

- The great number of harmonized standards and standards projects
  Of the numerous standards, draft standards and working documents pursuant to Directive 94/9/EC, over 70 documents had to be considered and evaluated by a number of people within a short space of time (see Annex).

- Progress of standards under development
  Revisions of draft standards and working documents, and to a lesser degree of standards in force, had to be anticipated during production of the study. For this reason, the version to which the final evaluation relates may no longer correspond to the up-to-date status of the standard or draft standard concerned. This applies in particular to CEN standards.

- Differences between electrical (CENELEC) and non-electrical (CEN) standards
  Whereas a sound body of dedicated standards - the structure of which does not always follow that of Directive 94/9/EC - has emerged over a number of decades in electrical explosion protection, European standards for the non-electrical sphere have been developed only comparatively recently, in response to publication of this Directive. The latter

standards in many cases still have the status of drafts or working documents, and have not been finalized in structure or content. The standards differ in terms of the specialist background knowledge required and their related mode of interpretation, since in the electrical sphere, products must primarily be tested by notified bodies, and standards are therefore primarily applied by such bodies; by contrast, in the non-electrical sphere, products' correspondence with the essential requirements of the directive can generally be tested by manufacturers themselves, and these standards should therefore be directed more towards lay persons in the area of explosion protection.

A number of procedures, which will be described in brief below, were employed for the gathering of information from the expertise of standards users and experts and from the national body of regulations.

4.1 Checklists

A checklist was drawn up for ascertainment of the extent to which individual standards and draft standards reflect the system of Directive 94/9/EC. The checklist was used to compare the content of the documents to be studied (see Annex) with the essential requirements under Annex II of the directive. For this purpose, the checklist is divided into three sections as shown in Fig. 4.1:

I. character of the standard;

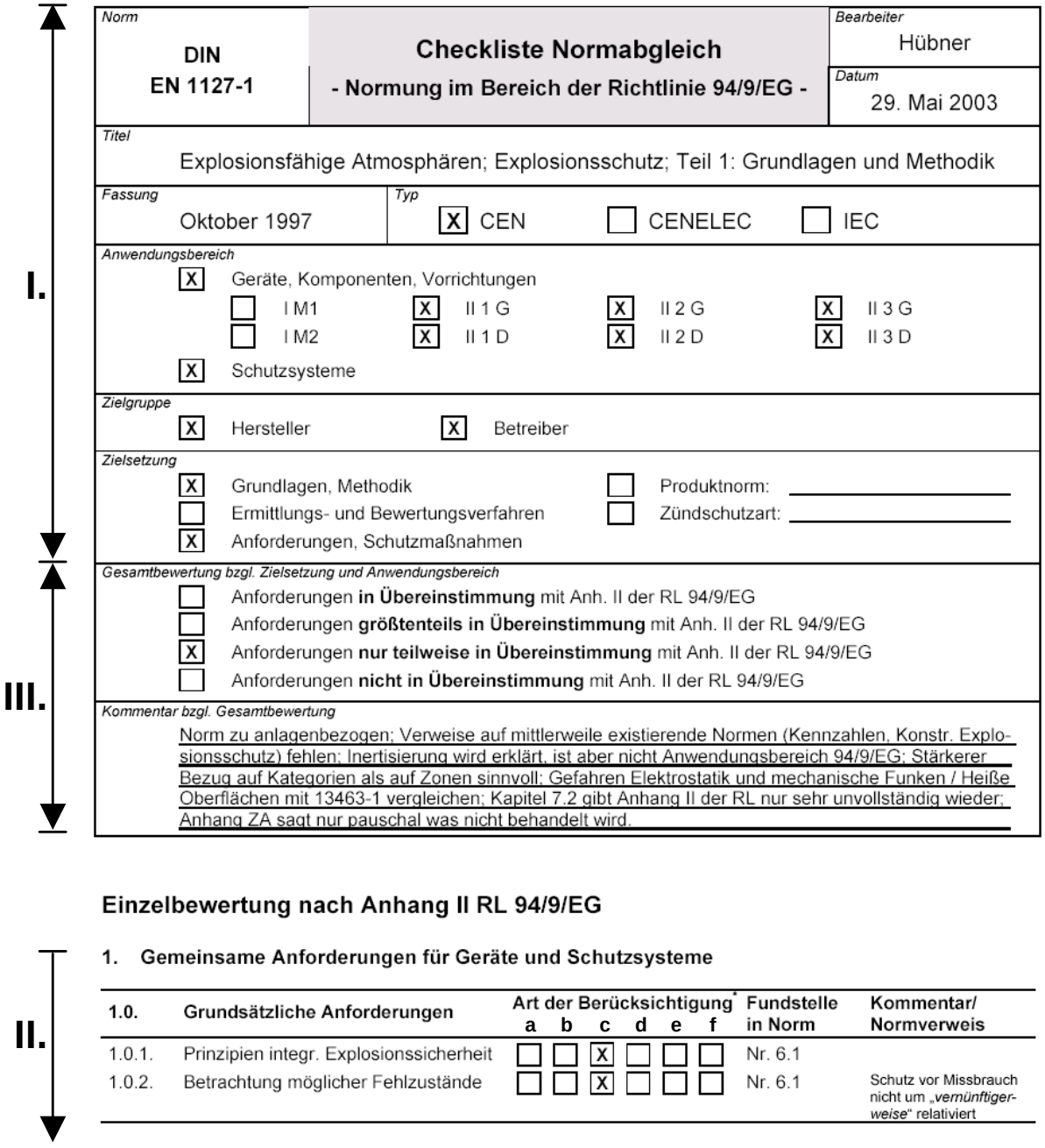
II. evaluation with regard to the essential requirements of Directive 94/9/EC Annex II concerning:

- **1.** common requirements for equipment and protective systems;
- **2.** further requirements for equipment;
- **3.** further requirements for protective systems;

III. overall rating.

For identification of the character of the standard, the contents of the standard were evaluated with regard to its target user group (manufacturers/operators) for assessment of deviations regarding the party to whom it is addressed (manufacturers), and the objectives assessed for the purpose of proper assignment of the standard's rating. Classification of the standard's objectives was based upon the principle of Type A, B and C standards; a greater distinction was however drawn regarding the content between principles/methods (e.g. EN 1127-1), proce-

dures for measurement and assessment (e.g. prEN 14034-1), requirements/protective measures (e.g. prEN 14373), product (e.g. EN 1834-1), and type of protection against ignition (e.g. prEN 13463-2). A single standard may satisfy several criteria.



I.

Norm	Checkliste Normabgleich	Bearbeiter
DIN EN 1127-1	- Normung im Bereich der Richtlinie 94/9/EG -	Hübner
		Datum: 29. Mai 2003

Titel: Explosionsfähige Atmosphären; Explosionsschutz; Teil 1: Grundlagen und Methodik

Fassung: Oktober 1997 — Typ: [X] CEN [ ] CENELEC [ ] IEC

Anwendungsbereich
- [X] Geräte, Komponenten, Vorrichtungen
  - [ ] I M1 — [X] II 1 G — [X] II 2 G — [X] II 3 G
  - [ ] I M2 — [X] II 1 D — [X] II 2 D — [X] II 3 D
- [X] Schutzsysteme

Zielgruppe: [X] Hersteller [X] Betreiber

Zielsetzung
- [X] Grundlagen, Methodik
- [ ] Ermittlungs- und Bewertungsverfahren
- [X] Anforderungen, Schutzmaßnahmen
- [ ] Produktnorm: _____
- [ ] Zündschutzart: _____

III.

Gesamtbewertung bzgl. Zielsetzung und Anwendungsbereich
- [ ] Anforderungen **in Übereinstimmung** mit Anh. II der RL 94/9/EG
- [ ] Anforderungen **größtenteils in Übereinstimmung** mit Anh. II der RL 94/9/EG
- [X] Anforderungen **nur teilweise in Übereinstimmung** mit Anh. II der RL 94/9/EG
- [ ] Anforderungen **nicht in Übereinstimmung** mit Anh. II der RL 94/9/EG

Kommentar bzgl. Gesamtbewertung:
Norm zu anlagenbezogen; Verweise auf mittlerweile existierende Normen (Kennzahlen, Konstr. Explosionsschutz) fehlen; Inertisierung wird erklärt, ist aber nicht Anwendungsbereich 94/9/EG; Stärkerer Bezug auf Kategorien als auf Zonen sinnvoll; Gefahren Elektrostatik und mechanische Funken / Heiße Oberflächen mit 13463-1 vergleichen; Kapitel 7.2 gibt Anhang II der RL nur sehr unvollständig wieder; Anhang ZA sagt nur pauschal was nicht behandelt wird.

Einzelbewertung nach Anhang II RL 94/9/EG

II.

1. Gemeinsame Anforderungen für Geräte und Schutzsysteme

1.0.	Grundsätzliche Anforderungen	Art der Berücksichtigung* a	b	c	d	e	f	Fundstelle in Norm	Kommentar/ Normverweis
1.0.1.	Prinzipien integr. Explosionssicherheit	[ ]	[ ]	[X]	[ ]	[ ]	[ ]	Nr. 6.1	
1.0.2.	Betrachtung möglicher Fehlzustände	[ ]	[ ]	[X]	[ ]	[ ]	[ ]	Nr. 6.1	Schutz vor Missbrauch nicht um „*vernünftigerweise*“ relativiert

Fig. 4.1: Structure of the checklist

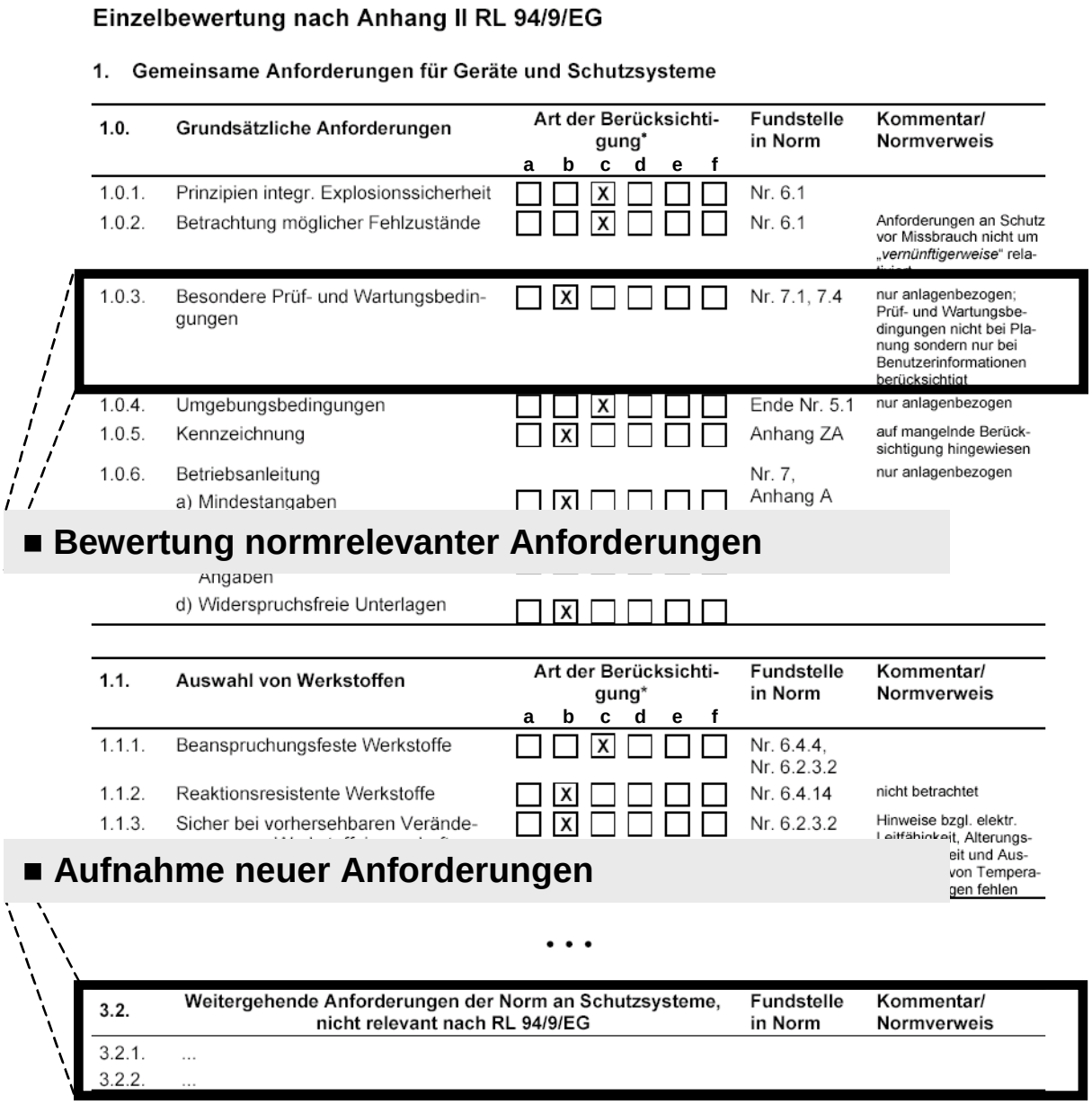
The individual standards were evaluated against the essential requirements contained in Annex II of the directive falling within the scope of application of the standard concerned (cf. Fig. 4.2). Each sub-item of Annex II was evaluated by assignment of a mark from "a" to "f". This system corresponds to the evaluation criteria shown in Table 4.1.

Table: 4.1 Criteria for evaluation of individual standards

Evaluation marks	Evaluation criterion (form of implementation in the standard of the essential requirements)
a	Requirement not relevant to the standard, i.e. outside the latter's scope (this does not extend to the informatory constraints, where present, in Annex ZA)
b	Requirements formulated in the directive supported unsatisfactorily or not at all
c	Measures correspond to the requirements of the directive
d	Requirements of the standard higher than those of the directive
e	Standard contradicts the directive requirement under consideration
f	Requirement in the directive not addressed, but reference to other standard(s)

The evaluation process was intended where possible to produce an objective assessment and deliver comparable results. Since a number of persons were involved in evaluation of the large number of standards, the evaluation process was organized as follows:

- Grounds were to be given in the form of brief comments for assignment of the evaluation marks "b", "d" and "e". Particular considerations, where they formed the basis of other results, were also to be indicated in the form of comments.
- Where the evaluation mark awarded differed from the information in Annex ZA, where published, a comment to this effect was to be made.
- Where a requirement of the directive lay within the scope of a standard and was not supported in it or at least mentioned in a reference to another standard or to Directive 94/9/EC, or by reproduction of the text of the directive, this deficit was marked "b". This procedure, although not corresponding to the CEN and CENELEC arrangements, which avoid reproduction of the text of a directive in standards, is nevertheless consistent with the presumption of conformity to which harmonized standards give rise, and with various provisions in electrical and non-electrical standardization, for example general requirements governing equipment in EN 1127-1, in which the definitions of equipment categories are repeated, or with the description of marking in EN 13463-1, in which information concerning the name and address of manufacturers, year of manufacture of devices, etc. is repeated.
- Standards governing protective systems which may also be distributed in the form of equipment (e.g. hydraulic flame arresters or rotary valves) were also to be evaluated for their support of the essential requirements for equipment under Annex II No. 2 of the directive.



