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**ITU-T**

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

**L.24**

(10/96)

SERIES L: CONSTRUCTION, INSTALLATION AND  
PROTECTION OF CABLES AND OTHER ELEMENTS  
OF OUTSIDE PLANT

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## **Classification of outside plant waste**

ITU-T Recommendation L.24

(Previously CCITT Recommendation)

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ITU-T L-SERIES RECOMMENDATIONS  
**CONSTRUCTION, INSTALLATION AND PROTECTION OF CABLES AND OTHER ELEMENTS OF  
OUTSIDE PLANT**

*For further details, please refer to ITU-T List of Recommendations.*

## FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation L.24 was prepared by ITU-T Study Group 6 (1993-1996) and was approved by the WTSC (Geneva, 9-18 October 1996).

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## NOTES

1. In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.
2. The status of annexes and appendices attached to the Series L Recommendations should be interpreted follows:
  - an *annex* to a Recommendation forms an integral part of the Recommendation;
  - an *appendix* to a Recommendation does not form part of the Recommendation and only provides so complementary explanation or information specific to that Recommendation.

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**Corrosion**

liquid 10-day test  
solid continue

**Oxidants**

- + explosiveness, flammability, reactivity with water\*
- continue
- suspect quantitative analysis  
explosiveness screening test

**\*Drying/humidity**

water calculation of % and dry residue  
negative flammability determination of dry weight

reactivity with water (+ characterized H12  
(  
(- continue

**Sulphides**

- + characterized H6
- continue
- suspect quantitative analysis

**Lixiviates**

- presence of any substance which has been declared to be carcinogenic or a toxic metal in a proportion of >0.01%
- + characterized H13
- continue

**Ecotoxicity**

- + characterized H14
- continue

**Testing for presence of pathogenic micro-organisms**

- + characterized H9
- continue

**Bacterial mutagenesis**

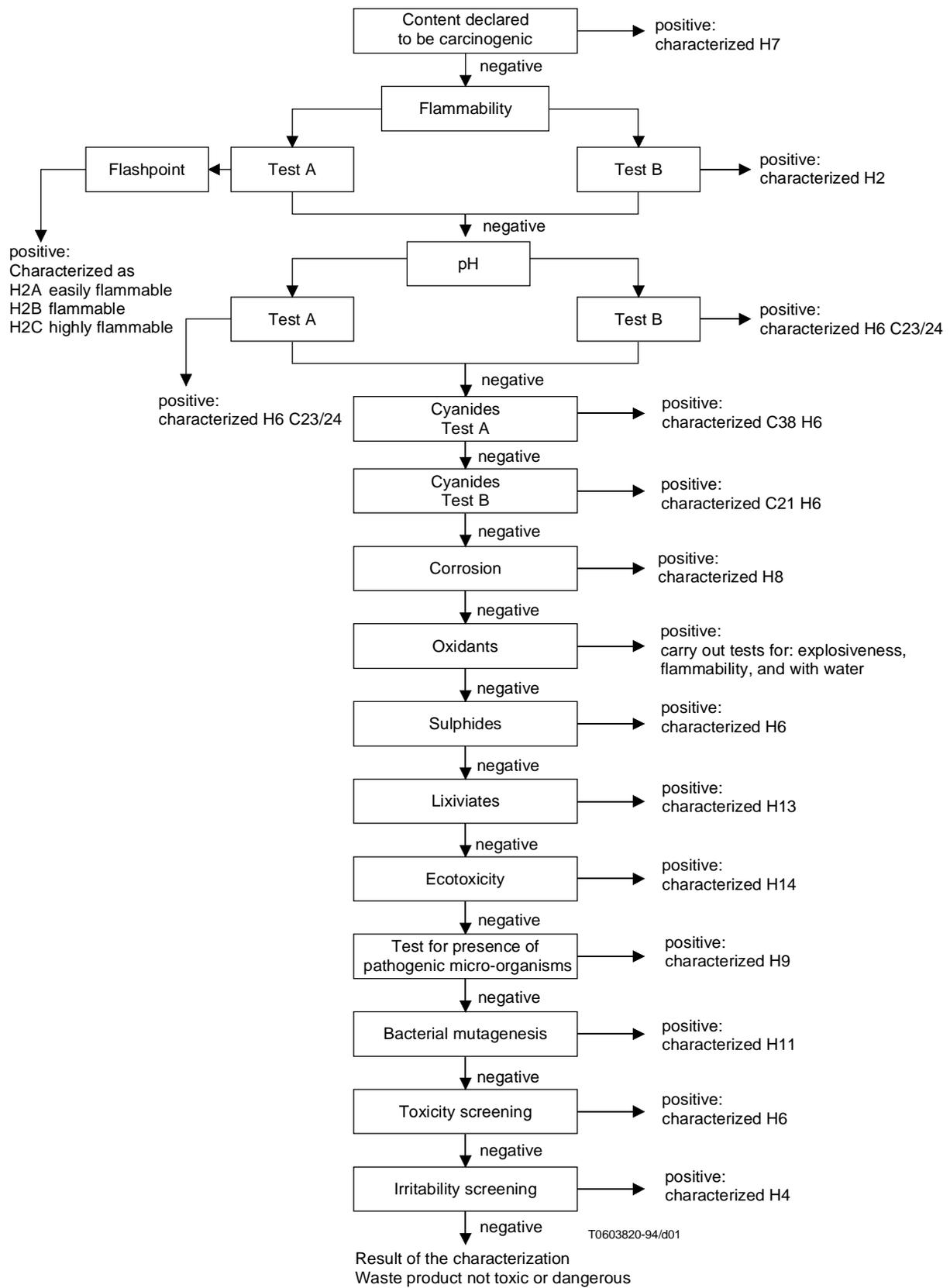
- + characterized H11
- acute toxicity screening (acute toxicity screening  
suspect ( (cell cultures  
cytotoxic (acute toxicity screening

