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PROTECTION OF CABLES AND OTHER ELEMENTS
OF OUTSIDE PLANT

Classification of outside plant waste

Recommendation ITU-T L.24



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Recommendation ITU-T L.24

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Summary

Recommendation ITU-T L.24 specifies a classification for products as toxic and dangerous waste (TDW) and methods to carry out a screening of the characterization of the different residues emanating from the outside plant.

Appendix I presents materials and products considered by Recommendation ITU-T L.24, and Appendices II and III provide information on legislations applied to waste and chemical substances.

Source

Recommendation ITU-T L.24 was approved on 29 November 2009 by ITU-T Study Group 5 (2009-2012) under Recommendation ITU-T A.8 procedures.

FOREWORD

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Classification of outside plant waste

1 Scope

After ISO 14000 (Environmental management), the environmental activities in the operators' companies, manufacturers and contractors had to adapt their procedures of classification of outside plant waste in the infrastructure of telecommunication networks.

There is a very considerable amount of outside plant waste, some of which includes products that may be considered to be dangerous, toxic or ecotoxic.

A waste product may be classified as toxic and dangerous waste (TDW) if, and only if, it contains any of the constituents listed in Table 1, and if these, in turn, present any of the characteristics shown in Table 2, in the proportions and limits considered in the current international regulations (Restriction of Hazardous Substances Directive or RoHS).

Table 1 – Constituents which, depending on the amount, concentration and form of presentation of the waste, may make the latter toxic and dangerous

Code No.	Waste with the following constituents
C1	Beryllium, beryllium compounds
C3	Hexavalent chromium compounds
C6	Soluble copper compounds
C8	Arsenic, arsenic compounds
C9	Selenium, selenium compounds
C11	Cadmium, cadmium compounds
C13	Antimony, antimony compounds
C14	Tellurium, tellurium compounds
C16	Mercury, mercury compounds
C17	Thallium, thallium compounds
C18	Lead, lead compounds
C21	Inorganic cyanides
C23	Acidic solutions and acids in solid form
C24	Basic solutions and bases in solid form
C25	Asbestos (powder and fibres)
C26	Metallic carbonyls
C28	Peroxides
C29	Chlorates
C30	Per chlorates
C31	Nitrides
C32	PCBs and/or PCTs
C33	Pharmaceutical or veterinary compounds
C34	Pesticides and other biocides

Table 1 – Constituents which, depending on the amount, concentration and form of presentation of the waste, may make the latter toxic and dangerous

Code No.	Waste with the following constituents
C37	Isocyanates
C38	Organic cyanides
C39	Phenols, phenolic compounds
C40	Halogenate solvents
C41	Organic, non-halogenate solvents
C42	Organo-halogenate compounds, excluding inert polymerized matter and other substances which appear in this table
C43	Aromatic compounds, polycyclic and heterocyclic organic compounds
C44	Ethers
C49	Any product from the polychlorate dibenzosulphide family
C50	Any product from the polychlorate dibenzoparadioxin family
C52	Tar-based products from refining operations and tarry waste from distillation operations
C53	Used mineral or synthetic oils, including water-oil mixtures and emulsions
C54	Unidentifiable and/or new chemical laboratory substances whose effects on the environment are not known

Table 2 – Characteristics of the waste which may make it toxic and dangerous

Code No.	Characteristics
H1	Explosive. Substances and preparations which could explode under the effect of a flame or which are more sensitive to shocks or friction than benzene dinitrate.
H2	Comburent. Substances and preparations which, in contact with others, particularly flammable ones, give rise to highly exothermic reactions.
H2A	Easily flammable substances. The following are defined as such: Substances and preparations which, at ambient temperature, in the air and without input, can heat up and even ignite. Substances and preparations in a liquid state which at ambient temperature have a flash point lower than 21°C. Substances and preparations which could easily ignite under the brief action of a strong ignition source and which continue burning or being consumed after the source is removed. Gaseous substances and preparations which are flammable in the air at normal pressure. Substances and preparations which, in contact with water or damp air, give off easily flammable gases in dangerous amounts.
H2B	Flammable. Substances or preparations whose flash point is greater than or equal to 21°C and lower than or equal to 55°C.
H2C	Highly flammable. Liquid substances and preparations whose flash point is lower than 0°C and whose boiling point is lower than or equal to 35°C.