Einzelbewertung nach Anhang II RL 94/9/EG

1. Gemeinsame Anforderungen für Geräte und Schutzsysteme

1.0.	Grundsätzliche Anforderungen	Art der Berücksichtigung* a	b	c	d	e	f	Fundstelle in Norm	Kommentar/ Normverweis
1.0.1.	Prinzipien integr. Explosionssicherheit	☐	☐	X	☐	☐	☐	Nr. 6.1	
1.0.2.	Betrachtung möglicher Fehlzustände	☐	☐	X	☐	☐	☐	Nr. 6.1	Anforderungen an Schutz vor Missbrauch nicht um „*vernünftigerweise*" rela-
1.0.3.	Besondere Prüf- und Wartungsbedingungen	☐	X	☐	☐	☐	☐	Nr. 7.1, 7.4	nur anlagenbezogen; Prüf- und Wartungsbedingungen nicht bei Planung sondern nur bei Benutzerinformationen berücksichtigt
1.0.4.	Umgebungsbedingungen	☐	☐	X	☐	☐	☐	Ende Nr. 5.1	nur anlagenbezogen
1.0.5.	Kennzeichnung	☐	X	☐	☐	☐	☐	Anhang ZA	auf mangelnde Berücksichtigung hingewiesen
1.0.6.	Betriebsanleitung							Nr. 7,	nur anlagenbezogen
	a) Mindestangaben	☐	X	☐	☐	☐	☐	Anhang A	
	Angaben								
	d) Widerspruchsfreie Unterlagen	☐	X	☐	☐	☐	☐		

■ Bewertung normrelevanter Anforderungen

1.1.	Auswahl von Werkstoffen	Art der Berücksichtigung* a	b	c	d	e	f	Fundstelle in Norm	Kommentar/ Normverweis
1.1.1.	Beanspruchungsfeste Werkstoffe	☐	☐	X	☐	☐	☐	Nr. 6.4.4, Nr. 6.2.3.2	
1.1.2.	Reaktionsresistente Werkstoffe	☐	X	☐	☐	☐	☐	Nr. 6.4.14	nicht betrachtet
1.1.3.	Sicher bei vorhersehbaren Verände-	☐	X	☐	☐	☐	☐	Nr. 6.2.3.2	Hinweise bzgl. elektr. Leitfähigkeit, Alterungs-

■ Aufnahme neuer Anforderungen

eit und Aus-
von Tempera-
gen fehlen

• • •

3.2.	Weitergehende Anforderungen der Norm an Schutzsysteme, nicht relevant nach RL 94/9/EG	Fundstelle in Norm	Kommentar/ Normverweis
3.2.1.	...		
3.2.2.	...		

Fig. 4.2: Evaluation of implementation in the standard of the essential requirements

- Where parts of multi-part standards were assessed, evaluation was performed for the full scope of the family of standards. Where relevant minimum requirements appeared in this case in other parts, this fact was indicated by the mark "f", with a comment in the form of a reference to the standard concerned. An exception is EN 50014, which was evaluated not in isolation, but in combination with the associated standards EN 50015 to 50020 and prEN 60079-18. prEN 61241-0, which applies only in combination with standards prEN 61241-1, IEC 61241-4 and prEN 61241-18, was evaluated in a similar fashion. In these cases, attention was drawn to the associated standards in the overall evaluation.

- Where requirements were formulated in a standard which could not be assigned to any of the essential requirements of Directive 94/9/EC, they were entered in separate checklist fields of the evaluation concerned (for example: protection against ionizing radiation, required in EN 1127-1 Nos. 5.3.11/6.4.11 – not addressed explicitly in Directive 94/9/EC, but only very generally in Annex II No. 1.3.1).

The concluding overall evaluation provides an overview of the essential deviations of the standard for the purpose of easier evaluation of the checklists. To this end, the level of correspondence was to be indicated in the header of the checklist and grounds indicated in a comment according to the following aspects:

- references to general/principle statements concerning the overall evaluation of the standard (e.g. "standard strongly concerned with systems", "stronger reference to categories than to zones would be constructive", or "inerting is explained, but does not fall under Directive 94/9/EC as a protective measure");
- specific statements concerning discrete major deviations with reference to the section containing the evaluations of individual standards (e.g. "Requirement for the instruction handbook highly deficient, Item 1.0.6.");
- proposals for further procedures (e.g. "compare electrostatics and mechanical sparking/hot surfaces as sources of ignition in EN 1127-1 with EN 13463-1");
- Evaluation of Annex ZA, if present (e.g. "failure to address minimum requirements indicated only generally in some cases, not at all in others, e.g. regarding the following aspects: 'Lifetime' (Item 1.2.1), 'Measures for safe opening' (Items 2.2.1.3, 2.2.2.4), 'Capacity to function in the event of power failure' (Item 3.0.3) and 'Prevention of failure due to outside interference' (Item 3.0.4)").

Chapter 5.1 contains an overview of the results of the checklist evaluation.

4.2 Interviews and discussions

In order for the knowledge of the experts involved in standardization (IEC, CEN, CENELEC and NASG working groups) and of users of standards (manufacturers, test bodies, institutions for statutory accident insurance and prevention (BGs), public bodies) to be exploited in the study in addition to that of the Contractor's certification and technical departments, interviews and discussions were conducted with experienced parties from all areas of explosion protec-

tion. The discussions considered equipment both in Equipment Group I for use in deep and open-cast mining, and in Equipment Group II for use in other areas in which a hazard is presented by potentially explosive atmospheres: both for electrical and non-electrical equipment, and safety, controlling and regulating devices.

The discussions and interviews were conducted in a structured manner and with reference to the area of activity of the individual concerned. Interviewers sought information on expectations and wishes concerning existing standards and draft standards with regard to the elimination of deficits, the level of detailing, and support of Annex II of the directive, or with regard to particular products and product groups. Users of standards were also consulted regarding deficits arising from lack of clarity, gaps or missing instructions for compliance with the basic requirements, and lack of practicability.

An overview of the relevant statements can be found in Chapter 5.2.

4.3 Research and literature survey

In order to study the potential impact upon the existing level of safety in Germany, the existing national body of regulations was compared to the current state of European standardization under Directive 94/9/EC. For this purpose, the regulations concerned, in particular those in the collected LOBA regulations and the standard governing erection, VDE 0118, were considered for the equipment and protective systems of Equipment Group I, since parallel product and erection requirements are contained in the "old" standards governing erection. For Equipment Group II, particular reference was made to the VDE 0165 standard governing erection. Within the sphere of Equipment Group II for non-electrical equipment and protective systems, the corresponding VDI guidelines and BG rules and specifications were also considered.

In order to verify and extend the experience gathered in the course of the study of possible deficits in the area of standardization and of the existing level of safety in Germany in the field of explosion protection, searches were conducted in databases of regulations and on the Internet.

The results of the research and literature surveys were included in the assessment of the results of the study in Chapter 6.

5 Description of the present situation

The section below summarizes the results of information gathered on the present state of standardization pursuant to Directive 94/9/EC. Information on the state of standardization prior to the Directive's entry into force on 1 July 2003 is presented in Chapter 6.3 in the context of the examination of possible changes in the level of protection.

5.1 Results of evaluation against the checklists

The study of harmonized standards and standards projects by means of checklists encompasses the documents which were available in a form suitable for evaluation during the course of the study. Unpublished draft standards available only as rudimentary working documents in the form of draft or revision comments and standards or draft standards which by definition are not able to support the essential requirements of Annex II of the directive were not evaluated against the checklists, but considered more closely in the interviews. These standards and standards projects specifically include the following:

- draft standards governing requirements for quality management systems, terminology, and measurement of parameters: EN 13980, prEN 13237, prEN 1839, prEN 13673-1/-2, prEN 13821, prEN 14522, EN 50281-2-1;
- working documents from standards projects at a rudimentary state of progress: WI 00305071, WI 00305041, WI 00305051, WI 00305055, WI 00305057, WI 00305062, prEN 60079-26.

From evaluation of all other standards, Table 5.1 provides an overview of examples of deficits in standards which were identified with regard to the support of various requirements of the directive. The cross-references refer to the grounds and to the individual standards examples in Chapter 6.1.

The results of checklist evaluation are shown in full in Annex A, Tables A.1-3 of the study. These results include the evaluation mark according to Table 4.1 given to each document studied against the numbering of the examined requirements formulated in Annex II of the directive. Individual comments, which can be found in the evaluations in Chapter 6, are not included.

Table 5.1: Overview of examples of deficits in standards as per Chapter 6.1

Standard	Over-all rating	Examples of general discrepancies arising from requirements in the directive which are missing from or inadequately detailed in a number of standards	Examples of specific discrepancies resulting from deviation from the requirements of the directive in detailed provisions
EN 1127-1	3	A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9, A.10, A.13	B.3.1
EN 1127-2	3	A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9, A.13	B.3.1
prEN 1710	2	A.4, A.5, A.6, A.9	-
EN 1755	2	A.1, A.2, A.3, A.4, A.5, A.9	B.2.1, B.3.2
EN 1834-1	2	A.4, A.5, A.6, A.8., A.9, A.12	B.1.1
EN 1834-2	2	A.1, A.2, A.4, A.5, A.6, A.8, A.11	-
EN 1834-3	2	A.1, A.2, A.4, A.5, A.6, A.8, A.12	B.1.3
EN 12874	3	A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.8, A.9, A.12, A.13	-
EN 13012	2	A.2, A.3	-
prEN 13237	-	-	B.1.4
EN 13463-1	3	A.1, A.2, A.3, A.4, A.5, A.6, A.7	B.1.2, B.1.5
prEN 13463-2	3	A.7	-
prEN 13463-3	2	A.7	-
prEN 13463-5	3	A.1, A.2, A.3, A.4, A.5, A.6, A.7, A.10	-
prEN 13463-6	2	A.4, A.7, A.8, A.9	-
prEN 13463-8	2	A.7, A.8, A.9	B.2.2
prEN 14034-1	2	-	B.1.6
prEN 14034-2	2	-	B.1.6
prEN 14034-3	2	-	B.1.6
prEN 14034-4	2	-	B.1.6
prEN 14373	4	A.1, A.2, A.3, A.4, A.5, A.6, A.8, A.9, A.10, A.11, A.12, A.13	B.1.7, B.3.3
prEN 14460	2	A.3, A.6, A.7, A.9, A.10	-
prEN 14491	2	A.3, A.4, A.5	B.1.8, B.3.4
prEN 14591-1	3	A.1, A.2, A.3, A.5, A.8	B.1.9
WI 00305058	3	-	B.1.10
WI 00305070	2	A.5	-
WI 00305072	2	A.2, A.3, A.5, A.9	-
WI 00305066	2	A.2, A.3, A.6, A.8, A.9, A.10	B.2.3
EN 50015	2	A.3	-
EN 50016	3	A.1, A.3, A.5, A.8, A.9	B.1.11
EN 50017	2	A.3, A.5	-
EN 50018	2	A.3, A.5	-
EN 50019	2	A.3, A.5, A.9	-
EN 50020	2	A.3, A.5	-
EN 50021	2	A.3, A.5	-
prEN 50039	2	A.3, A.5, A.9	-
EN 50104	2	A.2, A.3	-
EN 50050	2	A.3, A.4, A.5, A.6	-
EN 50241-1	2	A.2, A.3	-
EN 50241-2	2	A.2, A.3	-
EN 50281-1-1	2	A.3, A.5, A.9	B.3.5
EN 50281-1-2	2	A.5, A.9	-
EN 50284	2	A.5	-
EN 50303	2	A.3, A.5, A.8	-
prEN 50381	3	A.1, A.3, A.8, A.9	B.1.11
prEN 50394-1	2	A.3, A.5, A.6	-
prEN50402	2	A.3	-
prEN 60079-18	2	A.3, A.5	-
prEN 61241-1	2	A.2, A.3, A.5, A.9	-
prEN 61241-18	2	A.3, A.5	-
IEC 61241-4	3	A.1, A.2, A.3, A.8, A.9, A.14	B.1.11
EN 61779-1-2	2	A.2, A.3	-
EN 61779-1-3	2	A.2, A.3	-
EN 61779-1-4	2	A.2, A.3	-
EN 61779-1-5	2	A.2, A.3	-
EN 62013-1	2	A.2, A.3, A.5	-
IEC 62086-1	2	A.2, A.3, A.5, A.9, A.14	-

The following aspects concerning the present state of standardization may be taken from the detailed overview of the results of evaluation in Annex A:

- requirements in the directive which are supported only occasionally by standards pursuant to Directive 94/9/EC (requirements frequently marked "a");
- requirements in the directive which are not detailed adequately by standards pursuant to Directive 94/9/EC (frequently marked "b", "d", "e");
- contribution made by a standard to the support of essential requirements of the directive under Annex II (the greater the number of individual marks other than "a" and "f", the greater the number of requirements in the directive addressed by the standard);
- frequency with which the standard deviates from the essential requirements of the directive under Annex II (the greater the number of individual marks "b", "d" and "e" rather than "c", the lower the quantitative correspondence);
- standards addressing parties other than the manufacturers (indicated in Tables A.1-3 by M (Manufacturer), O (Operator);
- overall mark for the standards for frequency and significance of discrepancies with respect to the directive in comparison with each other (in Tables A.1-3, 1 = correspondence, 2 = broad correspondence ; 3 = partial correspondence only; 4 = no correspondence).

No immediate conclusions may be drawn from the comparison of the evaluation marks in Tables A.1-3 with regard to duplicate provisions, overlap and contradictions between CEN and CENELEC standards: inconsistencies could for example also arise between standards which support the same requirement as formulated in the directive and which are both therefore marked "c", but which set out different limit values and therefore contradict each other. The checklist results are therefore evaluated on the basis of the checklist comments and the suggestions made during the interviews. For further details, refer to Chapter 6.2.

5.2 Results of consultation in interviews and discussions

The structured interviews were conducted with users of standards and experts in both the electrical and the non-electrical sphere. The results of the interviews are shown below in anonymized form. The statements are not graded. They thus reflect the views of individuals and need not necessarily correspond to the generally recognized opinions in the sphere of stan-

dardization under Directive 94/9/EC. Repeated comments appear only once, but marked as such. The comments by the project support committee have also been included.

The following questions in particular were asked:

1. To what extent do the harmonized standards and draft standards pursuant to 94/9/EC and with which you are familiar support the essential requirements of Annex II of the directive; how do you rate the present state of standardization in general?
2. Do deficits such as duplication of provisions, overlap or contradictions exist between these standards or draft standards?
3. What conclusion do you reach when you compare the content of the standards with the existing level of safety in Germany?
4. In your view, is there a deficit of standards projects in certain areas?
5. In your view, are certain standards projects superfluous?
6. Do standards exist in which the party to whom the standard is addressed is not clearly the manufacturer and the test body?
7. General remarks.

Re 1: Support of Annex II of the directive; general rating of the state of standardization

- "Standards should generally provide a technical illustration of the requirements of the directive, and not repeat the text of the directive. That at least is what CEN demands. A different procedure applies however where no technical description is available for individual requirements of the directive: if the requirement of the directive is not cited in that case or no reference made to it, it remains unconsidered in the standard and may be overlooked by the user owing to the (claimed) presumption of conformity to which the standard gives rise."
- "Standards should contain references to requirements in the directive which they do not implement, in order to rule out these being simply overlooked by the user of the standard."
- "Individual standards should only support the directive and not contain general passages from it, as this merely results in the standard becoming bloated."
- "Individual standards should contain in their introduction or scope a clear reference to the need for all requirements set out in Annex II to be satisfied." (Repeated comment)

- "Certain product standards were not classified as harmonized standards under the directive until after completion, which explains deviations from Annex II of the directive: for example, requirements concerning the instructions or the general scope of the basic requirements, of which explosion protection constitutes only a small part, and the greater part of which lies outside the scope of the directive."
- "The structure of the standards is in some cases excessively complicated (for example: the EN 13463 series). The standards lack transparency even for experts. Conversely, specific requirements (for example concerning bearings) are missing from the details. The grounds given for such omissions are the lack of involvement by manufacturers in standardization activity, with the result that practical examples are missing."
- The "small" manufacturers would like a cookbook, but do not generally find one among the standards."
- "The significance of Annex ZA is viewed as beneficial, as the conformity of most non-electrical equipment (Categories 2 and 3) can be assessed by the manufacturer alone, and the annex makes it much easier for the user of a standard to place it in the context of Directive 94/9/EC. A clear indication by CEN of the form and depth of Annex ZA would however be desirable."

Re 2: Deficits such as duplication of provisions, overlap or contradictions

- "Owing to the different standards organizations responsible for electrical and non-electrical standards, a lack of co-ordination naturally results in requirements which are not uniform. This problem is exacerbated by the fact that at present, electrical standards are developed chiefly by the IEC and not at European level."
- "The EN 13463 series of standards are expected to exhibit deficits owing to the lack of involvement by experts. Revision during 2004 is already planned."
- "In EN 13463-1, non-electrical ignition sources are not addressed completely, e.g. flames and hot gases or mechanically generated sparks, as types of ignition source are already dealt with comprehensively in EN 1127-1. A corresponding reference to EN 1127-1 is however missing in EN 13463-1."
- "Standards should describe in greater detail the conditions upon which 'normal operation', 'incident' and 'rare incident' are based for their particular scope."