**Acute toxicity screening**

- + characterized H6 (+ H6  
( (- continue
- continue
- continue sub-chronic toxicity

**Irritability screening**

- + characterized H4
- characterized as neither toxic nor dangerous



**Figure 1/L.24 – Characterization flow chart**

Each of the characterization tests to be carried out is described in Annex A, following the screening order shown in the flow chart.

The approach to be followed should be that set out in the current national regulations. By way of example, that of the EEC, based on Directives 67/548, 84/449/EEC and their various updates, is described in Appendix I.

## Annex A

### Waste product characterization tests

#### A.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.

#### A.2 Flammability screening

This method allows the flammability potential of the residue to be characterized, whether it be 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  $55^{\circ}\text{C}$ , 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 A.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.

### A.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 A.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) *Balance method*

##### i) *Balance 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  $3.5 \pm 0.5$  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 balance 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.

### A.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)].

## A.5 Cyanides

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

In the Order of 13 October 1989, it is specified that one of the reactivity characteristics giving a waste product its 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 A.4 and detecting the presence of cyanides and sulphides as described in A.11, 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.

## 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 A.2 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.

## A.6 Corrosion

This test is carried out exclusively on liquid waste and its purpose is to ascertain the corrosion capacity of a substance in a short period of time.

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.

If a positive result is obtained in this test, the waste is to be considered toxic and dangerous and assigned code H8.

## **A.7 Oxidants**

This test method, based on ASTM Standard 4981-89, allows the presence of oxidants in the waste to be detected, although it does not enable them to be identified or their concentration to be measured.

The presence of oxidants in the waste may cause dangerous reactions.

For aqueous solutions, the sample itself is used for the test. For solids, semi-solids and sludge, a mixture of 1 to 5 g of the waste product in the same amount of reactive water is used.

A drop of the sample or the prepared mixture is placed on a potassium iodide paper; if the paper turns a dark blue colour, the presence of oxidants is revealed.

A positive result of the test will entail carrying out tests on flammability, explosiveness and reactivity with water, as described in the corresponding clauses.

## **A.8 Screening for explosive properties**

The need for this test depends on the results of the previous one.

The test, which is based on EEC Directive 84/449, determines whether the waste product presents a risk of exploding, in which case it would be designated an H1 code. Very small dry samples of about 10 mg are subjected to common stimuli (heating with a Bunsen burner, impact with a hammer, and any friction mechanism); it is observed whether there is any ignition, spark or explosion, and if not, whether there is any perceptible change in the substance.

### 1) *Heat sensitivity test*

This consists of heating the waste product in a steel tube in order to ascertain whether it might explode due to thermal pressure.

### 2) *Mechanical sensitivity test*

a) *Shock*: This consists of subjecting the sample to an impact by hitting it with a hammer on a steel anvil.

b) *Friction*: This consists of subjecting the substance to friction between two surfaces.

## **A.9 Flammability with water**

The aim of this test is to analyse whether the sample shows any reaction to water and whether it gives off any flammable gas in dangerous amounts in the reaction. It is or is not performed, depending on the results of the oxidants test described in A.7. The test method is based on 67/548/EEC.

### **Description of the test**

#### *Phase 1*

A small amount of the substance is placed in distilled water at 20° C and observed to see whether the gas released ignites.

### *Phase 2*

A filter paper bearing a small amount of the sample is placed on the surface of distilled water in a beaker and observed to see whether any gas is released and, if so, whether it is flammable.

### *Phase 3*

A pile 2 cm high and 3 cm in diameter is formed. Drops of water are added to it and it is observed to see whether gas is given off and whether the gas is flammable.