Table 2 – Characteristics of the waste which may make it toxic and dangerous

Code No.	Characteristics
H4	Irritants. Non-corrosive substances and preparations which, on immediate, prolonged or repeated contact with the skin or mucous membranes, could provoke an inflammatory reaction.
H5	Noxious products. Substances and preparations which, on inhalation, ingestion or cutaneous penetration, could entail risks of limited gravity.
H6	Toxic. Substances or preparations which, due to inhalation, ingestion or cutaneous penetration, could produce serious acute or chronic risks, or even death (including very toxic substances and preparations).
H7	Carcinogenic. Substances or preparations which, due to inhalation, ingestion or cutaneous penetration, could produce cancer or increase its frequency.
H8	Corrosive. Substances or preparations which, in contact with living tissue, could exercise a destructive action thereon.
H9	Infectious. Matter containing viable micro-organisms or their toxins which are known to cause disease in animals and man or are strongly suspected of doing so.
H10	Teratogenic. Substances and preparations which, due to inhalation, ingestion or cutaneous penetration, could cause damage to the foetus during its intrauterine development.
H11	Mutagenic. Substances and preparations which, due to inhalation, ingestion or cutaneous penetration, could produce alterations in the cells' genetic material.
H12	Substances or preparations which, in contact with water, air or acid, release a toxic or a very toxic gas.
H13	Materials which may, after disposal, produce another substance by whatever means, for instance, a lixiviation product possessing any of the characteristics listed above.
H14	Ecotoxic. Substances or preparations which are dangerous for the environment. Waste which entails immediate or deferred risks for the environment.

2 References

This clause has been intentionally left blank.

3 Definitions

None.

4 Abbreviations and acronyms

None.

5 Conventions

None.

6 Waste product characterization tests

It is recommended that a screening of the characterization of the different residues emanating from the outside plant be carried out in accordance with the following waste product characterization tests.

6.1 Content declared to be carcinogenic

The constituents of the waste are compared with the list of agents which may be considered as carcinogenic for man, in accordance with the IARC (International Agency for Research on Cancer).

Waste products which contain any agent included in the aforementioned list in a concentration of $\geq 0.01\%$ are assigned the code H7.

6.2 Flammability screening

This method allows the flammability potential of the residue to be characterized, whether it is liquid, solid or semi-solid.

According to law, a residue is to be identified by an H code if its burning point is less than or equal to 55°C , the burning point being defined as the temperature, adjusted for an atmospheric pressure of 101.325 kPa, at which the test liquid gives off vapours in a sealed container under the conditions defined in the test method and in amounts which produce a flammable vapour/air mixture in the aforementioned container.

Two tests are performed:

– *Test A*

Five grammes of the finely crushed sample are placed in an aluminium crucible and a reducing flame is applied for 2 or 3 s, without touching it. If the sample ignites, the burning point should be ascertained. Otherwise, the flame should be applied directly to the sample for at least 15 s. If the sample ignites, it is to be considered as having a positive flammability.

If the sample melts, boils or decomposes, the flammability test is to be considered as negative.

– *Test B*

For liquid waste, 100 ml of the sample is used for carrying out the test. In the case of solids, 2 g should be dissolved in 100 ml of water and the test performed on the resulting solution. The solution containing the residue is placed in a beaker which is then covered with a watch-glass and left to sit at an ambient temperature for five minutes, after which sparks are applied to the vapour area located immediately above the sample. The sample is considered to present a positive flammability potential if a flash appears in the vapour or the sample ignites.

The methods described are based on 67/548/EEC and on ASTM Standard D4982-89, Standard Test Methods for Flammability Potential Screening Analysis of Waste.

The positive or negative results of both tests are to be noted on the waste product characterization screening sheet, together with the ambient temperature at the time the test was performed.

In the event of a clearly negative result, full flammability screening will not be necessary since, if the sample withstands the temperature of a Bunsen burner without igniting, its burning point is very much higher than that established by law. In the event of a positive result in Test A, a more detailed analysis of the waste's behaviour may be necessary in order to ascertain its burning point according to the methods described in clause 6.3. Once the burning point has been determined, the waste may be classified as easily flammable (H2A), flammable (H2B) or highly flammable (H2C). In the event of a positive result in Test B, the waste product shall be designated by the code H2A.

6.3 Burning point

As indicated above, a waste product shall be considered dangerous and toxic if its burning point is less than or equal to 55°C, as defined in clause 6.2.