- "The requirements for light-metal alloys (aluminium content) differ in electrical and non-electrical standards."
- "Problems exist at the interface between electrical and non-electrical standards, as different standards organizations are involved and the exchange of information (and experience) is inadequate."
- "Parameters should not be listed in standards as numerical values, as these may change in the light of new findings (e.g. lower explosion limit of methane) without the standards being updated in a timely fashion. Tables containing numerous parameters can be found for example in EN 50054 and the EN 61779 series of standards."
- "Information on temperature stability is missing in EN 13463-1."
- "Specific rating of high-speed rotating parts is missing in EN 13463-5."
- "Definitions in prEN 13237 are not consistent with definitions in other standards (e.g. potential source of ignition, normal atmosphere); where contradictions exist, it is not clear which information is applicable."
- "The difference between potential and effective ignition source in EN 13463-1 is not clear; these points should in any case not be in this standard, but in EN 1127-1."
- "Electric motors for pumps are generally certified for ambient temperatures of up to 40 °C, but may be subjected to substantially higher ambient temperatures owing to the thermal radiation and conduction of a pump connected to them which may for example be delivering hot media. This information and corresponding protective measures should be considered in the standards. The standards further lack instructions for protecting the housing joint packing on submersible pump motors against ambient influences."
- "Where standards are intended to address hazards posed by sparking caused by workpieces, requirements should be described not only for a material (e.g. of a housing), but also for material combinations (e.g. of a housing and the part of the apparatus or tool coming into contact with it)."
- "The limitation of the surface area for dusts of less than 3 mJ in EN 13463-1 is not consistent with BGR 132."
- "EN 1127-1 is defective; however, only definitions and repetitions are being revised, and zoning deleted."

- "EN 1127-1 contains, under 6.3.3, a comment on each of the zone definitions. For example, for Zone 20: "In general these conditions, when they occur, arise inside containers, pipes and vessels etc." These instructions, which are very helpful to the user, have in some cases not been adopted in new standards, and should be added there, for example in prEN 61241-0."
- "In the standard governing pressure relief, the proposed corrections from VDI 3673 have not been adopted."
- "According to EN 1755, earthing of the conductive rollers of manually operated industrial trucks is sufficient. In combination with full vessels, however, too many charges arise which cannot be dissipated through the rollers alone. Stricter requirements may therefore be required than those described. This is unsatisfactory."
- "The division of the EN 14034 series of standards into four parts is of little benefit and also leads to error."
- "The division of the EN 14034 series of standards into a number of parts with considerable overlap and numerous duplicate provisions was undertaken in response to pressure from the standards institutes, and could not be prevented. A common standard or a generic standard with separate parts for specific parameters would be more constructive."
- "The only point of correspondence between the EN 14034 series of standards and Annex II of the directive is the essential safety requirement of No. 1.0.1, "principles of integrated explosion safety". The limitation of the effects of explosion in the introduction could be interpreted here as the basis and sole measure of explosion safety. Such a misunderstanding could be eliminated by an explanatory note."
- "Inconsistencies between Parts 1 to 4 of the EN 14034 series of standards are a result of problems with the translation and will be eliminated by corrections to the English draft."
- "The description of the igniter in addition to the description of the ignition source would be beneficial as an addition to the content of the EN 14034 series."
- The aspect of "lifetime" in the context of Annex II of the directive is not accorded adequate attention, as it has not yet been possible to carry this aspect through at international level (IEC), and it has not therefore been considered in the CENELEC standards."
- "The interface between electrical and non-electrical standards and consideration of the reliability of monitoring elements could be better co-ordinated (for example, the use of

motor-protective circuit-breakers is not governed clearly; consideration of motor bearings is not governed unambiguously in electrical standards; requirements for safety-related monitoring facilities are missing)."

- "Standards do not address whether monitoring devices must be certified (by a certification body) or their reliable operation may be declared by the manufacturer alone."
- "In the absence of standardized provisions, the essential recommendations of *Wintrich and Degener*, "Explosionsgeschützte Reibungsbremsen" (PTB-Mitteilungen 1968, Vol. 2, pp. 95-100) were applied for many decades in Germany. Owing to the uncontrollable rise in temperature, the friction surfaces in applications in Zone 1 were enclosed in type "d" flameproof enclosures. prEN 13463-5 limits itself to the provision in Section 9 "...allowing for the maximum kinetic energy to be dissipated, the maximum surface temperature shall not be exceeded at any part exposed to the potentially explosive atmosphere...". In the absence of more detailed provisions, consideration should also be given to theoretical limitation of the permissible switching energy (e.g. in markings or the instruction handbook)."
- "In the USA, the provisions of the UL (Underwriters' Laboratories; UL 674) have applied since 1929; in Canada, the regulations of the CSA (Canadian Standards Association; C 22.2 No. 145) apply. These provisions, which have proved their effectiveness for decades, were by necessity given appropriate consideration in the activities of IEC SC 31H. Consistent with the strong North American influence at the beginning of IEC's standardization activity, European practice (Practice A) was standardized parallel to the North American practice (Practice B) in IEC 1241-1-1. Practice B was eliminated during adoption in the European body of standards in 1998 in the EN 50281-1-1 currently applicable. The new drafts for the IEC 61241 series were developed in an IEC/CENELEC parallel voting procedure; in draft standard prEN 61241-1/VDE 0170/0171 Part 15-1 of October 2002, they contain the two variants in the form "Practice A and Practice B". Table 11 of the paper "Aktuelle Normenarbeit zum Explosionsschutz in durch Staub gefährdeten elektrischen Anlagen" (EX-Zeitschrift 2003, pp. 22-30) includes a comparison of the two practices. European users of standards will have considerable difficulty with the unfamiliar Practice B; for example, the standardized dust layer now refers to a depth of 12.5 mm, for which tabular values are not available in Europe, rather than 5 mm. If this standardization practice resulting from the parallel procedure, which is completely alien to European users, is to be avoided in Europe, co-ordinated European intervention is necessary. Ex-

perience has shown that unilateral national action, for example by the German representative, is not heeded."

- "IEC 61241-4, dated March 2001, contains the following definition in 2.31 for Zone 20: "Area in which combustible dust, as a cloud, is present continuously or frequently, during normal operation, in sufficient quantity to be capable of producing an explosive concentration of combustible dust mixed with air, *and/or where layers of dust of uncontrollable and excessive thickness can be formed*." This definition was included by the Secretariat SC 31H in this standard even though it was already anticipated that IEC 61241-10 and EN 50281-3 would contain the following definition, drawn up by Germany: "A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently." Owing to the prolonged discussion of the principles of this issue, the formulation in IEC 61241-4 should be brought into line with the European standpoint, if possible by a corrigendum, and at the latest at adoption as EN 61241-4."

- "The new drafts for the standards in the IEC 61241 series were developed at IEC level and by definition contain no references to the ATEX categories and markings. They were published as prEN 61241 without review by CENELEC and without interim consideration by a working group. Should they be published without European revision, the specifically European elements included in the EN 50281 series, which would then be superseded, would be eliminated. (Contractor's note: strictly speaking, they could not in fact then be adopted as harmonized standards.)"

- "In prEN 61241-0, it is in some cases difficult and on occasion impossible to establish to which zones (categories) the requirements apply. EN 50281-1-1, which is now to be superseded, is substantially clearer in structure. An objection from Germany to this effect has been referred to the MT, and will therefore be considered only in the course of a revision, if at all."

Re 3: Comparison with the existing level of safety

- "Standardization itself under Directive 94/9/EC is unlikely to jeopardize the level of safety in Germany; this is more likely to arise through implementation in practice, as foreign organizations apply the standards to equipment and protective systems with a different approach (to that usual in Germany), and may then also distribute this equipment and these protective systems in Germany."

- "At the present time, it is interesting to note that operators are beginning to raise zone classifications in order to be able to use more inexpensive equipment, in particular where non-electrical equipment is involved in potentially explosive atmospheres."
- "Manufacturers must give greater consideration to a higher level of safety (risk assessment) than in the past."
- "The new need for assessment of the ignition risks on the non-electrical side has resulted in a rise in the safety level; "systematic risk assessment" is particularly significant in this respect."
- "The directive will lead in future to a higher safety level than that currently in place in Germany, as the necessity for consideration of the equipment hazards in the course of the declaration of conformity and the requirement for a QA system will result in a raising of awareness, even should the state of the art remain the same."
- "In the electrical sphere, the level of safety has remained the same, as this area has been the subject of standardization for decades, and standards have been applied as a matter of course."
- "Owing to the correspondence in content with the VDI guideline 2263 formerly applied, the safety level in Germany regarding the definition of parameters for dusts need not be regarded as jeopardized."
- "In the absence of standardized provisions, the essential recommendations by *Wintrich and Degener*, "Explosionsgeschützte Reibungsbremsen" (PTB-Mitteilungen 1968, Vol.2, pp. 95-100) were applied for many decades in Germany. Owing to the uncontrollable rise in temperature, the friction surfaces in applications in Zone 1 were enclosed in type "d" flameproof enclosures. In section 9, prEN 13463-5 restricts itself to the provision that "allowing for the maximum kinetic energy to be dissipated, the maximum surface temperature shall not be exceeded at any part exposed to the potentially explosive atmosphere". Practical experience teaches how low the value of such a theoretical provision is. In my opinion, the safety level with this arrangement is substantially inferior to that formerly in place in Germany. The comment that the use of other protective measures is expressly recommended in order for sources of ignition to be prevented from arising is by no means adequate."

Re 4: Areas in which standards projects are lacking

- "Fulfilment of the requirements for instructions is a difficult subject, as it has not been clarified how much familiarity with the subject the user may be assumed to possess."
- "The inclusion of purely informatory 'notes' on possible zoning in standards is proposed as a useful instrument."
- "Provisions governing uniform test parameters are desired in standards governing gas instruments."
- "New standards projects are not considered beneficial, as they would not be feasible owing to the lack of available personnel for standardization work, and existing draft standards should first be revised."
- "A procedural 'risk assessment' standard similar in philosophy to the EX-RL explosion prevention regulations would appear necessary. It may be more appropriate for such a standard to be included under Directive 1999/92/EC. Nevertheless, risk assessment poses problems for manufacturers. Such a standard would be beneficial for this reason."
- "A product standard for stirrers is necessary which, whilst not formulating requirements for product characteristics, indicates the sources of ignition to be anticipated and the circumstances leading to them, and particularly the types of ignition source to be anticipated in the event of incidents and rare incidents."
- "No generally accepted list exists of what constitutes equipment (in the context of the directive), and what does not, and does not therefore fall within the directive's scope."
- "Product standards are not beneficial, as complicated things cannot be standardized, although manufacturers increasingly demand such standards."
- "Altogether, good bodies of regulations such as the EX-RL and the BGR 132 should be taken up at European level in order to define the interface between manufacturer and operator. An important point in this regard is zoning. The formal separation into zone and category is not constructive."
- "Standard governing the use of monitoring devices."
- "Standard governing the requirements for safety devices on electronic equipment, such as protective motor switches and monitoring devices for equipment in pressurized enclosures."

Re 5: Superfluous standards projects

- "EN 50281-3, 'Equipment for use in the presence of combustible dust - Part 3: Classification of areas where combustible dusts are or may be present' is not constructive (repeated comment)."
- "A standard governing instructions is superfluous; the provisions of Directive 94/9/EC are sufficient."
- "Protective systems employed in mining (water trough or stone dust barriers) should not be standardized under Directive 94/9/EC (alone), as their use is controlled by the operator."
- "The unanimous view on the standardization committees is that water trough or stone dust barriers used as safety systems fall within the scope of Directive 94/9/EC."

Re 6: Party to whom the standard is directed

- "The party to whom the standard is directed is frequently unclear (for example in the case of machines and intrinsically safe systems)."
- "In the case of EN 50281-3, 'Equipment for use in the presence of combustible dust - Part 3: Classification of areas where combustible dusts are or may be present', the standard is also directed at the operator."

Re 7: Miscellaneous and general remarks

- "Directive 94/9/EC itself is aimed too closely at the interests of electrical explosion protection; too few manufacturers were involved, and 94/9/EC was developed with an excessively theoretical approach."
- "prEN 13463-4 and prEN 13463-7 are not yet suitable for evaluation. It is still unclear what constitutes an ignition source in Part 4, and what content will be retained in Part 1; the draft of Part 7 has been completely rejected, and the corresponding CENELEC draft is awaited."
- "With the exception of EN 13463-1, no other part of this family of standards was available in its final form on 1 July 2003. From this date onwards, however, the manufacturer was required to distribute equipment the ignition characteristics of which were to be evaluated against uniform and concrete criteria which did not exist. Were a responsible designer to apply the (not generally available) draft standards in advance, the consequence may have

been expensive and ultimately obsolete developments. This is shown clearly by the spasmodic stages of development to the "c" type of protection."

- "Better exchange of information during the development and amendment of standards at the draft stage is recommended, in order for example to avoid duplicate provisions, which in some cases even differ in content; problems can currently be seen in the non-electrical sphere, as many standards projects are in progress in CEN parallel to CENELEC; call upon CEN to take advantage of CENELEC's many years of experience."
- "Attention is drawn to the greater costs (at least at the outset) entailed by application of the directive."
- "The QA requirements (certification and monitoring) cause problems (are resource-intensive) for small manufacturers or manufacturers with only a small number of explosion-proof products."
- "Standards exist, for example for printing machines, which do not fall within the scope of Directive 94/9/EC, but which contain explosion protection requirements which in some cases are absurd (for example that hoses through which flammable materials are delivered must be earthed)."[5]
- "Clear provisions are desirable from CEN/CENELEC by which product and operating requirements for more complex equipment can be distinguished from each other. This particularly concerns standards which are harmonized under further EU directives and govern for example the product requirements associated with operational zoning of the environment, this in some cases being regulated differently from country to country, for example for filling station equipment."
- "The objective of standardization should not generally be the explicit description of technical measures for the fulfilment of individual requirements; such measures should be left to the manufacturer's innovation. Instead, the directive should be underpinned by criteria and benchmarks which can be used to assess whether a requirement of the directive has been met by the protective measure(s) employed. Should specific measures nevertheless be formulated, all technical options should be listed."
- "In order to permit adequate consideration of the aspect of 'foreseeable misuse', a clarifying definition supplementary to the directive is desirable. It should be made clear whether

[5] This statement is not relevant to the study and will not be considered further during the evaluation.

measures ranked by category are to be employed, or the extent to which 'criminal intent' is to be considered."

- "Critical attention is drawn to the inconsistencies in the numbering of zones and categories."
- "The German term for directive ('Richtlinie') should be replaced by the term 'Direktive' in order to avoid misunderstandings."
- The provisions governing erection for plants (Group I) are not harmonized; in consequence, equipment (machines) continues to differ in specification within the EU (contrary to the philosophy behind the directive)."
- "Discrepancies in standards can also be found between the different language versions and also, for example, in the ATEX guidelines[6], the English version of which lacks the second sentence of Footnote a) in Table 2 of Chapter 4.1.2, in contrast to the German and French translations. This sentence states that the equipment is always to be considered as a whole with regard to whether it falls within the scope of the directive."
- "Standards are desired with fewer cross-references and with insertion of the relevant passages from the referenced standards, even should this result in the standards being substantially thicker, repetitive, and more difficult to keep up-to-date. American standards have been written in this way for many years."
- "The chief criticism of standardization: projects take too long. In the USA, a standard is published within five years at the latest."

[6] Guidelines on the Application of Council Directive 94/9/EC OF 23 March 1994, May 2000, European Commission, DG Enterprise (www.europa.eu.int/comm/enterprise/atex/guide)

6 Evaluation of the results of the study

The results from the checklist and consultation and from the literature surveys and database searches are considered together below, and evaluated with regard to the support of the objectives of protection formulated in Directive 94/9/EC.

6.1 Deficits of European standards under Directive 94/9/EC

Based upon comparison of the essential requirements under Annex II of the directive with the evaluated technical content of the standards and upon the information gathered during the interviews and discussions, the deficits noted were assigned to the following categories:

A. General discrepancies in European standards resulting from requirements in the directive which are consistently missing or inadequately detailed.

B. Specific discrepancies in certain European standards resulting from deviation of technical or organizational detail provisions within the scope of the standards from the requirements of the directive:

- **B.1** Detail provision supporting the requirement of the directive is inadequate, i.e. partly or completely missing from the standard
- **B.2** Detail provision is stricter than that of the requirement in the directive
- **B.3** Detail provision contradicts the requirement in the directive

The following list of identified deficits is not exhaustive, but indicates substantial discrepancies in the standards pursuant to Directive 94/9/EC which were examined within the time allocated for the study and which in the Contractor's view are of an essential nature.