If a positive result is obtained on completing any of the above phases, the substance is to be considered dangerous and the next phase should not be carried out. If the result is negative in all three phases, proceed to phase 4.

### *Phase 4*

This requires the use of the equipment described in ISO Standard 1773. The test substance is mixed with distilled water at 20° C and the flow of gas measured at intervals of one hour during the first seven hours, at the end of which, if the flow is variable, the measuring time is extended either until a constant flow is obtained or until a maximum period of five days has elapsed.

If a flow of 1 l·h/kg is exceeded at any time, the substance is to be considered dangerous without there being any need to continue the test, and it is assigned code H2A. Otherwise, a sample of the gas obtained is analysed as indicated in the gas flammability test described in A.10.

## **A.10 Gas flammability test**

This test is based on 67/548/EEC.

It enables one to determine whether gases mixed with air at ambient temperature and pressure present a flammability period.

It consists of exposing mixtures with increasingly higher concentrations of the test gas to an electric spark and observing whether ignition occurs.

A glass tube 5 cm in diameter and 35 cm long, placed vertically, is used as a recipient. The ignition electrodes are placed 6 cm away from the bottom of the tube, and 3 to 5 mm away from each other.

With the aid of a chemical pump, the cylinder is filled with a mixture of known proportions of air and the gas obtained in the flammability with water test described in A.9. A spark is set off in this mixture and it is observed whether a flame is produced in the vicinity of the electrodes and whether it spreads along the tube. If this does not happen, the concentration of the gas is increased by steps of 1% volume until ignition occurs or until all the gas has been used in the mixture.

If a positive result is obtained in this test, the waste is to be considered toxic and dangerous and assigned code H2A.

## **A.11 Sulphides**

As mentioned earlier, it is specified in EEC Directive 67/548 that one of the reactivity characteristics giving a waste product its 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.

The pH measurement test described in A.4, and the test for detecting sulphides allow one to establish whether the waste belongs to this group of substances or not.

The test technique, based on ASTM Standard 4978-89, allows the presence of sulphides to be detected in residual liquids, sludge, semi-solids and solids, although it does not enable their concentration or type to be determined. The lead acetate paper test described below is used.

### **Lead acetate paper test**

This test is based on the formation of hydrogen sulphide in the samples containing sulphides when they are acidified.

To perform it, 5 to 10 g of the sample are placed in a beaker. Solid samples should be mixed with 15 ml of water. Hydrochloric acid is added until a pH value lower than 2 is reached. The presence of hydrogen sulphide is detected by the silvery brown or black colour which the lead acetate paper turns on contact with the sample.

If the presence of sulphides is detected, a quantitative analysis should be performed.

## Quantitative sulphide analysis

For liquid waste, a sample of the waste product itself is used for the test. In the case of solid waste, a distillate must be made by following the procedure described below. The distillation apparatus shown in Figure A.2 is used. 25 ml of cadmium and zinc acetate solution is placed in each of the bubbling jars. The gas inlet is connected to an oxygen-free nitrogen source and 2 to 10 g of the sample with about 10 ml of water are added to the reaction flask. The apparatus is then connected up and 25 ml of hydrochloric acid added slowly. After one hour of distillation, the sulphide content of the bubbling jars is assessed.

### A.12 Humidity and hygroscopic capacity test

The aim of this test is to determine the humidity percentage of the solid or semi-solid waste products and their resistance to drying. To this end, they are subjected to a hydrating and drying process.

The test is based on ASTM Standards D4843-88, C305, D2216.

A representative fraction of the waste is selected and weighed. In order to obtain the humidity content, the sample is dried at 60° C for 24 hours, after which it is weighed, heated to 60° C once more for 6 hours and then weighed again in order to check whether it has reached a constant weight. If not, the process is repeated until this happens. Subsequently, the sample is rehydrated and dried at least twice more, enabling the dry weight, the evaporable material and the percentage of recoverable humidity to be determined.

This test is included in the characterization screening, since the percentage of humidity is a parameter to bear in mind if one wishes to dispose of a waste product in a dump. A higher humidity percentage usually means a higher cost.

### A.13 Lixiviation

The lixiviation method, based on 67/548/EEC and ASTM Standards D 4874-89, D 4793-88 and D 3987-85, is the process used for extracting soluble substances contained in solid or pasty waste.

The lixivate provides analytical information about the concentration of toxic substances in the waste product, due mainly to the presence of metal ions. It is used as a sample in determining toxicity by means of the biotests described in A.14. In both analyses the pH of the lixivate is important, as it will determine the solubility of the different ions.

Of the two methods described in Spanish legislation, method 1 or “EP” is used to obtain the lixivate.

#### Method 1 or “EP”

A sample of 100 g of waste product is taken and the solid phase separated from the liquid one. The solid matter is weighed and 16 times its weight in double-distilled water added. It is then placed in a shaker to prevent sedimentation and ensure constant contact between the fluid and the sample.