The methods to be followed for determining the burning point of liquid substances whose vapours may be kindled by ignition sources are described here, since the law does not describe any method for determining the burning point of solid samples. Solid specimens should be dissolved in a sufficient amount of water and the test performed on the resulting liquid.

There are two acceptable methods for determining the burning point of waste, according to 67/548/EEC and standards ISO 1516, ISO 3680, ISO 1523, ISO 3679, ISO 2719 and ASTM D-56.

1) *Balanced method*

i) *Balanced method in a closed beaker*

The sample is placed in a closed beaker, submerged in a bath and heated by slowly raising the temperature of the bath so that the temperature difference between the bath and the sample does not exceed 2°C. Moreover, it should be ensured that the temperature of the sample increases at a rate which does not exceed 0.5°C in 1.5 min.

At intervals of at least 1.5 min, ignition tests should be carried out through the application of a spherical flame with a diameter of 3.5 ± 0.5 mm to the vapour released by the sample. The lowest temperature at which ignition occurs should be noted and adjusted for an atmospheric pressure of 101.3 kPa.

The ignition point is defined as the minimum temperature to which the product has to be heated for the vapours given off to ignite in the presence of a flame.

ii) *Rapid balanced method*

For liquids whose burning point is suspected to be lower than 110°C, a faster procedure than the one described above may be used, with a small sample:

- a) For liquids whose burning point is expected to be between the ambient temperature and 110°C, the sample is heated and the ignition test performed under balanced conditions at a temperature 3°C lower than the expected burning point. The test is repeated until ignition is observed at a temperature more than 1°C above the temperature at which ignition was not observed. The temperature is then adjusted for an atmospheric pressure of 101.3 kPa.
- b) For liquids whose burning point is suspected to be lower than the ambient temperature, the sample is cooled to a temperature 3°C lower than the expected flammability point, and the ignition tests are carried out.

2) *Non-balanced method*

The sample is placed in a beaker with a sealed cover and heated slowly at a constant rate. A flame is brought close at regular intervals until it ignites the vapour above the sample. The lowest temperature at which ignition occurs is the sample's burning point.

6.4 Determination of pH

According to law, any aqueous liquid waste with a pH less than or equal to 2 or greater than or equal to 12.5 shall be considered to be TDW.

For aqueous liquid waste, the waste product itself is used for the test. For solid waste, sludge and non-aqueous liquids, the residue is mixed with water in a concentration of 1 g/ml, shaken and left to settle. The pH is measured once the suspension has precipitated.

The pH is ascertained by two methods:

- *Test A:* With a pH paper. A small amount of the sample is placed on a pH strip. The result is obtained by visual comparison of the strip with the standard colour scale, and the pH is recorded to the nearest unit.
- *Test B:* With a pH meter, calibrated with at least two buffer solutions. The results are recorded to the nearest 0.1 pH unit.

The first method allows the pH to be determined rapidly although the value obtained is less accurate than with the pH meter. Moreover, it enables the calibration range of the pH meter to be established.

These methods are based on 67/548/EEC and on ASTM Standard D4980-89.

This test makes it possible to determine whether the waste should or should not be designated by codes C23 or C24 (C23: acid solutions and acids in solid form; C24: basic solutions (or bases in solid form)).

6.5 Cyanides

6.5.1 Detection of the presence of cyanides

This test may be used to detect the presence of potentially hazardous cyanides in the waste, without determining their concentration and type.

In EEC Directive 67/548, it is specified that one of the reactivity characteristics giving a waste product's toxic and dangerous character is the presence of substances such as cyanides or sulphides, which may generate toxic gases in pH media between 2 and 12.5.

By measuring the pH as described in clause 6.4 and detecting the presence of cyanides and sulphides as described in clause 6.8, it can be established whether or not the waste belongs to this group of substances.

Two tests, based on ASTM Standard D5049-90, are used in order to determine the presence of cyanides.

In some cases, if the result of the test is not clear, it is supplemented by a quantitative analysis with the aid of a CN-sensitive reversible electrode.

The waste product should be assigned code C38 H6 if the result of Test A is positive and code C21 H6 if the result of Test B is positive.

1) *Test A: Chloramine-T method*

The tests are performed on the sample itself when this is a liquid; solids should be dissolved in a proportion of 1:10 with water.

The presence of cyanides in the sample is observed through the formation of cyanogen chloride, when the liquid waste is made to react with Chloramine-T at pH 8. The pH 8 is obtained by adding a phosphate buffer solution to the sample.