Re A.: General discrepancies:

- **A.1** Many harmonized standards fail to consider hazards arising from misuse of equipment and protective systems (cf. Item 1.0.2. Table A.1). Consideration would be helpful; it should however be clarified that misuse in this context is inadvertent, and does not, as might incorrectly be understood from the German text, also include intentional misuse.
- **A.2** Where a standard is assumed to give rise to the presumption of conformity, including with regard to fulfilment of the requirements for marking, as described in

Chapter 4.1. (see Note 3 on Page 13##), implementation of the requirement concerning marking as formulated in Annex II No. 1.0.5 of the directive is found to be incomplete in over half the standards studied (see Table A.1). In addition, certain standards completely fail to address requirements for marking or, as in the case of standards governing explosion suppression systems (prEN 14373) or automatic explosion extinguishing installations on selective road headers (WI 00305072), requirements for marking are imposed which differ from those formulated in Directive 94/9/EC. Product standards frequently only contain references to EN 292-2, with the result that aspects of relevance to explosion technology extending beyond marking as regulated by the Machinery Directive are not considered; standards governing gas warning equipment and internal combustion engines, in particular, lack information on the Ex symbol, year of manufacture, and equipment category. Where certain product standards are concerned, this deficit can be attributed to the fact that they were not classified as harmonized standards pursuant to the directive until after completion.

A.3 Requirements for instructions are not generally formulated in full as required by the directive; this particularly applies to product standards (cf. Table A.1, Item 1.0.6.). As with marking (see A.2), the reason for this in product standards is the retrospective classification of finalized standards as harmonized standards under Directive 94/9/EC.

A.4 Many CEN standards require only in certain cases, and certain CENELEC standards not at all, that materials be selected which under predictable changes in property do not lead to any reduction in safety (cf. Table A.1 Item 1.1.3.). The standards concerned thus lack information on, in particular, the ageing properties of materials employed for safety-relevant components and the reduction where applicable in electrical conductivity resulting from changes to plastics. In certain standards, the above requirement is supported only for certain items of equipment within the scope, and not for others: for example, prEN 13463-5 contains such information for packing, bearings and moving parts, but not for drives, couplings, brakes, springs and conveyor belts. In addition, certain standards for safety devices apply the requirement of the directive to the equipment to be protected, and not to the safety device itself.

A.5 It is not always apparent in the standards whether and in what way the aspect of "lifetime" has been considered (cf. Table A.1, Item 1.2.1.).

A.6 Organizational requirements for safe opening of enclosed or encapsulated equipment and safety systems are considered only in part or not at all in a number of standards (cf. Table A.1 Item 1.2.6.). Adequately formulated requirements for warning instructions and measures for safe opening (e.g. special tools) are missing. The information is also missing from the instructions that opening of the enclosure or switching off where necessary results in a loss of explosion protection, or that failure caused by penetration by moisture or dust must be considered for intrinsically safe equipment which according to the standard may safely be opened.

A.7 The consideration of "protection against other hazards", which is frequently deemed unsatisfactory in the standards, is considered in Table A.1 Item 1.2.7. This assessment is based primarily upon the requirement for protection against injury formulated in Annex II No 1.2.7. a) of the directive and not generally included in the standards; the requirement may be addressed by the detailing of measures or by reference to such measures in standards for the avoidance of physical injury or other harm which might be caused by direct or indirect contact with the equipment. The requirement that foreseeable conditions of overload must not give rise to dangerous situations (Annex II No. 1.2.7. d) of the directive) is likewise frequently ignored.

A.8 Altogether, very few requirements for safety devices are supported by the CEN standards, and not many more by the CENELEC standards (cf. Table A.2 Item 1.5.). Standards for electrical equipment for example contain certain tentative provisions; the level of reliability is however frequently not laid down but instead placed within the responsibility of manufacturers and operators. CEN standards do not usually address the essential requirements for safety devices at all; attention is however generally drawn to this deficit in Annex ZA. In certain cases, however, Annex ZA contains misleading comments which describe these essential requirements as lying outside the scope of the standard concerned, as for example in prEN 13463-6. In some cases, requirements are also imposed with the aid of terminology which is not satisfactorily defined, such as "failsafe" in EN 1834-2/-3, or essential requirements are diminished, as for example in prEN 14373, according to

which the consideration of software risks is not obligatory, but "...it shall attempt to...", a deficit which should in fact have been noted by the Consultant.

A.9 Likewise poorly supported are requirements concerning the integration of safety-related system requirements, in particular in CEN standards (cf. Table A.2 Item 1.6.). This particularly concerns measures for manual de-energization of equipment running in automatic mode, measures for avoidance of hazards caused by power failure on equipment with safety-related functions and protective systems, and information on the arrangement of detectors and warning devices.

A.10 Particularly conspicuous in supplementary requirements for equipment are deficits in standards governing the design of equipment for the safe opening of parts of equipment which could constitute a source of ignition (cf. Tables A.2-3 Items 2.1.1.3, 2.1.2.4, 2.2.1.3, 2.2.2.4.). These deficits generally concern standards governing Group II Category 1 and 2 equipment, which generally do not then contain any provisions on this aspect.

A.11 Under No. 2.0.2.1 of the directive, the supplementary requirements for Category M2 equipment set out protective measures which ensure "that sources of ignition do not become active during normal operation, even under more severe operating conditions, in particular those arising from rough handling". "More severe operating conditions" and "rough handling" are however not described by examples, nor supported by corresponding measures, in any harmonized standards governing equipment in this category.

A.12 Users of standards and experts have proposed that the conditions for "normal operation", "incidents" and "rare incidents" be detailed more clearly in Type C standards, particularly for satisfaction of the supplementary requirements for equipment under Annex II Nos. 2.1.1.1., 2.1.2.1., 2.2.1.1., 2.2.2.1., 2.3.1.1. and 2.3.2.1. of Directive 94/9/EC. Among those questioned, a majority also wish to see at least information in Type C standards drawing attention to the requirements of the directive which are not supported by a standard but which are or could be of relevance.

A.13 Only CEN standards are affected by the supplementary requirements for protective systems, since purely electrical products - with the exception of safety devices, which however constitute equipment - are not capable of stopping explosions or

limiting their potential effects once they have been triggered. In particular, requirements concerning the prevention of failure caused by external effects and the capacity for integration of a protective system into a circuit with a suitable alarm threshold are neglected.

A.14 Essential standardization activity in the sphere of electrical standards is now conducted almost exclusively at IEC level. Since different categories have not (yet) been introduced at international level, the possibility cannot be ruled out of the relevant differences in the level of requirements not being considered satisfactorily in draft standards based upon IEC standards, for example concerning protection against dust explosion.

Re B.1.: Discrepancies in particular standards from which detailed provisions are missing in part or in full:

B.1.1 With regard to the intake of flammable gases by motors employed outside areas of mines susceptible to firedamp, information is lacking on the potential hazard posed by rises in surface temperature. Conversely, this hazard has already been addressed for underground areas in accordance with prEN 1710 No. 5.4 (cf. Items 2.2.1.2. and 2.3.1.2. in Table A.3 regarding EN 1834-1).

B.1.2 EN 13463-1, with its focus on the avoidance of ignition sources, details only selected non-electrical ignition sources (hot surfaces and electrostatic charges); information on temperature stability is missing, and the difference between potential and effective ignition sources remains unclear. No reference is made to EN 1127-1 with regard to examples of other ignition sources which may need to be considered. A number of experts wish to see at least a suitable reference at this point.

B.1.3 The visual test procedure to EN 1834-3 specifies freshly ground charcoal as the test substance for the testing of spark catchers for Category 2 D motors. It is questionable whether this procedure is sufficient for support of the requirement for the avoidance of sparks constituting potential ignition sources formulated in Annex II No. 1.3.1 should the motor be employed in potentially explosive atmospheres involving more reactive dusts or dusts with a thermal capacity higher than that of charcoal.

B.1.4 prEN 13237 defines terminology for use in standards governing equipment and protective systems for use in potentially explosive atmospheres. In the context of

the directive, the definitions, for example "ambient atmosphere" or "ambient temperature" are in some cases detailed incorrectly or at the very least in a misleading manner. In addition, definitions are missing for key concepts of the essential requirements under Annex II of the directive, for example "instructions" or "lifetime".

B.1.5 In the context of principles and requirements concerning the use of non-electrical equipment in potentially explosive atmospheres, EN 13463-1 No. 13.3.3 2. Indent 2 specifies the maximum surface temperature of Group II, Category I G equipment. This is presumably a typographical error, and should read Group II, Category 1 G.

B.1.6 In order to ensure consideration of hazards posed by various ignition sources under Annex I No. 1.3.1 of the directive, description of the igniter would be beneficial in the 14034 standards in addition to description of the ignition source.

B.1.7 Protective systems are distributed separately for use as autonomous systems (Directive 94/9/EC Article 1). According to Annex II No. 1.0.1, their function is to halt an explosion immediately and/or to limit its range to an adequately safe level. In its support of the requirements for explosion suppression systems, prEN 14373 neither addresses the suppression function of an autonomous protective system, nor does it provide information on the necessary decoupling of explosion-suppressed areas.

B.1.8 Pressure-relief systems are protective systems under Annex II No. 3.1.5 of the directive. prEN 14491 however lacks the provision that a pressure-relief system in this context is a protective system as defined by the directive, and the reference to explosion decoupling is not present.

B.1.9 Roadway air doors for assurance of a stable air supply following possible explosions in underground mines are to be designed and manufactured following due analysis of possible operating faults (94/9/EC Annex II No. 1.0.2.). Defective closure of the air doors, for example resulting from obstacles or misuse, is however not addressed in prEN 14591-1.

B.1.10 In order to prevent an explosion from spreading, water trough barriers are employed in underground mines. The design of these barriers is addressed in working document WI 00305058. The working document fails to include information on

regular checks of the water level for assurance of serviceability in the context of maintenance requirements under Annex II No. 1.0.3 of the directive and on the required strength (for example in the event of flying debris) of the frame structure bearing the water troughs in support of Annex II No. 3.1.1 of the directive.

B.1.11 The electrical standards dealing with the area of pressurized apparatus, EN 50016, IEC 61241-4 and prEN 50381, lack requirements for the technical design of safety devices for the monitoring of pressure and purging.

Re B.2.: Discrepancies in standards containing detail provisions stricter than the requirement in the directive:

B.2.1 For the safety of industrial trucks, EN 1755 requires, in addition to the requirement for marking formulated in Annex II No. 1.0.5 of the directive, a number of minimum markings not relevant to explosion protection (e.g. unladen weight, rated carrying capacity, and maximum/minimum permissible battery weight). At this point, it would appear more practical to consider all information not relevant to explosion protection by way of suitable references to relevant standards, for example those pursuant to the Machinery Directive.

B.2.2 Certain parts of the EN 13463 family of standards include a section formulating requirements for the instructions (Annex II No. 1.0.6 of the directive) and for the technical documentation. One consequence of this has been that unnecessary requirements are formulated for technical documentation and in some cases also for instructions (for example the inclusion of copies of test reports specified in Part 8). On occasions, the complete instructions are required as part of the documentation, which is not a requirement under Annex VIII of the directive for technical documentation relevant only to explosion protection.

B.2.3 Annex II No. 1.0.6 of the directive requires the existence of instructions but does not specify a particular format. Despite this, working document WI 00305066, governing fans for use in potentially explosive atmospheres, requires that documents be supplied in both hard copy and electronic form. Manufacturers increasingly prefer the electronic form; it is however questionable whether the paper form may be omitted. Under the Machinery Directive, hard copy has been agreed upon.

B.2.4 Within the sphere of electrical standards, evaluation of neither the checklists nor the interviews revealed requirements in standards containing detailed provisions stricter than those of the directive.

Re B.3.: Discrepancies in standards containing detail provisions in contradiction with the requirements of the directive:

B.3.1 Directive 94/9/EC distinguishes between safety devices consisting of equipment on the one hand and of a part of equipment or protective system on the other, both in Article 1 with regard to terminology and in Annex II with regard to the essential requirements. The listing in No. 7.2 b) of EN 1127-1 and -2 groups these products together indiscriminately and together with measures (e.g. inerting system) under the undefined term "safety system".

B.3.2 On the basis of EN 414, "Safety of machinery - Rules for the drafting and presentation of safety standards", EN 1755 governing the safety of industrial trucks presents a list comparing hazards corresponding to the essential requirements formulated in Annex II of the directive with sub-chapters containing the corresponding requirements of the standard. Not all sub-chapters correspond to the associated hazard as defined with the same terminology in the requirement formulated in 94/9/EC Annex II.

B.3.3 For the detailing of requirements for explosion suppression (cf. Annex II No. 3.1.6. of the directive), prEN 14373 contradicts the directive by treating explosion suppression systems not as protective systems, but as components and in some cases as equipment in the form of equipment for explosion protection. The draft standard further describes the use of explosion suppression systems for the protection of working areas. This practice is not the state of the art in Germany.

B.3.4 Protective systems for pressure release, which are governed by prEN 14491, must be used in conjunction with pressure shock resistant design, provisions for which are contained in prEN 14460. Pressure shock resistance is consequently employed as a value in prEN 14491; no reference to prEN 14460 is however provided.

B.3.5 EN 50281-1-1 employs limitation of the surface area as a measure for the avoidance of electrostatic discharges (propagating brush discharges). This provision in the standard is incorrect and thus contradicts the directive. The passage concerned

has however already been corrected in IEC 61241-0/1, which is due to supersede EN 50281-1-1.

EN 13980, which details the requirements for quality systems for manufacturers of equipment, components, devices and protective systems, cannot be applied to Directive 94/9/EC Annex II. It has nevertheless been considered within the study, as the requirements for the quality assurance system, like the essential requirements of the directive, **must** be met by the manufacturer prior to distribution of a product. Annexes IV and VII of Directive 94/9/EC form the basis for comparison in this case rather than Annex II.

The standard makes no direct mention of safety, controlling and regulating devices, nor of components. It likewise contains no indication of the frequency and intervals at which audits are to be performed by notified bodies. Although Annexes A and B describe quality control inspections with reference to a number of types of protection, the examples refer in the majority of cases to electrical equipment and are only partly suitable if at all, and by no means adequate, for application to non-electrical equipment, protective systems, and safety, controlling and regulating devices such as gas warning equipment. No mention is made of the control of essential documents such as declarations of conformity and instructions.

In consideration of the standards studied with regard to the parties to whom they are addressed, 17 of the standards listed in Table A.3 contain technical information also of interest to operators, of which seven standards in particular, i.e. some 12% of all standards considered by the study, place requirements directly upon the operator. These standards are basic standards (EN 1127 Parts 1 and 2), various standards governing types of protection and the selection and maintenance of electrical appliances (prEN 50039, EN 50281-1-2, EN 50303), and certain standards governing protective systems (prEN 14491, WI 00305058). Their relevance to the operator is evident firstly from the nature of the formulations, for example: "... work processes in adjacent *installations* ...", "information for use including maintenance which shall be supplied with ..., e.g. an *instruction handbook*", "...covering normal operation including *start-up* and *shut-down*...", or "... information on required *qualifications* and *training* (...) to enable the *user* to select qualified staff for the tasks...". Secondly, standards addressed to operators are frequently characterized by information on the selection of equipment or protective systems or on their conditions of use and erection. In standards for products fabricated by operators themselves, the requirements of the standard must also be met by the operator. This

particular case concerns for example the working document for water trough barriers (WI 00305058), which deals with the number and arrangement of tested water troughs in underground mines.

The relationship between the requirements of Directive 94/9/EC and a harmonized standard should be indicated in Annex ZA of the standard. The annex is published together with CEN standards as an informative part and will therefore be considered briefly. Generally speaking, information on the relationship to the directive is on the whole rudimentary in Annex ZA of older standards, whereas more recent standards contain detailed comparisons with the basic requirements of Annex II of the directive. Annex ZA of standards EN 1834 Parts 1 to 3 for example thus refers only to the ATEX and Machinery Directives. Conversely, if the standards are analysed according to the essential requirements, the majority are found to contain detailed information; here too, however, information on the relationship to the directive regarding safety devices and the integration of safety requirements relating to the system (Annex II Nos. 1.5. and 1.6. of the directive) is not generally present.