The shaking process is started, and the pH of the solution is checked periodically and adjusted to  $5 \pm 0.2$  through the addition of 0.5 N acetic acid, without ever adding more than 4 ml of acid per gramme of solid.

The pH is adjusted every 15, 30 and 60 minutes and continually for at least six hours. Extraction continues until 24 hours have elapsed, at the end of which the pH is adjusted once again. If after 24 hours the pH is greater than 5.2, extraction should be continued for four more hours.

Once extraction has been completed, an amount of double-distilled water is added in accordance with the following equation:

$$V = 20 W - 16 W - A$$

where:

V = ml of double-distilled water to be added

W = weight in grammes of solid

A = ml of 0.5 N acetic acid added

The matter taken from the extractor is separated into its solid and liquid phases in the same way as before beginning the process, and the two liquids obtained from the filtering process are mixed, the mixture being used in the toxicity biotests and in determining the concentrations of toxic substances through Inductive Plasma Coupling (IPC) emission spectrometry.

## **A.14 Ecotoxicity**

In order to establish the ecotoxicity of the waste, its lixivate is analysed by means of the luminescence biotest, which is one of the tests stipulated in 67/548/EEC.

### **Luminescence biotest**

This test is based on the decrease in bioluminescence of the bacterium *Photobacterium Phosphoreum* when exposed to toxic substances. This response can be considered to be linear within a range of concentrations of the substance.

The toxicity of the waste is measured by means of the  $EC_{L50}$  parameter, representing the concentration of the sample which causes a 50% reduction in the intensity of the light emitted at 15° C and with an incubation time of 15 min.

In order to determine the luminescence, an apparatus is used, to measure the difference between the bacteria in a blank sample without waste and in various samples with different concentrations of the waste product, in given temperatures and salinity conditions. The  $EC_{L50}$  value for the waste is obtained from these values, using a simple mathematical formula.

If the lixivate has an  $EC_{L50}$  value ( $t = 15$  min. 15° C) lower than or equal to 3000 mg/l, the waste product is to be considered toxic and assigned the ecotoxic waste code H14.

## **A.15 Testing for the presence of pathogenic organisms**

The aim of this test is to determine the presence in the sample of viable organisms, which are known to cause, or which may cause, disease in animals or man.

The test is performed on 1 ml of liquid waste or 5 ml of recovering solution + Twen 80 in which 1 g of solid, atomized sample has been incubated. The sample is added to a nutritive medium with sterile yeast extract.

The presence of micro-organisms is detected by the appearance of cloudiness in the sample after it has been left to incubate for one day at 35° C.

An API 20 or similar type of biochemical identification system is used to identify the micro-organisms.

The sample is to be considered infectious, and assigned code H9, if the micro-organism most present in it belongs to a pathogenic species, for animals or man, or if the total number of micro-organisms detected exceeds 100 000 per gramme in the plate count.

## **A.16 Bacterial mutagenesis**

The purpose of this test is to determine whether the waste product can produce alterations in the genetic material of cells. A positive result will indicate that the residue should be considered to be mutagenic and therefore designated by code H11 according to TDW legislation.

The test is based on the methods described in Community Directive 84/449/EEC.

Extrapolating the results obtained in animal or “in vitro” experiments, the possible effects on man can be determined.

The test consists of exposing the bacteria to the test substances – with or without metabolic activation – and then counting the reverted colonies after an incubation period. The number obtained is compared with that of the spontaneously reverted colonies, observed in a control culture which is not treated and/or in the presence of a solvent.

The mutagenesis characteristic is revealed by the increase in the frequency of spontaneous reverted mutations.

In the mutagenicity report, the bacteria, the strain used in the test and the resulting mutation frequency should be noted.

## **A.17 Toxicity and irritability screening**

This test is designed to determine the toxicity and irritability of the waste, while keeping the number of animals used to the strict minimum necessary for the toxicological tests.

The tests are based on Community Directive 84/449/EEC and on ASTM Standard E 1163-90.

1) *Toxicity*

One female rat is given an oral dose of the waste corresponding to 600 mg/kg of its weight, and another is given 1200 mg/kg of its weight through the cutis.

If both animals survive, no further toxicity tests need to be carried out. If one of them dies, the complete test is performed: oral or cutaneous administration, or both, as the case may be.

2) *Irritability*

A dose of the waste is applied to the skin and eyes of an adult albino rabbit, i.e. 0.1 ml of liquid or 0.1 g of solid waste on the eyes and 0.5 ml of liquid or 0.5 g of solid waste on 6 cm of clean skin. After 15 min., the appearance of erythema on the animal's skin is observed and, using appraisal tables, assigned a number from 0 to 4 depending on the cutaneous reaction observed. The appearance of ocular damage is assessed in the same way.