The presence of cyanogen chloride is detected by the intense red colour which appears when barbituric acid is added to the substance formed by the reaction of the waste solution with Chloramine-T.

This method is used to detect the presence of cyanides which are sensitive to chlorination.

2) Test B: Prussian blue method

A sample of between 1 and 5 g of the waste product is taken. In the case of solid samples, a paste is made with the waste by mixing it in a proportion of 1:10 with water, and its pH is adjusted to 12 through the addition of sodium hydroxide (NaOH). Solutions of ferrous sulphate and ferric chloride are then added, and concentrated sulphuric acid is added slowly until the pH falls below 1. The presence of cyanides is revealed by the greenish-blue colour which appears on addition of the sulphuric acid.

This method indicates the presence of free cyanides and many of the cyanide compounds.

6.5.2 Quantitative determination of cyanides

If the presence of cyanides was detected in the two previous tests, they should be subject to quantitative determination. In liquid samples, the test is carried out directly on the sample following elimination of interferences. In the case of solid samples, 2 ml of cuprous chloride acid is added to the sample placed in the distillation apparatus shown in Figure 1 and diluted with water up to 80 ml. The solution is heated and distilled in 5 ml of 1 N sodium hydroxide to a final volume of 10 ml.

Taking either 100 ml of the liquid sample from which the interferences have been eliminated or the distillate of the solid diluted down to 100 ml, the cyanide content is determined potentiometrically, using a cyanide-sensitive reversible electrode.

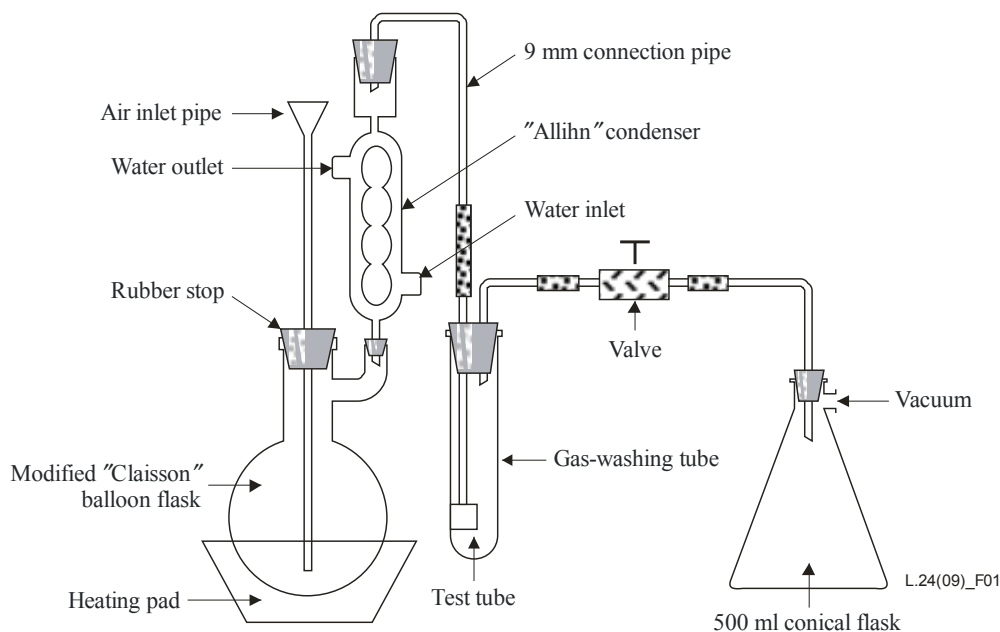


Figure 1 – Assembly for cyanide distillation in solid samples

6.6 Corrosion

A liquid waste product shall be considered to be corrosive when it corrodes a thickness of more than 6.35 mm of steel in one year at a test temperature of 55°C. These values are extrapolated in such a way that the test time is reduced to 10 days, as this is representative of the waste's corrosiveness. The test may be extended in time if the result is not sufficiently clear after 10 days.

Steel nails with their upper part protected by a rust-proof coating are used in the test. They are submerged in a test tube containing the sample.

Measurements are taken of the difference in diameter between the protected and unprotected part of each steel nail. In order to measure the diameter of the protected part of the nail, the rust-proof coating is dissolved using acetone, and the nail is then rinsed with water. A precision gauge is used for making the measurement and at least three measurements are taken in each area.