Altogether, an Annex ZA intended to support the application of a standard but drawn up without due care would tend to appear misleading:

- when references contained in the standard are incorrect or incomplete (e.g. EN 13463-1);
- when references are missing from the standard (e.g. owing to inadequate updating of the annex, as for example in prEN 13463-3);
- when, in particular, requirements are presented as lying outside the scope of the standard but are in fact a constituent part of it or indeed its principal focus (e.g. prEN 13463-6, see also Deficit A.9).

Furthermore, in the case of prEN 13237, which contains definitions from the sphere of explosion protection, an Annex ZA for harmonization of the terminological concepts with the essential requirements formulated in Annex II of the directive would not appear constructive.

To conclude, the survey of users of standards and in some cases also of experts revealed that a carefully prepared Annex ZA is deemed very useful, for both non-electrical and electrical equipment. It substantially facilitates the correct relation of a standard by manufacturers to the provisions of Directive 94/9/EC and thereby also the design of equipment and protective systems in compliance with the directive and, for both the majority of items of non-electrical

equipment (Categories 2 and 3) and the electrical equipment of Category 3, performance by the manufacturer of the conformity assessment procedure. Clear indication by CEN of the form and depth of Annex ZA is however desired.

6.2 Duplicate provisions, overlap and contradictions between harmonized standards

Discrepancies between harmonized standards were identified during processing of the check-list results in conjunction with the experience and knowledge of the parties to the study, and in some cases verified during the interviews and discussions. A distinction may be drawn between discrepancies within CEN standards and CENELEC standards and between CEN and CENELEC standards as follows:

1. Differences between CEN standards:

- In order to prevent violation of the specified surface temperatures for equipment in Group II Category 2 G (Annex II N. 2.2.1.2 of the directive): According to EN 1127-1 No. 6.4.2, "the temperatures of all surfaces (...) shall not exceed the minimum ignition temperature", or "where (...) the gas or vapour can be heated to the temperatures of the surface, (...) shall not exceed 80% of the minimum ignition temperature of the gas measured in °C", whereas according to EN 13463-1 No. 13.3.3, the "measured maximum surface temperature shall not exceed (...) the temperature class, less 5 K for (...) T6, T5, T4 and T3, less 10 K for T2 and T1". These different algorithms may yield different maximum surface temperatures, according to the ignition temperature of the gases concerned.
- Contradictions in definitions and requirements resulting from duplicate provisions can be found between Parts 1 and 4 of prEN 14034 concerning determination of the explosion characteristics of dust clouds. According to this standard, the rise in explosion pressure is defined in one instance as a function of the test conditions only and in another as a function of the test and standard atmospheric conditions; secondly, the dust vessel of the test facility must be rated in one instance for a pressure of at least 20 mbar and in another for a pressure of at least 20 bar. According to experts, the two contradictions are attributable to translation errors during drafting of the standards and are to be corrected in the course of future revisions. Experts and users of standards further expressed their desire for a combined version of such standards.

- Safety requirements for Category M2 motors for use in underground workings are supported by the EN 1834-2 standard. Paragraph 1 of the scope of the standard is however taken from Part 1 of the series of standards, with the result that EN 1834-2 refers, incorrectly, to Group II, Category 2 and 3 motors, for atmospheres rendered potentially explosive by gases and vapours.
- In order to prevent explosions from being triggered by the materials employed (Annex II No. 1.1.1 of the directive), EN 13463-1 states that the magnesium and titanium component by weight must not exceed 7.5% for all light-alloy equipment in Group I; the corresponding figure in EN 1834-2 for motors in Group I is 6%. As the value specified in EN 13463-1 is already geared towards future IEC standards, however, it may be anticipated that this value will also be adopted in EN 1834-2 in the medium term.
- For the "flame arrester" protective system, EN 12874 contains the provision governing the materials employed in the interests of adequate material strength that aluminium must not contain more than 6% magnesium. This provision should be supplemented at the earliest opportunity with the provision of EN 1127-1 that magnesium or aluminium content should not exceed 10% by weight in alloys (25% in coatings) under operational conditions in which the presence of rust particles cannot be excluded. Only then is the basic requirement for the avoidance of potential ignition hazards (Annex II Nos. 2.1.1.1, 2.2.1.1, 2.3.1.1 of the directive) caused by extraneous mechanically generated sparks addressed satisfactorily. Should this protection requirement not be considered, the strength measure as formulated in EN 12874 should be deemed hazardous.
- EN 1834-2 includes provisions supporting the requirement in the directive for enclosed design and prevention of leaks (Annex II No. 1.2.3. of Directive 94/9/EC) in the form of measures for safe fuel supply for the use of Group I Category M2 motors. These measures are equally advantageous for Group II Category 2 G and 2 D motors, but are not formulated as a requirement in the corresponding standards EN 1834-1 and -3 respectively.
- The draft of standard prEN 13237 contains concepts for support of the basic requirements for equipment and protective systems for use in potentially explosive atmospheres. Some of the definitions differ, at least in wording, with those found in harmonized standards under Directive 94/9/EC, for example "maximum rate of explosion pressure rise" (cf. EN 14034-1), or "reduced explosion pressure" (cf. prEN 14460 and prEN 14373).

2. Differences between CENELEC standards:

- Requirements for the avoidance of electrostatic discharge (propagating brush discharges) differ between EN 50281-1-1 and IEC 61241-0/1 (cf. B.3.2). The incorrect passage referred to in EN 50281-1-1 has however already been corrected in IEC 61241-0/1, which is to supersede EN 50281-1-1.

- Standards containing materials parameters, such as EN 50054 or the EN 61779 series of standards, present a risk of inconsistency between these parameters and the state of the art owing to a lack of revision (for instance of the lower explosion limit of methane). Rather than specification of explicit numeric values, it therefore appears more constructive to refer in the standards only to regularly updated collections of materials data.

- IEC 62086-1 sets out requirements for Category 2 G and 3 G electrical resistance trace heating. Requirements for Category 2 G resistance trace heating are also detailed in EN 50019 for the increased safety type of protection. The requirements profiles are not identical, in particular regarding the practical tests to be performed. Application may yield different results.

3. Differences between CEN and CENELEC standards:

- For the avoidance of triggering of explosions (Annex II No. 1.1.1 of the directive), EN 13463-1 No. 8.2 requires that materials of external parts of light-alloy Group II Category 2 equipment contain no more than 7.5% magnesium, whereas EN 50014 permits a maximum magnesium content of 6% by weight. Since, however, the value specified in EN 13463-1 is already geared to that of future IEC standards, the higher content of 7.5% magnesium will also be adopted in CENELEC standards and this contradiction eliminated in the medium term.

- For protection of non-electrical equipment for use in potentially explosive atmospheres, prEN 13463-3 details requirements for flameproof enclosure systems under Annex II No. 1.2.9 of Directive 94/9/EC. The standard refers in this instance largely to EN 50018, but contains the following provision for type-testing of Category 2 G and M2 flameproof non-electrical equipment: "...that mining flameproof enclosures with joints of *less* than 1 mm width and 3 mm length were unlikely to permit propagation of coal dust deposit combustion from inside the enclosure to outside." This provision is not compatible with the objective of minimum gap lengths and the EN 50018 standard to which reference is made. A correct formulation would be: "joints of *more* than 3 mm in length". This contradiction

also indicates the importance of complete reproduction of requirements in a standard when complex concepts are transferred from another standard if misunderstandings impacting upon safety are to be avoided. For this reason, prEN 13463-3 with its many references to EN 50018 in conjunction with substitute wording at transition appears less user-friendly and hardly conducive to review for deficits. By contrast, the adoption of suitably adapted passages from EN 50018 could substantially facilitate application of the standard in this instance.

- Implementation of a minimum layer thickness of a chargeable plastic surface constitutes a measure for the avoidance of propagating brush discharges. With a value of 10 mm, this minimum thickness differs in the non-electrical sphere in EN 13463-1 from the 8 mm required in the electrical sphere in EN 50281-1-1 and in prEN 61241-0.
- A principle lack of co-ordination exists at the interfaces between electrical and non-electrical standards, for example a lack of consideration of non-electrical components of electrical equipment, such as the bearings of electric motors or the use of protective motor switches.
- According to experts, deficits between electrical and non-electrical standards may continue to be anticipated in the future, as different standards organizations are involved, and the exchange of experience is unsatisfactory.

6.3 The level of protection of existing national provisions and European standards: a comparison

Prior to transposition of Directive 94/9/EC, requirements for non-electrical explosion protection were specified primarily in technical rules, instructions for implementation and rules for accident prevention regulations, guidelines and safety rules such as the EX-RL (BGR 104), the electrostatic rules (BGR 132), and of course, where applicable, in general form in the 9th Ordinance of the GSG, the German Equipment Safety Act, in which Directive 98/37/EC (formerly 89/392/EEC) for machinery has been transposed into German law. Further principles, in some cases containing very detailed specifications, can be found in VDI guidelines (VDI 2263, VDI 3673). The focus of the majority of technical rules lay upon the assessment of operational issues of explosion protection, i.e. the consideration was geared towards plants, apparatus or activity. Assessment of specific apparatus or machinery with regard to explosion protection and corresponding documentation by a manufacturer was rare.

The state of the art has therefore been described in Germany in the past in information in technical rules, standards and specifications, by tried and tested technical solutions and by generally accepted good practice. The national standards institutions VDI and DIN/VDE and industry associations such as VDMA, VCI, VdS or VdSI acted as regulators.

The BGs, whose state regulatory mandate under the German Social Code is implemented in accident prevention regulations, guidelines, safety rules, codes of practice and principles, play a key role in the drafting of technical legislation. As independent legal standards, the accident prevention regulations are limited in their scope to employers and insurees (employees), but in conjunction with generally accepted good practice have an influence which extends beyond insurance legislation, and should be regarded as being similar in status to ordinances.

The explosion prevention regulations (EX-RL) with a collection of examples (BGR 104) issued by the BG Chemie have acquired outstanding significance in the BG system. The BG Chemie has a co-ordinating role for all industrial sectors with regard to this issue. The basic principles set out in the EX-RL, namely:

1. avoidance of explosion hazards by measures which prevent or limit the formation of hazardous explosive atmospheres;
2. avoidance of ignition sources by measures which prevent the ignition of hazardous potentially explosive atmospheres;
3. avoidance of hazardous consequences of explosion by design measures which limit the effects of an explosion to an acceptable level

can be found in all bodies of regulations. These basic principles are also taken up in Directive 94/9/EC in the ranked categories of measures. The relationship between the scale and depth of measures on the one hand and the frequency with which potentially explosive atmospheres arise on the other is also expressed in the directive. In contrast to the EX-RL, the directive deliberately avoids the concept of zoning, and introduces the term "category". Overall, however, it can be said that the philosophy of the EX-RL is retained in Directive 94/9/EC with regard to equipment and protective systems. One reason for this is without doubt the high acceptance of the EX-RL as a mature body of regulations rooted in practice. Content of the EX-RL can also be found, albeit in strongly condensed form, in EN 1127-1. The content of the VDI guidelines has likewise largely been transferred to the corresponding CEN standards, with the result that application of these standards equally poses no threat to the existing level of safety. Deviations in technical detail from the former national body of regulations can

doubtless be found in places; these deviations are however detail points which, although they may diminish existing practice in places and enhance it in others, by no means jeopardize the existing safety level. Overall, there is no doubt that the majority of relevant German experts in the field were and continue to be involved in CEN standardization activity, with the result that the standard reflects the state of the art in Germany. It may consequently be stated that the level of safety in Germany is in no way at risk with regard to the technical content of the standards.

Conversely, a general trend towards either a higher or a lower level of safety may be discerned. Such a trend is however unrelated to the detailing of the directive by standards, but is instead directly related to the requirements which ensue from application of the directive.

The obligation upon manufacturers to generate declarations of conformity gives rise at the same time to a need for the explosion protection concept for an item of equipment or protective system to be systematically reviewed and documented. This results in weak points being identified and eliminated which were not previously evident. As type-testing certificates were not required for equipment in the non-electrical sphere, the tendency was for explosion protection measures to be implemented system-wide, and therefore often from a wider perspective. Less attention was paid to the individual items of equipment in detail. The new, equipment-oriented approach however need not necessarily result in safer equipment or for that matter in a rise in the safety level in Germany. In many cases, review of the existing explosion protection measures leads to reconsideration, but not always to technical modification of the equipment.

A much greater effect must be anticipated from the instructions, which are a requirement of the legislation and the standards. Within them, the manufacturer must describe safe operation of his equipment or protective system, and also state the constraints upon application. Instructions must be examined in the course of the conformity assessment procedures. Provided the points set out in Directive 94/9/EC are observed and care is exercised in their implementation during generation of the instructions, greater transparency for the user of the equipment may at least be expected.

Finally, it may be stated for the non-electrical non-underground sphere that introduction and application of Directive 94/9/EC and the associated standards does not lead to a noticeable change in the safety level. However, as regulation of this area in the past has placed a lower emphasis upon equipment, introduction and application of the standards leads to much confu-

sion and difficulty. These difficulties can be expected to diminish with time as the standards are revised and as manufacturers, test bodies and operators become more familiar with the subject.

Since their inception, measures for the prevention of gas and/or dust explosion have improved continually in both **coal mining** and other industries. A range of other measures have been developed to prevent occurrence of a potentially explosive atmosphere caused by coal dust, beside the primary measures for explosion protection which prevent or limit the formation of potentially explosive atmospheres caused by methane. Electrical and non-electrical apparatus has had to be manufactured and operated in such a way that it cannot become a potential ignition source, even in the event of an incident. In the past, requirements for apparatus in the sphere of non-coal mining were regulated by such instruments as the EX-RL, the ElexV, and the applicable VDE provisions and DIN/EN standards. Underground coal mining was excluded in part from the scope of these regulations. The prospecting, extracting and processing of mineral resources is regulated by the Federal Mining Act of 13 August 1980. This act authorizes the German regional governments or the Federal Minister of Economics to issue "mining ordinances" where necessary for protection against hazards to life and health and the protection of property, workers and third parties in operations. The protective measures undertaken on apparatus for avoidance of gas or coal dust explosions were laid down in the regional governments' "Coal Mining Ordinances" and the explosion protection guidelines based upon them.

These guidelines included:

- Prüfbestimmungen für Betriebsmittel aus Kunststoffen zur Verwendung in Bergwerken unter Tage, Kunststoff-Prüfbestimmungen, Landesoberbergamt NRW, published March 1993.
- Technische Anforderungen des Landesoberbergamtes Nordrhein-Westfalen an Grubenlokomotiven im Untertagebereich von Steinkohlenbergwerken, Landesoberbergamt NW, 1987.
- Wassertrogsperren Bauart 4 (aufgeteilte Wassertrogsperren) Rundverfügung des Landesoberbergamtes NRW, Dortmund 1970.
- Bestimmungen des Landesoberbergamtes Nordrhein-Westfalen zur Prüfung von Wassertrögen für Wassertrogsperren im Steinkohlenbergbau (Wassertrog-Prüfbestimmungen), 1985.

- Anforderungen des Landesoberbergamtes Nordrhein-Westfalen an die Bauart von Zugkatzen mit Eigenantrieb durch Dieselmotoren (Dieselkatzen) für Einschienehängebahnen im Untertagebetrieb von Steinkohlenbergwerken (Bauvorschriften für Dieselkatzen), 1976.

This body of regulations, i.e. the corresponding provisions issued by the various regional mining inspectorates, defined the requirements profile for the use of non-electrical apparatus and equipment.

In the course of subsequent European harmonization, various harmonized standards were or are still being created which describe the distribution of equipment and protective systems. These standards create a means by which the essential safety requirements of Directive 94/9/EC can be met.

prEN 1710 and in particular EN 1834-2 for example lay down the safety requirements for the design and construction of Group I motors (for use in underground parts of mines and parts of surface installations of mines endangered by firedamp and/or combustible dust). The requirements described in these standards correspond almost completely to the former requirements of the North Rhine-Westphalia Mining Inspectorate (LOBA NRW). prEN 1710 details the technical requirements for explosion protection relating to the construction of equipment and components for use in parts of mining installations susceptible to firedamp.