If the result of the assessment is greater than 1, the irritability test does not need to be confirmed; if the result is less than 1, it needs to be confirmed in some cases by carrying out the complete test described in Directive 84/449/EEC.

The waste is assigned code H6 if the acute toxicity screening is positive, and code H4 if the irritability test is positive.

### **A.18 Complete irritability test**

This is only performed in the case of death of the animal used for the toxicity and irritability test described in A.17.

1) *Skin irritation test*

A dose of the waste is applied to the shaven skin of several animals; the reaction is observed over a period of time long enough to allow the reversible nature of the effects produced to be assessed.

2) *Eye irritation test*

A dose of the waste is applied to one eye of several animals and the degree of irritation assessed at regular intervals.

### **A.19 Acute oral toxicity test**

This test is based on ASTM Standard E 1163-90.

It is only carried out if the animal used for the toxicity and irritability test dies. It constitutes a method for determining the LD<sub>50</sub> (Mean Lethal Dose) of a material in rats.

Initially, a female rat is given an estimated LD<sub>50</sub> dose. If it survives, the next rat is given a higher dose, but if it dies, the second rat is given a lower dose. The LD<sub>50</sub> is calculated using the most probable maximum method.

### **A.20 Acute toxicity test by cutaneous application**

This test is only carried out if the animal used for the toxicity and irritability test dies.

It is based on Directive 84/449/EEC.

If the waste product is solid, it is atomized and dampened with water; if it is liquid, it is normally used without being diluted.

Increasingly larger doses of the waste are administered through the cutis, on the shaven skin of several batches of laboratory animals. The effects produced are observed and an autopsy carried out on all the animals.

### **A.21 Final action**

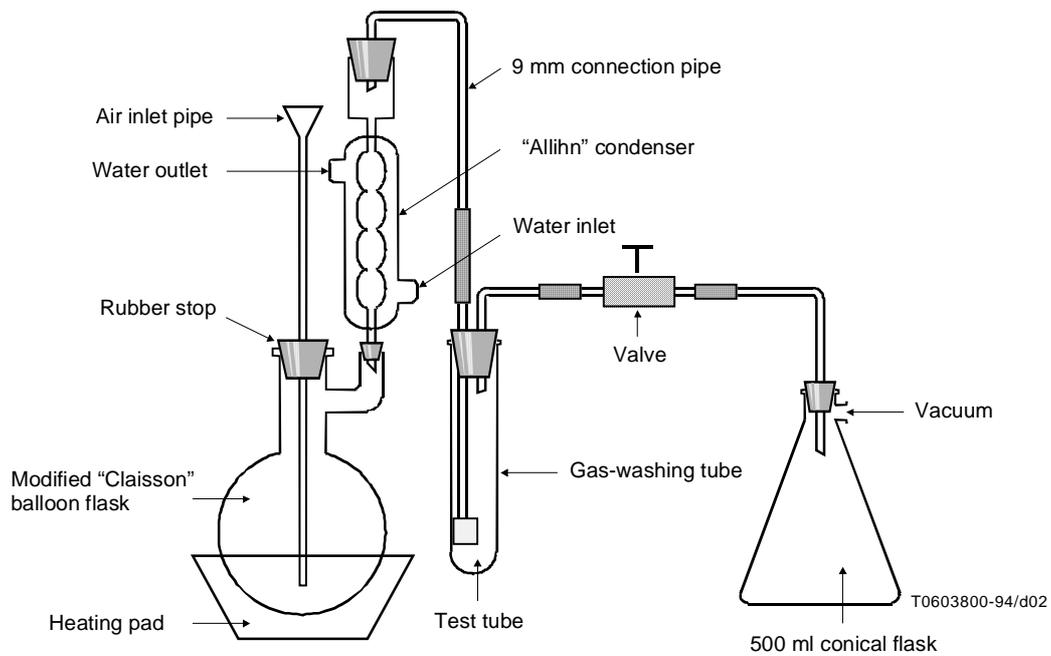
Once all the waste products have been classified according to the above tests, a table is prepared grading them by groups in accordance with their subsequent management and handling. For instance, waste to be dumped, incinerated, buried, packed and sent to particular places, etc.

**Table A.1/L.24 – Constituents which, depending on the amount, concentration and form of presentation of the waste, may make the latter toxic and dangerous**

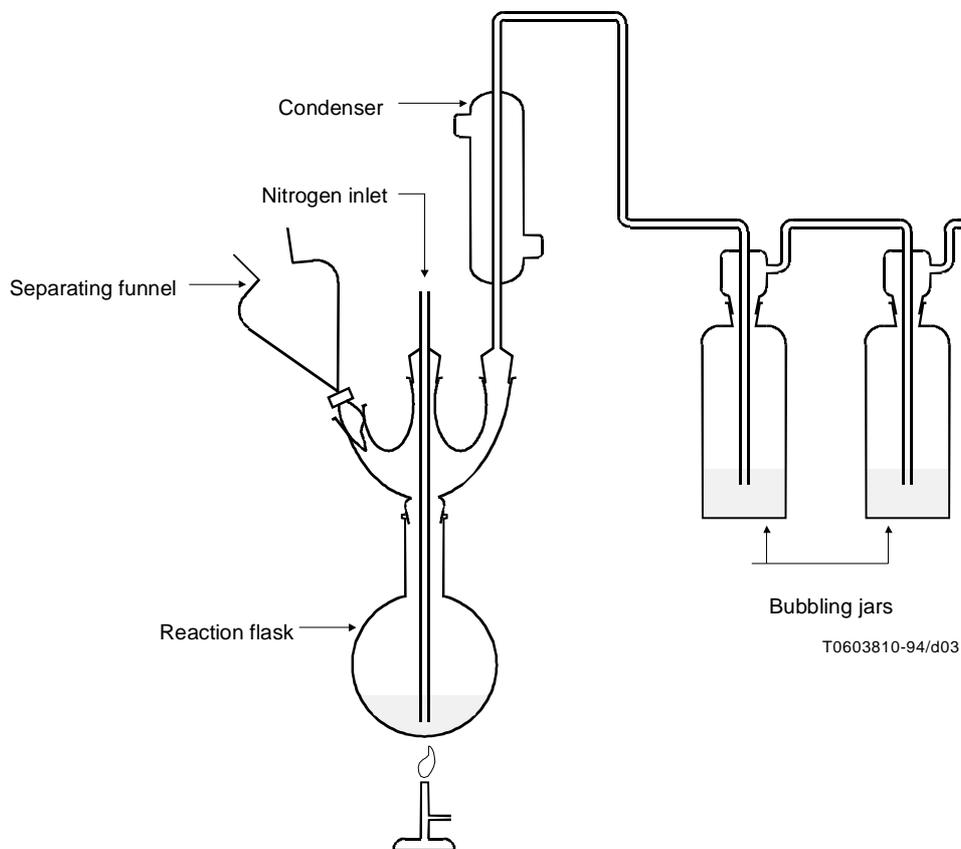
Code No.	Waste with the following constituents
C1	Beryllium, beryllium compounds
C3	Hexavalent chromium compounds
C6	Soluble copper compounds
C8	Arsenic, arsenic compounds
C9	Selenium, selenium compounds
C11	Cadmium, cadmium compounds
C13	Antimony, antimony compounds
C14	Tellurium, tellurium compounds
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	Perchlorates
C31	Nitrides
C32	PCBs and/or PCTs
C33	Pharmaceutical or veterinary compounds
C34	Pesticides and other biocides
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 dibenzoparadoxin 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 A.2/L.24 – Characteristics of dangerous waste**

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 flashpoint 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 flashpoint is greater than or equal to 21° C and lower than or equal to 55° C.
H2C	Highly flammable. Liquid substances and preparations whose flashpoint is lower than 0° C and whose boiling point is lower than or equal to 35° C.
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 an acid, release a toxic or 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.



**Figure A.1/L.24 – Assembly for cyanide distillation in solid samples**



**Figure A.2/L.24 – Assembly for sulphur distillation in solid samples**

## Appendix I

### EEC legislation

European Community legislation on waste and chemical substances is dealt with in three subclauses:

- Solid urban waste.
- Toxic and dangerous waste.
- Chemical substances.

The Directives and Decrees issued in each subclause are as follows:

#### **I.1 Solid urban waste**

75/442/EEC Waste

- COM (88) 391 FINAL – SYN 145
- 91/156/EEC

76/431/EEC Waste management

81/972/EEC Recycling of used paper

90/C 122/EEC Policy on the matter of waste

COM (91) 102 FINAL – SYN 335 Dumping waste

COM (91) 219 FINAL – SYN 217 Civil liability for damages caused by waste

91/692/EEC Standardization of reports

Decision on the Draft Council Directive regarding dumping of waste. Document No. 40 of 17 February 1992.

#### **I.2 Toxic and dangerous waste**

75/439/EEC Used oils

- 87/101/EEC

76/403/EEC PCB and PCT management

- COM (91) 373 FINAL – SYN 161

78/319/EEC Toxic and dangerous waste

- 91/689/EEC Dangerous waste

84/631/EEC Cross-border transfers

- 85/469/EEC
- 86/279/EEC
- COM (88) 391 FINAL – SYN 145

91/157/EEC Batteries and storage batteries

#### **I.3 Chemical substances**

67/548/EEC Classification and labelling of dangerous substances

- 69/91/EEC
- 73/146/EEC
- 75/409/EEC
- 79/831/EEC

- 83/467/EEC
- 84/449/EEC
- 87/302/EEC
- 91/325/EEC
- 91/326/EEC
- 91/632/EEC
- COM (91) 469 – SYN 276
- COM (8) FINAL – SYN 227
- 92/33/EEC
- 92/37/EEC