The draft of WI 00305070, "Explosion prevention and protection in underground mining – Water trough barriers", drawn up by CEN/TC 305, "Potentially explosive atmospheres - Explosion prevention and protection", details the requirements and test procedures for water troughs employed in water trough barriers in underground coal-mines. Here too, the test requirements for calculation of the water distribution were adopted from the former requirements of the regional mining inspectorate.

Altogether, it can be said that the level of safety and protection formerly applied has essentially been adopted in the relevant standards or current draft standards with regard to the requirements concerning the distribution of equipment and protective systems for use underground. One reason for this is the high acceptance of the rules and requirements drawn up for the mining industry. For this reason, it can be assumed that no diminishment of the existing safety level of non-electrical equipment and protective systems need be anticipated from the new regulatory arrangements for explosion protection.

In the sphere of **electrical explosion protection**, design regulations for Category 2 G and M2 equipment have been formulated for many years in European and international standards. European directives for these equipment categories have also existed for over 20 years. As these standards were harmonized largely unchanged under Directive 94/9/EC, the safety level for Categories 2 G and M2 has remained the same.

No documented requirements existed in the past in European standards for the other equipment categories. IEC standards existed only for electrical equipment with protection against dust explosion, and for equipment for Zone 2 (Category 3 G). At approximately the same time as Directive 94/9/EC came into force, European standards were also drawn up for these equipment categories. These standards drew upon both the IEC standards referred to above, and the bodies of regulations applicable in Germany. These bodies of regulations particularly concerned equipment for Zones 0 and 10 and equipment which may be operated in high-methane atmospheres (M1).

The requirements concerning the level of safety for Categories 1 G and M1 is thus in principle broadly comparable to that of the previously applicable bodies of regulations. Shifts towards a higher or lower safety level may however be observed in the details. For Category 3 G equipment, the safety level has certainly been raised, as the requirements set out in EN 50021 are substantially more detailed and more far-reaching than the requirements profile defined previously in VDE 0165 and in the directive.

For electrical equipment with dust explosion protection, comparison with the bodies of regulations formerly applicable in Germany is difficult, as these regulations were based upon a 2-zone concept. If the requirements for Zone 10 are compared with Category 1 D, much the same applies as stated above for Category 1 G, i.e. a safety level which is virtually unchanged. The safety level for Category 3 D is higher than that for Zone 11 equipment; here too, the requirements formulated in EN 50281-1-1 and prEN 61241-0/1 are substantially more detailed and far-reaching than the requirements profile formerly defined in VDE 0165. No body of regulations comparable to Category 2 D existed previously in Germany.

6.4 Areas not supported by standards or standards projects; superfluous standards and standards projects

The study was also to examine the extent to which additional standards projects in support of Directive 94/9/EC are considered necessary, or whether standards already exist which are deemed unnecessary and should therefore be dropped.

Areas not supported by standards or standards projects

In the view of the project support committee and of the Contractor, no further product standards should be developed, as the existing body of standards (including the prestandards) adequately details the product characteristics, and no further need exists for individual product groups to be detailed on the standardization level. Some manufacturers would like to develop their products against a specific standard. The purpose of standards is not however to reproduce the technical implementation, but only to state the requirements for the product properties. Furthermore, the number of standards needed in order to cover all products would be very high. The standards committees would be unable to handle the corresponding workload.

As described under B.1.4, virtually all standards governing equipment housed in pressurized enclosures (EN 50016, IEC 61241-4, prEN 50381) currently lack information on the level of requirements for the safety devices required for monitoring the pressure and the purging process. As the monitoring devices are of essential importance for these types of protection, this constitutes a significant deficit in these standards. Requirements for other safety devices such as protective motor switches and thermal monitoring devices are also missing from standards. For these reasons, a standard which sets out the quality and the requirements profile of safety devices is important in order for a defined safety level to be attained for the technology described. A corresponding standard should therefore be developed.

Superfluous standards and standards projects

As already explained in 6.2, IEC 62086-1 defines requirements for Category 2 G and 3 G electrical resistance trace heating. Requirements for resistance trace heating are also described in EN 50019 for the increased safety type of protection. The requirements profile, in particular for the practical tests to be performed, is not identical; application may yield different results. This product standard should therefore be dropped or at least not adopted as an EN standard.

In the view of the sub-working group responsible for revision of the collection of examples within the "Explosion protection" area of the "Chemistry" technical committee, EN 60079-10 (VDE 0165, Part 101), "Electrical apparatus for explosive gas atmospheres - Part 10: Classification of hazardous areas" and EN 50281-3 (VDE 0165, Part 102), "Equipment for use in the presence of combustible dust - Part 3: Classification of areas where combustible dusts are or may be present" should be converted to a Technical Report, as they correspond to the area governed by Directive 1999/92/EC, which, in contrast to Directive 94/9/EC, is addressed to operators and not to manufacturers. In the view of the sub-working group, the zones should not be defined in standards.

6.5 Discrepancies within Directive 94/9/EC

Great importance is attached to harmonized standards under Directive 94/9/EC: they are "...standards relating to the design, manufacture and testing of equipment, compliance with which enables a product to be presumed to meet such essential requirements. (...) judgment will have to be exercised in the implementation of those requirements in order to take account of both the technology obtaining at the time of manufacture and overriding technical and economic requirements. (...) specific, clear marking of said equipment, stating its use in a potentially explosive atmosphere, is also necessary."[7]

Even though the present study was only to examine the extent to which existing standards or working documents satisfy this high requirement, certain discrepancies were noted which will be discussed briefly below.

The purpose of standards is to detail the essential requirements defined in the directive. Should essential requirements be missing or be formulated very vaguely, standards committees will have difficulty in producing good results, particularly since the result may in any case be expected to be a compromise where different philosophies, perspectives and interests must be reduced to the lowest common denominator.

- The directive thus requires for example no specific marking of safety devices or protective systems. This clearly shows that the authors of the text of the directive were essentially thinking in the existing language used to describe electrical equipment.

[7] From the Recitals of Directive 94/9/EC, October 1996

- Nor does the directive describe how combined equipment which under Article 1 Paragraph 3 a) constitutes equipment in its own right is to be marked and what conformity assessment procedures are to be followed for this purpose.

- Directive 94/9/EC fails to regulate the marking of separate components of equipment or protective systems which consist of a number of distributed components, for example protective systems consisting of sensors and actuators, as for example in prEN 14591-2 (WI 00305072) governing automatic explosion extinguishing installations on selective road headers.

- With regard to safety devices, the directive itself fails to describe which conformity assessment procedures are to be followed.

Under Directive 94/9/EC, the use of software for implementation of a safety function is prohibited. This requirement in the directive no longer corresponds to the state of the art, as software is now certainly used as a component in safety devices, and it is also technically possible for an adequate safety level to be attained provided suitable requirements are placed upon the control system.

Annex II No. 1.0.1. of the directive requires that equipment and protective systems adhere to the principles of integrated explosion protection according to which where possible, the avoidance of potentially explosive atmospheres is to take precedence over the prevention of ignition sources or limitation of the scale of explosions. This prioritization is not implemented in standards whose focus lies solely upon avoidance of ignition sources or upon engineered explosion protection and in which explosion protection is based solely upon these principles (cf. Table A.1, Item 1.0.1.). The experts' view is that this contradiction is due partly to a deficit in the directive, namely that the requirement under Annex II Item 1.0.1 is inappropriate in a directive for equipment intended specifically for use in potentially explosive atmospheres; a corresponding passage for assignment of the principle of explosion protection addressed in the standard within the above prioritization would also be a conceivable means of preventing misunderstanding.

Although Directive 94/9/EC applies to distribution and placing in service, opinions differ regarding whether it is also to be observed by parties constructing equipment for their own use. The guidelines on the application of Directive 94/9/EC contain a clear provision on this point under 3.4; it would however be in the interests of all parties concerned were ambiguity to be

avoided in the text of the directive itself. Directive 98/37/EC contains an unequivocal provision in Article 8(7).

It should be self-evident that installation or erection of plant does not fall within the scope of Directive 94/9/EC; this aspect does however give rise to difficulties, for example with regard to the protective systems.

The definition of Category M2 may give rise to misunderstandings. The provision formulated for Category 2, that the explosion protection measures of the apparatus are to assure the required measure of safety even under frequent equipment incidents or fault conditions which may normally be anticipated, is missing.

The directive attaches great importance to the principle of the presumption of conformity, according to which equipment, protective systems and devices manufactured in observance of standards pursuant to this directive may be assumed to satisfy the relevant essential health and safety requirements, as set out in other New Approach directives. Although it contains, under Article 6, provisions for the procedure to be followed should the harmonized standards not fully comply with the relevant essential requirements stated in Article 3, it contains no clear provision that manufacturers and notified bodies are obliged at all times to ensure that the state of the art attained at the time of manufacture of the equipment is actually observed. Whilst such statements may be found in the "Guide to the Implementation of Directives Based on New Approach and Global Approach"[8], they are not even formulated in the guides to the directive itself. The difficulties faced by stakeholders in this area are revealed by the ongoing discussion at present of the action which should in fact be taken by manufacturers and notified bodies upon the appearance of new versions of standards. This is however not a problem exclusive to Directive 94/9/EC, but one of a more general nature.

[8] Guide to the Implementation of Directives Based on New Approach and Global Approach, for example Nos. 4.1 and 6.4, European Commission, 2000

Annex A

Results of evaluation of individual harmonized standards

The standards were evaluated individually against the basic requirements of Annex II of the directive lying within the scope of the standard concerned. Each sub-item of Annex II of the directive was evaluated by assignment of one of the following marks:

- **a:** Requirement not relevant to the standard, i.e. excluded from the scope of the standard (this does not extend to the informatory constraints, where present, in Annex ZA)
- **b:** Requirements of the directive supported unsatisfactorily or not at all
- **c:** Measures pursuant to the requirements of the directive
- **d:** Requirements of the standard higher than those of the directive
- **e:** Standard contradicts the directive requirement under consideration
- **f:** Requirement in the directive not addressed, but reference to other standard(s)

The party to whom the standards are addressed was evaluated by distinction between manufacturers (M) and operators (O). Within the overall evaluation, each standard was assessed in terms of the frequency and significance of its deficits with respect to the directive as follows:

- **1:** Requirements corresponding to those of Annex II of Directive 94/9/EC
- **2:** Requirements largely corresponding to those of Annex II of Directive 94/9/EC
- **3:** Requirements corresponding only partly to those of Annex II of Directive 94/9/EC
- **4:** Requirements not corresponding to those of Annex II of Directive 94/9/EC

In order for the evaluation process to be as objective as possible and to deliver comparable results, a number of rules for evaluation were laid down. These rules are described in greater detail in Chapter 4.1 of the study and are necessary for a proper understanding of the tables below.

Table A.1: Results of the evaluation

	IEC 62086-1	EN 62013-1	EN 61779-1-5	EN 61779-1-4	EN 61779-1-3	EN 61779-1-2	IEC 61241-4	prEN 61241-18	prEN 61241-1	prEN 60079-18	prEN 50402	prEN 50394-1	prEN 50381	EN 50303	EN 50284	EN 50281-1-2	EN 50281-1-1	EN 50241-2	EN 50241-1	EN 50050	EN 50104	prEN 50039	EN 50021	EN 50020	EN 50019	EN 50018	EN 50017	EN 50016	EN 50015
	CENELEC																												
Target group	M	M	M	M	M	M	M	M	M	M	M	M	M	MO	M	MO	M	M	M	MO	M	MO	M	M	M	M	M	M	M
Overall assessment	2	2	2	2	2	2	3	2	2	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2
1.	Common requirements for equipment and protective systems																												
1.0.	General requirements																												
1.0.1.	c	c	f	f	f	f	c	c	c	c	c	f	c	c	c	c	c	f	f	a	f	a	c	c	c	c	c	c	c
1.0.2.	c	c	a	a	a	a	b	c	c	c	c	c	b	c	c	a	c	a	a	c	a	c	c	c	c	c	c	b	c
1.0.3.	c	c	c	c	c	c	a	f	a	f	c	a	a	c	b	c	a	c	c	c	c	f	c	f	c	c	c	b	c
1.0.4.	c	c	c	c	c	c	c	f	c	f	a	c	c	c	c	c	c	c	c	c	c	f	c	f	c	c	c	c	c
1.0.5.	b	b	b	b	b	b	b	c	b	c	a	c	c	c	c	a	c	b	b	c	b	c	c	c	c	c	f	c	c
1.0.6.a)	c	c	b	b	b	b	b	c	c	c	c	c	c	c	f	a	c	b	b	c	c	c	b	c	c	c	c	c	c
1.0.6.b)	b	b	b	b	b	b	b	b	b	b	b	b	b	b	f	a	b	b	b	c	b	b	b	b	b	b	b	b	b
1.0.6.c)	c	c	c	c	c	c	b	c	c	c	c	b	c	c	f	a	c	c	c	c	c	c	b	c	c	c	c	c	c
1.0.6.d)	b	c	b	b	b	b	b	b	c	b	b	b	b	b	f	a	c	b	b	b	b	b	b	b	b	b	b	b	b
1.1.	Selection of materials																												
1.1.1.	c	c	a	a	a	a	c	c	c	c	a	f	c	c	c	b	c	a	a	c	a	f	c	c	c	c	c	c	f
1.1.2.	c	c	a	a	a	a	c	b	b	b	a	f	c	c	c	b	b	a	a	b	a	f	c	c	c	c	c	c	f
1.1.3.	c	c	c	c	c	c	c	c	c	c	a	c	c	c	c	a	c	c	c	b	c	f	c	c	c	c	c	c	f
1.2.	Design and Construction																												
1.2.1.	b	b	a	a	a	a	c	b	b	b	c	b	c	b	b	b	b	a	a	b	a	b	b	b	b	b	b	b	f
1.2.2.	a	c	a	a	a	a	a	a	c	a	c	a	a	a	a	a	c	a	a	a	a	a	a	a	c	c	a	a	f
1.2.3.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c
1.2.4.	a	a	a	a	a	a	c	f	f	f	a	f	a	a	a	c	f	a	a	c	a	f	c	b	c	c	a	a	c
1.2.5.	c	c	a	a	a	a	a	f	c	f	a	a	a	a	a	a	c	a	a	c	a	c	c	c	c	c	a	a	a
1.2.6.	c	c	a	a	a	a	c	a	c	a	a	b	c	c	a	c	c	a	a	b	a	a	c	a	c	c	c	c	c
1.2.7.	a	a	a	a	a	a	a	f	a	f	a	a	a	a	a	a	a	a	a	c	a	f	a	f	a	a	a	a	c
1.2.8.	c	c	a	a	a	a	c	c	a	c	a	f	a	b	b	a	a	a	a	c	a	f	a	c	c	a	c	c	c
1.2.9.	a	a	a	a	a	a	a	c	a	c	a	a	a	c	f	a	a	a	a	f	a	a	c	a	a	c	a	a	a
1.3.	Potential ignition sources																												
1.3.1.	c	c	a	a	a	a	c	c	c	c	a	f	c	c	c	c	c	a	a	a	a	f	c	c	c	c	c	c	c
1.3.2.	c	c	a	a	a	a	c	f	c	f	a	f	c	c	c	c	e	a	a	c	a	f	c	f	c	c	f	f	f
1.3.3.	f	a	a	a	a	a	c	f	a	f	a	a	c	a	f	f	a	a	a	c	a	f	c	f	f	f	f	f	c
1.3.4.	c	a	a	a	a	a	a	a	c	a	a	f	a	c	f	c	c	a	a	a	a	a	c	a	c	c	c	c	c
1.3.5.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
1.4.	Hazards arising from external effects																												
1.4.1.	c	c	c	c	c	c	b	f	a	f	a	a	b	a	c	a	c	c	c	c	c	f	a	f	c	c	c	b	c
1.4.2.	c	c	c	c	c	c	b	c	a	c	a	f	b	c	c	c	a	c	c	c	c	b	c	b	c	c	f	b	f