76/769/EEC Marketing of dangerous preparations

- 82/828/EEC
- 83/478/EEC
- 85/467/EEC
- 85/610/EEC
- 89/677/EEC
- 89/678/EEC
- 91/173/EEC
- 91/338/EEC
- 91/339/EEC
- COM (91) 7 FINAL – SYN 325
- 91/659/EEC
- COM (92) 195 FINAL – SYN 414

80/1107/EEC Protection of workers against the risks related to exposure to chemical, physical and biological agents

- 83/477/EEC            Protection of workers against the risks related to exposure to asbestos.
- 88/642/EEC
- 91/322/EEC
- 91/382/EEC            Risks related to exposure to asbestos during work

Council Decision of 27 February 1984

Health and safety at work.

88/378/EEC Classification, packing and labelling of dangerous preparations.

- 90/492/EEC
- 91/155/EEC

Regulation No. 1734/88    Export and import of dangerous chemical products

Regulation No. 428/89    Exportation of particular chemical products

91/C339/09                Ecological label

COM (91) 468 FINAL    Import/export of dangerous chemical products.

COM (91) 544             Ecological label

880/1992 of the Council of 23 March 1992, regarding a Community system for the granting of the ecological label.  
Document 99 of 11 April 1992.

## Appendix II

(Information from Telefónica de España)

**Table II.1/L.24 – Materials graded according to components**

Product	Grade	Type/hazardousness	Recommended treatment	Composition	Comments
“Solvex Tar” aromatic oil impregnation of wooden posts	E-15-L	C-43		Product of oil-based origin. Components: naphthalene, paraffins ...	
PVC joint adhesive	G-90-L	C41/ /H4/2A ( /14) RTP	Incineration	PVC resin solution in organic solvent (tetrahydrofuran, cyclohexanone and butanone)	The characterization was carried out on the liquid and solid (dry) adhesive, both of which were found to be TDW.
Alkaline nickel-cadmium station batteries	A-80-S B-100-L	C11/24	Safety Dep. Physical- Chemical P.	Miscellaneous: Ni(OH) <sub>3</sub> , Cd, KOH	
Lead-acid batteries	A-60-S B-20-L	C18/23	Safety Dep. Physical- Chemical P.	Miscellaneous: lead sulphuric acid	
Cartridge mixture of aluminium ether-mica ZINC electrode	A-100-S	/ /H2B	Neutralization in Physical- Chemical P.	Aluminium powder, copper oxide and activator powder	
Cartridge mixture of aluminium ether-mica rod electrode	A-100-S	/ /H2B	Neutralization in Physical- Chemical P.	Aluminium powder, copper oxide and activator powder	
Bostik N.820 liquid cement	G-100-L	C41/ /H5/H2A RTP		Elastomer solution in ketone solvent, e.g. methyl ethyl ketone	Limited life. Consult specifications. The characterization was carried out on aged liquid cement.
Floor wax	E-30-S	C53	Incineration	Miscellaneous: beeswax, solid paraffin	
Cable-sealing compound (PREN)	G-40-S	C41/ /H5 RTP	Inventory control. Inerting	Epoxy resin-polyamine or polyamide hardener, e.g. triethylene-tetramine	Limited life. Consult specifications. The characterization screening was carried out on the aged compound.
“Flex-Gel” filling compound for paired cables	E-30-S	C53		Mineral oil with synthetic rubber thickener and polyethylene waxes	
Sealant for occupied ducts	G-100-S	C37, (C43)/ /H4 RTP INH.ING. CON.	Inventory control. Inerting	Two separate components: methyl-diphenyl-isocyanate (MDI), N-methyl-dicyclohexylamine (foaming agent)	Limited life. The characterization was carried out on the aged compound.