	WI 00305066	WI 00305072	WI 00305070	WI 00305058	prEN 14591-1	prEN 14491	prEN 14460	prEN 14373	prEN 14034-4	prEN 14034-3	prEN 14034-2	prEN 14034-1	prEN 13463-8	prEN 13463-6	prEN 13463-5	prEN 13463-3	prEN 13463-2	EN 13463-1	EN 13012	EN 12874	EN 1834-3	EN 1834-2	EN 1834-1	EN 1755	prEN 1710	EN 1127-2	EN 1127-1	
	CEN																											
Target group	M	M	M	MO	MO	MO	M	M	MO	MO	MO	MO	M	M	M	M	M	M	M	M	MO	MO	MO	MO	M	MO	MO	
Overall assessment	2	2	2	3	3	2	2	4	2	2	2	2	2	2	3	2	3	3	2	3	2	2	2	2	2	3	3	
1.																												1.
1.0.																												1.0.
1.0.1.	c	c	c	a	c	b	b	b	b	b	b	b	f	f	b	f	f	e	c	b	c	c	c	c	b	c	c	1.0.1.
1.0.2.	c	c	a	a	b	a	c	b	a	a	a	a	c	c	b	c	f	b	c	b	b	b	c	b	c	c	c	1.0.2.
1.0.3.	c	c	c	b	a	b	c	b	a	a	a	a	c	c	c	f	c	b	c	b	c	c	c	c	c	b	b	1.0.3.
1.0.4.	c	c	c	a	c	c	c	b	a	a	a	a	c	c	b	c	c	c	c	b	c	c	c	c	c	c	c	1.0.4.
1.0.5.	b	b	f	a	f	a	c	b	a	a	a	a	c	c	b	c	c	b	b	b	b	b	c	c	f	b	b	1.0.5.
1.0.6.a)	d	b	a	a	b	b	c	b	a	a	a	a	d	c	b	c	c	c	b	b	f	f	f	b	c	b	b	1.0.6.a)
1.0.6.b)	c	b	a	a	b	b	b	b	a	a	a	a	f	f	b	f	f	b	b	b	f	f	f	c	f	b	b	1.0.6.b)
1.0.6.c)	c	b	a	a	b	b	c	b	a	a	a	a	f	f	b	f	f	c	b	b	f	f	f	b	f	b	b	1.0.6.c)
1.0.6.d)	b	b	a	a	b	b	c	b	a	a	a	a	f	f	b	f	f	b	b	b	f	f	f	b	f	b	b	1.0.6.d)
1.1.																												1.1.
1.1.1.	c	c	c	a	c	b	c	b	a	a	a	a	f	f	b	f	f	c	c	b	c	c	c	c	c	b	c	1.1.1.
1.1.2.	c	c	c	a	c	b	c	b	a	a	a	a	c	b	b	f	f	b	c	b	b	c	b	b	c	c	c	1.1.2.
1.1.3.	c	c	c	a	c	b	c	b	a	a	a	a	c	b	b	f	f	b	c	b	b	b	b	b	b	b	b	1.1.3.
1.2.																												1.2.
1.2.1.	c	b	b	a	b	b	c	b	a	a	a	a	c	f	b	c	c	b	c	b	b	b	b	b	b	b	b	1.2.1.
1.2.2.	c	c	c	f	a	a	c	b	a	a	a	a	c	c	b	f	c	b	c	b	c	c	c	c	c	c	c	1.2.2.
1.2.3.	c	a	a	a	a	a	c	b	a	a	a	a	c	c	b	c	a	b	c	b	b	c	c	b	b	c	c	1.2.3.
1.2.4.	c	c	a	a	a	a	b	b	a	a	a	a	c	f	c	f	f	c	a	b	c	c	a	c	c	c	c	1.2.4.
1.2.5.	a	c	a	a	c	a	b	b	a	a	a	a	c	c	b	f	f	c	c	b	a	a	a	a	c	b	b	1.2.5.
1.2.6.	b	a	a	a	a	a	b	b	a	a	a	a	f	f	b	f	f	b	a	b	b	b	b	f	b	b	b	1.2.6.
1.2.7.	f	c	a	a	c	c	b	a	a	a	a	a	b	b	b	b	b	b	c	b	f	f	c	f	c	b	b	1.2.7.
1.2.8.	c	c	a	a	a	a	b	a	a	a	a	a	c	c	c	a	a	b	c	b	c	c	c	c	c	b	b	1.2.8.
1.2.9.	b	a	a	a	a	a	c	a	a	a	a	a	a	a	b	c	a	f	a	a	a	c	c	f	c	b	b	1.2.9.
1.3.																												1.3.
1.3.1.	c	c	a	a	a	a	a	b	a	a	a	a	c	c	c	c	c	b	c	b	c	c	c	c	c	c	c	1.3.1.
1.3.2.	f	b	c	a	b	a	a	b	a	a	a	a	f	f	c	f	f	c	c	b	c	c	c	b	c	f	c	1.3.2.
1.3.3.	f	c	a	a	a	a	a	b	a	a	a	a	a	b	b	b	a	b	c	b	f	f	c	c	c	f	c	1.3.3.
1.3.4.	c	a	a	a	c	a	a	b	a	a	a	a	c	c	c	f	c	c	a	b	c	c	c	c	c	c	c	1.3.4.
1.3.5.	c	a	a	a	a	a	a	a	a	a	a	a	b	c	c	c	a	b	a	b	c	c	c	a	b	c	c	1.3.5.
1.4.																												1.4.
1.4.1.	b	c	a	a	c	a	c	b	a	a	a	a	c	c	c	b	b	c	c	b	b	c	c	b	c	b	b	1.4.1.
1.4.2.	d	c	c	a	c	a	c	b	a	a	a	a	c	c	b	c	b	b	c	b	b	c	c	b	c	b	b	1.4.2.

Table A.2: Results of the evaluation

	CENELEC																												
	IEC 62086-1	EN 62013-1	EN 61779-5	EN 61779-4	EN 61779-3	EN 61779-2	IEC 61241-4	prEN 61241-18	prEN 61241-1	prEN 60079-18	prEN 50402	prEN 50394-1	prEN 50381	EN 50303	EN 50284	EN 50281-1-2	EN 50281-1-1	EN 50241-2	EN 50241-1	EN 50050	EN 50104	prEN 50039	EN 50021	EN 50020	EN 50019	EN 50018	EN 50017	EN 50016	EN 50015
1.5.	Requirements in respect of safety-related devices																												
1.5.1.	a	a	c	c	c	c	b	a	a	a	e	a	b	b	a	a	a	c	c	a	c	a	a	a	a	a	a	b	a
1.5.2.	a	a	c	c	c	c	b	a	a	a	c	a	b	b	a	a	a	c	c	a	c	a	a	a	a	a	a	b	a
1.5.3.	a	a	a	a	a	a	b	a	a	a	a	a	b	a	a	a	a	a	a	a	a	a	a	a	a	a	a	b	a
1.5.4.	a	a	c	c	c	c	a	a	a	a	c	a	a	a	f	a	a	c	c	a	c	a	a	a	a	a	a	b	a
1.5.5.	a	a	c	c	c	c	b	a	a	a	c	a	b	a	a	a	a	c	c	a	c	a	a	a	a	a	a	a	a
1.5.6.	a	a	c	c	c	c	b	a	a	a	c	a	b	a	a	a	a	c	c	a	c	a	a	a	a	a	a	a	a
1.5.7.	a	a	c	c	c	c	b	a	a	a	c	a	b	a	a	a	a	c	c	a	c	a	a	a	a	a	a	a	a
1.5.8.	a	a	c	c	c	c	b	a	a	a	c	a	b	a	a	a	a	c	c	a	c	a	a	a	a	a	a	b	a
1.6.	Integration of safety requirements relating to the system																												
1.6.1.	a	c	a	a	a	a	b	a	b	a	a	a	b	a	a	a	b	a	a	c	a	b	a	a	a	a	a	a	a
1.6.2.	c	a	a	a	a	a	c	c	b	c	a	f	c	c	f	a	b	a	a	c	a	c	a	c	c	a	c	c	a
1.6.3.	a	a	c	c	c	c	a	a	a	a	c	a	a	a	a	b	a	c	c	a	c	a	a	a	a	a	a	b	a
1.6.4.	c	c	a	a	a	a	c	c	c	c	c	a	c	c	c	c	c	a	a	c	a	c	a	f	c	a	c	c	a
1.6.5.	b	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	a	a	a	a	a	a	a	b	a	a	a	a
2.	Supplementary requirements in respect of equipment																												
2.0.1.	Requirements applicable to equipment in category Mb of equipment-group I																												
2.0.1.1.	a	a	a	a	a	a	a	a	a	c	a	c	a	c	a	a	a	a	a	a	a	a	a	f	a	a	a	a	a
2.0.1.2.	a	a	a	a	a	a	a	a	a	c	a	f	a	c	a	a	a	a	a	a	a	a	a	b	a	a	a	a	a
2.0.1.3.	a	a	a	a	a	a	a	a	a	c	a	f	a	c	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a
2.0.1.4.	a	a	a	a	a	a	a	a	a	a	a	f	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
2.0.2.	Requirements applicable to equipment in category Mc of equipment-group I																												
2.0.2.1.	c	a	a	a	a	a	a	c	a	c	a	c	a	a	a	a	a	a	a	a	a	a	a	c	c	a	c	c	c
2.0.2.2.	a	c	a	a	a	a	a	a	a	a	a	f	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	c	c
2.0.2.3.	a	c	a	a	a	a	a	a	a	a	a	f	a	a	a	a	a	a	a	a	a	a	a	c	c	a	f	b	c
2.1.1.	Requirements concerning explosive atmospheres caused by gases, vapours or hazes (equipment II b G)																												
2.1.1.1.	a	a	a	a	a	a	a	a	a	c	a	a	a	a	c	a	a	a	a	a	a	c	a	c	a	a	a	a	a
2.1.1.2.	a	a	a	a	a	a	a	a	a	c	a	a	a	a	f	a	a	a	a	a	a	c	a	c	a	a	a	a	a
2.1.1.3.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	f	a	a	a	a	a	a	a	a	c	a	a	a	a	a
2.1.2.	Requirements concerning explosive atmospheres caused by gases, vapours or hazes (equipment II b D)																												
2.1.2.1.	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	a	c	a	a	a	a	a	a	a	a	a	a	a	a
2.1.2.2.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
2.1.2.3.	a	a	a	a	a	a	a	a	f	a	a	a	a	a	a	a	f	a	a	a	a	a	a	a	a	a	a	a	a
2.1.2.4.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	a	a	a	a	a	a	a

	CEN																											
	WI 00305066	WI 00305072	WI 00305070	WI 00305058	prEN 14591-1	prEN 14491	prEN 14460	prEN 14373	prEN 14034-4	prEN 14034-3	prEN 14034-2	prEN 14034-1	prEN 13463-8	prEN 13463-6	prEN 13463-5	prEN 13463-3	prEN 13463-2	EN 13463-1	EN 13012	EN 12874	EN 1834-3	EN 1834-2	EN 1834-1	EN 1755	prEN 1710	EN 1127-2	EN 1127-1	
1.5.																												1.5.
1.5.1.	b	c	a	a	b	a	c	b	a	a	a	a	b	c	a	a	a	a	c	b	b	b	c	c	a	b	b	1.5.1.
1.5.2.	b	c	a	a	b	a	a	b	a	a	a	a	b	b	a	a	a	a	c	b	b	b	c	c	a	b	b	1.5.2.
1.5.3.	b	a	a	a	a	a	a	b	a	a	a	a	a	b	a	a	a	a	a	a	c	c	c	c	a	b	b	1.5.3.
1.5.4.	a	a	a	a	a	a	a	b	a	a	a	a	c	c	a	a	a	a	a	a	a	a	b	a	a	b	b	1.5.4.
1.5.5.	b	c	a	a	a	a	a	b	a	a	a	a	a	c	a	a	a	a	a	b	c	c	b	c	a	b	b	1.5.5.
1.5.6.	b	c	a	a	a	a	a	b	a	a	a	a	c	c	a	a	a	a	a	a	b	b	b	c	a	b	b	1.5.6.
1.5.7.	b	c	a	a	a	a	a	b	a	a	a	a	b	c	a	a	a	a	a	a	b	b	b	c	a	b	b	1.5.7.
1.5.8.	a	a	a	a	a	a	a	b	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	b	b	1.5.8.
1.6.																												1.6.
1.6.1.	b	c	a	a	a	a	a	b	a	a	a	a	a	b	a	a	a	a	c	a	c	c	c	b	b	b	b	1.6.1.
1.6.2.	a	a	a	a	a	a	b	b	a	a	a	a	a	b	a	a	a	a	a	b	c	c	c	b	c	b	b	1.6.2.
1.6.3.	a	c	a	a	a	a	a	b	a	a	a	a	a	b	a	a	a	a	c	b	a	a	a	a	b	b	b	1.6.3.
1.6.4.	f	b	a	a	c	a	a	b	a	a	a	a	b	b	a	f	c	a	c	b	f	f	b	c	b	b	b	1.6.4.
1.6.5.	a	c	a	a	a	a	a	b	a	a	a	a	a	c	a	a	a	a	a	b	a	a	b	c	b	b	b	1.6.5.
2.																												2.
2.0.1.																												2.0.1.
2.0.1.1.	a	a	a	a	a	a	a	a	a	a	a	a	c	c	a	a	a	c	a	a	a	a	a	a	a	c	a	2.0.1.1.
2.0.1.2.	a	a	a	a	a	a	a	a	a	a	a	a	c	c	a	a	a	b	a	a	a	a	a	a	a	b	a	2.0.1.2.
2.0.1.3.	a	a	a	a	a	a	a	a	a	a	a	a	f	c	a	a	a	c	a	a	a	a	a	a	a	c	a	2.0.1.3.
2.0.1.4.	a	a	a	a	a	a	c	a	a	a	a	a	f	f	a	a	a	c	a	a	a	a	a	a	a	b	a	2.0.1.4.
2.0.2.																												2.0.2.
2.0.2.1.	a	a	a	a	a	a	a	b	a	a	a	a	c	c	c	c	a	c	a	a	a	b	a	a	c	c	a	2.0.2.1.
2.0.2.2.	a	a	a	a	a	a	b	b	a	a	a	a	f	f	b	f	a	c	a	a	a	b	a	a	c	b	a	2.0.2.2.
2.0.2.3.	a	a	a	a	a	a	a	b	a	a	a	a	c	c	c	c	a	b	a	a	a	c	a	a	b	c	a	2.0.2.3.
2.1.1.																												2.1.1.
2.1.1.1.	c	a	a	a	a	a	a	b	a	a	a	a	c	c	c	a	a	c	c	b	a	a	a	a	a	a	c	2.1.1.1.
2.1.1.2.	c	a	a	a	a	a	c	b	a	a	a	a	f	c	c	a	a	c	c	a	a	a	a	a	a	a	c	2.1.1.2.
2.1.1.3.	b	a	a	a	a	a	b	b	a	a	a	a	f	f	b	a	a	c	c	a	a	a	a	a	a	a	b	2.1.1.3.
2.1.2.																												2.1.2.
2.1.2.1.	a	a	a	a	a	a	a	b	a	a	a	a	c	c	c	a	a	c	a	a	a	a	a	a	a	a	c	2.1.2.1.
2.1.2.2.	a	a	a	a	a	a	c	b	a	a	a	a	c	c	c	a	a	b	a	a	a	a	a	a	a	a	b	2.1.2.2.
2.1.2.3.	a	a	a	a	a	a	c	b	a	a	a	a	f	c	c	a	a	c	a	a	a	a	a	a	a	a	c	2.1.2.3.
2.1.2.4.	a	a	a	a	a	a	b	b	a	a	a	a	f	f	c	a	a	c	a	a	a	a	a	a	a	a	b	2.1.2.4.

Table A.3: Results of the evaluation

	CENELEC																													CEN																											
	IEC 62086-1	EN 62013-1	EN 61779-5	EN 61779-4	EN 61779-3	EN 61779-2	IEC 61241-4	prEN 61241-18	prEN 61241-1	prEN 60079-18	prEN 50402	prEN 50394-1	prEN 50381	EN 50303	EN 50284	EN 50281-1-2	EN 50281-1-1	EN 50241-2	EN 50241-1	EN 50050	EN 50104	prEN 50039	EN 50021	EN 50020	EN 50019	EN 50018	EN 50017	EN 50016	EN 50015	WI 00305066	WI 00305072	WI 00305070	WI 00305058	prEN 14591-1	prEN 14491	prEN 14460	prEN 14373	prEN 14034-4	prEN 14034-3	prEN 14034-2	prEN 14034-1	prEN 13463-8	prEN 13463-6	prEN 13463-5	prEN 13463-3	prEN 13463-2	EN 13463-1	EN 13012	EN 12874	EN 1834-3	EN 1834-2	EN 1834-1	EN 1755	prEN 1710	EN 1127-2	EN 1127-1	
2.	Supplementary requirements in respect of equipment																																																								2.
2.2.1.	Requirements concerning explosive atmospheres caused by gases, vapours or hazes (equipment II 2 G)																																																								2.2.1.
2.2.1.1.	c	a	a	a	a	a	a	c	a	c	a	a	c	a	a	a	a	a	a	c	a	c	a	c	c	c	c	c	c	c	a	a	a	a	a	a	b	a	a	a	a	c	c	c	c	a	c	c	b	a	a	c	c	a	a	c	2.2.1.1.
2.2.1.2.	c	a	a	a	a	a	a	c	a	c	a	a	c	a	a	a	a	a	a	c	a	c	a	c	c	c	c	c	c	c	a	a	a	a	a	c	b	a	a	a	a	f	c	c	f	a	c	c	a	a	a	c	c	a	a	c	2.2.1.2.
2.2.1.3.	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	c	a	c	a	c	c	c	c	c	c	a	a	a	a	a	a	b	b	a	a	a	a	f	f	b	f	a	c	c	a	a	a	b	f	a	a	b	2.2.1.3.
2.2.2.	Requirements concerning explosive atmospheres caused by air/dust mixtures (equipment II c D)																																																							2.2.2.
2.2.2.1.	a	a	a	a	a	a	c	a	c	a	a	a	a	a	a	a	c	a	a	c	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	b	a	a	a	a	c	c	c	c	a	c	a	a	b	a	a	c	a	a	c	2.2.2.1.
2.2.2.2.	a	a	a	a	a	a	c	a	c	a	a	a	a	a	a	a	c	a	a	c	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	a	a	a	a	a	f	c	c	f	a	c	a	a	c	a	a	c	a	a	c	2.2.2.2.
2.2.2.3.	a	a	a	a	a	a	c	a	c	a	a	a	a	a	a	a	c	a	a	c	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	c	b	a	a	a	a	c	c	c	c	a	b	a	a	c	a	a	c	a	a	b	2.2.2.3.
2.2.2.4.	a	a	a	a	a	a	c	a	a	a	a	a	a	a	a	c	a	a	a	f	a	a	a	a	a	a	a	a	a	b	a	a	a	a	a	b	b	a	a	a	a	f	f	b	f	a	c	a	a	b	a	a	f	a	a	b	2.2.2.4.
2.3.1.	Requirements concerning explosive atmospheres caused by gases, vapours or hazes (equipment II d G)																																																								2.3.1.
2.3.1.1.	c	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	c	a	a	a	a	a	a	b	a	a	a	a	c	c	a	a	c	c	a	b	a	a	c	c	a	a	c	2.3.1.1.
2.3.1.2.	c	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	c	a	a	a	a	a	c	b	a	a	a	a	f	c	a	a	c	c	a	a	a	a	c	c	a	a	c	2.3.1.2.
2.3.2.	Requirements concerning explosive atmospheres caused by gases, vapours or hazes (equipment II d D)																																																									2.3.2.
2.3.2.1.	a	a	a	a	a	a	c	a	c	a	a	a	a	a	a	a	c	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	b	a	a	a	a	f	c	a	a	c	c	a	a	c	a	a	c	a	a	c	2.3.2.1.
2.3.2.2.	a	a	a	a	a	a	c	a	b	a	a	a	a	a	a	a	c	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	a	b	a	a	a	a	c	c	a	a	c	c	a	a	c	a	a	c	a	a	c	2.3.2.2.
2.3.2.3.	a	a	a	a	a	a	c	a	b	a	a	a	a	a	a	c	a	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	b	b	a	a	a	a	c	c	a	a	c	c	a	a	c	a	a	c	a	a	c	2.3.2.3.
3.	Supplementary requirements in respect of protective systems																																																								3.
3.0.	General requirements																																																								3.0.
3.0.1.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	b	c	c	c	c	c	c	a	a	a	a	a	a	a	a	a	a	a	c	a	c	a	a	a	c	c	3.0.1.
3.0.2.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	c	c	b	b	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	f	c	3.0.2.
3.0.3.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	c	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	b	b	3.0.3.
3.0.4.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	a	c	b	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	b	b	3.0.4.
3.1.	Planning and design																																																								3.1.
3.1.1.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	b	c	c	c	c	a	a	a	a	a	a	a	a	a	a	a	b	a	c	c	a	a	f	b	3.1.1.
3.1.2.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	c	c	c	b	a	a	a	a	a	a	a	a	a	a	a	b	a	c	c	a	a	f	c	3.1.2.
3.1.3.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	c	a	c	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	c	a	a	f	b	3.1.3.
3.1.4.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	a	c	c	c	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	f	c	3.1.4.
3.1.5.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	c	a	b	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	f	c	3.1.5.
3.1.6.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	a	c	a	a	a	b	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	c	3.1.6.
3.1.7.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	b	a	a	a	a	a	a	a	a	a	a	a	c	a	a	c	a	a	c	c	3.1.7.
3.1.8.	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	c	a	a	a	a	a	b	a	a	a	a	a	a	a	a	a	a	a	b	a	a	a	a	a	b	b	3.1.8.

Annex B

List of the standards and standards projects studied under Directive 94/9/EC

CEN standards:

EN 1127-1	Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology; 1997
EN 1127-2	Explosive atmospheres - Explosion prevention and protection - Part 2: Basic concepts and methodology for mining; 2002
prEN 1710	Equipment and components intended for use in potentially explosive atmospheres in mines; 2002
EN 1755	Safety of industrial trucks - Operation in potentially explosive atmospheres - Use in flammable gas, vapour, mist and dust; 2000
EN 1834-1	Reciprocating internal combustion engines - Safety requirements for design and construction of engines for use in potentially explosive atmospheres - Part 1: Group II engines for use in flammable gas and vapour atmospheres; 2000
EN 1834-2	Reciprocating internal combustion engines - Safety requirements for design and construction of engines for use in potentially explosive atmospheres - Part 2: Group I engines for use in underground workings susceptible to firedamp and/or combustible dust; 2000
EN 1834-3	Reciprocating internal combustion engines - Safety requirements for design and construction of engines for use in potentially explosive atmospheres - Part 3: Group II engines for use in flammable dust atmospheres; 2000
prEN 1839	Determination of explosion limits of gases and vapours; 2001
EN 12874	Flame arresters - Performance requirements, test methods and limits for use; 2001
EN 13012	Petrol filling stations - Construction and performance of automatic nozzles for use on fuel dispensers; 2001
prEN 13237	Potentially explosive atmospheres - Part 1: Terms and definitions for equipment and protective systems intended for use in potentially explosive atmospheres; 2001
EN 13463-1	Non-electrical equipment for potentially explosive atmospheres - Part 1: Basic method and requirements; 2001
prEN 13463-2	Non-electrical equipment intended for use in potentially explosive atmospheres - Part 2: Protection by flow restricting enclosure "fr"; 2002
prEN 13463-3	Non-electrical equipment for potentially explosive atmospheres - Part 3: Protection by *flame proof* enclosure 'd'; 2002
prEN 13463-4	Non-electrical equipment for potentially explosive atmospheres; Part 4: Protection by inherent safety; 2002
prEN 13463-5	Non-electrical equipment intended for use in potentially explosive atmospheres - Part 5: Protection by constructional safety 'c'; 2002
prEN 13463-6	Non-electrical equipment for potentially explosive atmospheres - Part 6: Protection by control of ignition sources 'b'; 2002
prEN 13463-7	Non-electrical equipment for potentially explosive atmospheres - Part 7: Protection by pressurisation; 2002

prEN 13463-8 Non-electrical equipment for potentially explosive atmospheres - Part 8: Protection by liquid immersion 'k' ; 2002

prEN 13673-1 Determination of the maximum explosion pressure and the maximum pressure rise of gases and vapours - Part 1: Determination of the maximum explosion pressure; 2001

prEN 13673-2 Determination of maximum explosion pressure and maximum explosion pressure rise of gases and vapours - Part 2: Determination of the maximum explosion pressure rise; 2002

prEN 13821 Potentially explosive atmospheres - Explosion prevention and protection - Determination of minimum ignition energy of dust/air mixtures; 2001

prEN 13980 Application of quality systems; 2002

prEN 14034-1 Determination of explosion characteristics of dust clouds - Part 1: Determination of the maximum explosion pressure; 2002

prEN 14034-2 Determination of explosion characteristics of dust clouds - Part 2: Determination of the maximum rate of explosion pressure rise $(dp/dt)_{max}$ of dust clouds; 2002

prEN 14034-3 Determination of explosion characteristics of dust clouds - Part 3: Determination of the minimum explosive concentration of dust clouds; 2002

prEN 14034-4 Determination of explosion characteristics of dust clouds - Part 4: Determination of limiting oxygen concentration of dust clouds; 2001

prEN 14373 Explosion suppression systems; 2002

prEN 14460 Explosion resistant equipment; 2002

prEN 14491 Dust explosion venting protective systems; 2002

prEN 14522 Determination of the minimum ignition temperature of gases and vapours; 2002

prEN 14591-1 Explosion prevention and protection in underground mining - Protective systems - Part 1: 2-bar explosion proof ventilation structure; 2002

WI 00305058 Explosion prevention and protection in underground mining - Part X: Protective systems - Water trough barriers; 2002

WI 00305070 Explosion prevention and protection in underground mining - Part X: Water trough barriers; 2002

WI 00305071 Explosion prevention and protection in underground mining – Equipment and protective systems for firedamp drainage; 2002

WI 00305072 Explosion prevention and protection in underground mining - Part X: Automatic explosion extinguishing installation at road headers; 2001

WI 00305038 Determination of the spontaneous ignition behaviour of dust accumulations; 2001

WI 00305041 Determination of the limiting oxygen concentration (LOC) for gases and vapours; 2002

WI 00305051 Explosion venting devices; 2001

WI 00305055 Gas explosion venting protective systems; 2002

WI 00305057 Explosion isolation; 2001

WI 00305062 Methodology for risk assessment of equipment and protective systems for intended use in potentially explosive atmospheres; 1999

WI 00305066 Safety requirements for ignition protected fans; 2002

CENELEC standards (IEC standards):

EN 50014	Electrical apparatus for potentially explosive atmospheres - General requirements; 1997
EN 50015	Electrical apparatus for potentially explosive atmospheres - Oil- immersion "o"; 1998
EN 50016	Electrical apparatus for potentially explosive atmospheres - Pressurized apparatus "p"; 1995
EN 50017	Electrical apparatus for potentially explosive atmospheres - Powder filling "q"; 1998
EN 50018	Electrical apparatus for potentially explosive atmospheres - Flameproof enclosure "d"; 2000
EN 50019	Electrical apparatus for potentially explosive atmospheres - Increased safety "e"; 2000
EN 50020	Electrical apparatus for potentially explosive atmospheres - Intrinsic safety "i"; 2002
EN 50021	Electrical apparatus for potentially explosive atmospheres - Type of protection "n"; 1999
prEN 50039	Electrical apparatus for potentially explosive atmospheres - Intrinsically safe electrical systems "i" - Group II systems for gas atmospheres; 2001
EN 50050	Electrical apparatus for potentially explosive atmospheres - Electrostatic hand-held spraying equipment; 2001
EN 50104	Electrical apparatus for the detection and measurement of oxygen - Performance requirements and test methods; 1998
EN 50241-1	Specification for open path apparatus for the detection of combustible or toxic gases and vapours - Part 1: General requirements and test methods; 1999
EN 50241-2	Specification for open path apparatus for the detection of combustible or toxic gases - Part 2: Performance requirements for apparatus for the detection of combustible gases; 1999
EN 50281-1-1	Electrical apparatus for use in the presence of combustible dust - Part 1- 1: Electrical apparatus protected by enclosures; construction and testing; 1998
EN 50281-1-2	Electrical apparatus for use in the presence of combustible dust - Part 1- 2: Electrical apparatus protected by enclosures; selection, installation and maintenance; 1998
EN 50281-2-1	Electrical apparatus for use in the presence of combustible dust - Part 2- 1: Test methods; methods for determining the minimum ignition temperatures of dust; 1998
EN 50284	Special requirements for construction, test and marking of electrical apparatus of equipment group II, category 1 G; 1999
EN 50303	Group 1, category M1 equipment intended to remain functional in atmospheres endangered by firedamp and/or coal dust; 2000
prEN 50381	Transportable ventilated rooms with or without an internal source of release; 2001
prEN 50394-1	Electrical apparatus for potentially explosive atmospheres - Group I: Intrinsically safe systems - Part 1: Construction and testing; 2002
prEN 50402	Electrical apparatus for the detection and measurement of combustible or toxic gases or vapours or of oxygen - Requirements on the functional safety of fixed gas detection systems; 2002
prEN 60079-18	Electrical apparatus for explosive gas atmospheres -Part 18: Construction, test and marking of type of protection encapsulation "m"; 2002

prEN 60079-26 Electrical apparatus for explosive gas atmospheres - Part 26: Construction, test and marking of group II Zone 0; 2002

prEN 61241-0 Electrical apparatus for use in the presence of combustible dust - Part 0: General requirements; 2002

prEN 61241-1 Electrical apparatus for use in the presence of combustible dust - Part 1: Protection by enclosures "tD"; 2002

IEC 61241-4 Electrical apparatus for use in the presence of combustible dust - Part 4: Electrical apparatus; Type of protection "pD"; 2001

prEN 61241-18 Electrical apparatus for use in the presence of combustible dust - Part 18: Protection by encapsulation "mD"; 2002

EN 61779-1 Electrical apparatus for the detection and measurement of flammable gases - Part 1: General requirements and test methods; 2000

EN 61779-2 Electrical apparatus for the detection and measurement of flammable gases - Part 2: Performance requirements for group I apparatus indicating a volume fraction up to 5% methane in air; 2000

EN 61779-3 Electrical apparatus for the detection and measurement of flammable gases - Part 3: Performance requirements for group I apparatus indicating a volume fraction up to 100% methane in air; 2000

EN 61779-4 Electrical apparatus for the detection and measurement of flammable gases - Part 4: Performance requirements for group II apparatus indicating a volume fraction up to 100% lower explosive limit; 2000

EN 61779-5 Electrical apparatus for the detection and measurement of flammable gases - Part 5: Performance requirements for group II apparatus indicating a volume fraction up to 100% gas; 2000

EN 62013-1 Caplights for use in mines susceptible to firedamp - Part 1: General requirements - Construction and testing in relation to the risk of explosion; 2002

IEC 62086-1 Electrical apparatus for explosive gas atmospheres - Electrical resistance trace heating - Part 1: General and testing requirements; 2001

Annex C

Abbreviations

ATEX	Atmosphère explosible (explosive atmosphere)
BG	Berufsgenossenschaft (Statutory Accident Insurance Institution)
BGR	BG Rule
CEN	Comité Européen de Normalisation / European Committee for Standardization
CENELEC	Comité Européen de Normalisation Electrotechnique / European Committee for Electrotechnical Standardization
DIN	Deutsches Institut für Normung e.V. (German institute for standardization)
ElexV	Verordnung über elektrische Anlagen in explosionsgefährdeten Bereichen (ordinance governing electrical plant in explosion hazard areas)
EN	European standard (CEN, CENELEC)
EX-RL	BG Rules for explosion protection
IEC	International Electrotechnical Commission
KAN	Commission for Occupational Health and Safety and Standardization
LOBA	Regional mining inspectorate
MT	Maintenance Team
NASG	Safety principles standards committee (DIN)
OH&S	Occupational Health and Safety
prEN	Draft European standard
PTB	Physikalisch-Technische Bundesanstalt
QA	Quality assurance
TC	Technical Committee
VCI	Verband der Chemischen Industrie e.V. (association of the German chemical industry)
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e.V. (German association for electrical, electronic & information technologies)
VDI	Verein Deutscher Ingenieure e.V. (association of German engineers)
VDMA	Verband deutscher Maschinen- und Anlagenbau e.V. (association of German machinery and plant manufacturers)
VdS	VdS Schadenverhütung GmbH
VDSI	Verband Deutscher Sicherheitsingenieure e.V. (association of German safety engineers)
WG	Working Group
WI	Work Item