**Table II.1/L.24 – Materials graded according to components (continued)**

Product	Grade	Type/hazardousness	Recommended treatment	Composition	Comments
150 BB splicing set	A-80-S G-100-S		Separation of components for possible sale	Miscellaneous: thermorect.sheath (polyolefin) metallic core (aluminium alloy), encapsulant ...	Advisable to code and treat the components separately. Limited life. Consult specifications.
ER splicing set	A-80-S G-100-S	C37/ /H5 (Encapsulant) TDW	Incineration of encapsulant	Inert and encapsulating components based on disocyanate of diphenyl-methylene and polyol	The characterization screening was carried out as a waste product of the set when formed.
Armorcast splicing set	A-80-S G-100-S	C37/ /H5 (Armorcast bandage) TDW		Miscellaneous: metallic components, putty and armorcast bandage (contains isocyanates)	The characterization screening was carried out as a waste product of the set when formed.
Creosate for wood preservation	F-10-L	(C36 European Leg.) C43/ /H7/H14 RTP		Distillation of the secondary coal tar	It could produce dangerous substances or incineration; study required.
Scrap lead-sheathed cable	A-80-S	C18/ /H5 RTP INH. ING.CON.	Separation of components for possible sale	Miscellaneous: lead, ...	Lead exposure limit: 0.05 mg/m <sup>3</sup> .
Lead scrap	A-60-S	C18/ /H5 RTP INH. ING.CON.	Could be sold, waste bags	Lead	Exposure limit: 0.05 mg/m <sup>3</sup> .
Wood scrap	K-40	If it contains creosate it may be H7		Wood. If the wood is creosoted, the waste should be analysed separately	More thorough analysis required.
Wood scrap with metal	J-100	If it contains creosote it may be H7		Wood, metal. If the wood is creosoted, the waste should be analysed separately	More thorough analysis required.
Radioactive detectors and lightning conductors		Radioactive waste	Special dumping ground. Radioactive waste	Miscellaneous	
Gella for slicing	C-10-L	C37/ /H5 RTP INH. CON.		Isocyanate and polybutadiene resin	Limited life. Consult specifications.
Supergras grease	E-30-S	C53	Incineration		
Aguila 75 grease	E-30-S	C53			
Methyl-ethyl ketone cleaner	G-60-L	C41/ /H2A/H4 RTP	Recovery, incineration	Methyl-ethyl ketone	Analysed in the waste characterization screening. Exposure limit 200 ppm (590 mg/m <sup>3</sup> ).
PVC joint cleaner	H-10-L	C40/ /H5/H2B/(H7) RTP INH.ING	Recycling	Methylene chloride	Characterization was carried out on the product as waste. Exposure limit: 500 ppm.
Petroleum jelly cleaner	G-70-L	C41/ /H2B/4 ( /14) RTP	Recovery, incineration	Mixture of D-limonene with 5% of liquid vaseline	Analysed in the waste characterization screening.

**Table II.1/L.24 – Materials graded according to components (concluded)**

Product	Grade	Type/hazardousness	Recommended treatment	Composition	Comments
Contact-cleaning liquid	E-20-L	C53		Solution of 20% white vaseline oil in refined heavy solvent	
Trichloro-trifluorethane liquid	H-10-L	C40/ /H14 RTP	Recycling	Freon 113 (TTE)	Among the substances that destroy the ozone layer. Characterization carried out as a waste product.
Perchloroethylene liquid for pin cleaning	H-10-L	C30/ /H5 RTP		Perchloroethylene	
Lead sheaths	A-60-S	C18/ /H5 RTP INH.ING.CON	Could be sold, waste bags	Lead	Exposure limit: 0.05 mg/m <sup>3</sup> .
Epoxy putty	G-40-S G-20-S	C39/ /H5 RTP	Inventory control. Inerting	Two separate packed products: epoxy based on bisphenol A; triethyltetramine hardener	The unmixed component wastes are harmful. Characterization carried out on aged putty.
Meig mortar for cable-sealing	G-20-S	/ /H4/8		Epoxy with inert loads. Polyamine hardener. Example: triethyl-tetramine	
Dry batteries	A-20-S		Recycling, controlled collection	Miscellaneous: zinc-carbon ammonium chloride. There are mercury batteries (C16)	
50 lead expansion block	A-60-S	C18/ /H5 RTP INH. ING.CON.	Could be sold, waste bags	Lead	Exposure limit: 0.05 mg/m <sup>3</sup> .
Gas detector tubes	B-50-L	C23/ /H8 RTP		Iodine pentoxide and fuming sulphuric acid	
Lead pipes	A-60-S	C18/ /H5 RTP INH. ING.CON.	Could be sold, waste bags	Lead	Exposure limit: 0.05 mg/m <sup>3</sup> .

## Appendix III

**Table III.1 – Materials characterized in Telefónica de España**

Product	Type/hazardousness	Recommended treatment	Composition	Comments
PVC joint adhesive	C41/ /H4/2A( /14) RTP	Incineration	PVC resin solution in organic solvent (tetrahydrofuran, cyclohexanone and butanone)	The characterization was carried out on the liquid and solid (dry) adhesive, both of which were found to be TDW.
Fibre-optic cables	Inert	Controlled dumping ground	Miscellaneous	
Bostik N.820 liquid cement	C41/ /H4 RTP	Safety incinerating tank	Nitrylic rubber or other synthetic elastomer solution	Results refer to aged liquid cement (in addition, liquid should be classified H2A).
Sealant for occupied ducts	Inert	Incinerating or dumping ground	Methyl-diphenyl-isocyanate (MDI). (N-methyl-dicyclohexylamine)	Results refer to the aged hazardousness of the aged product.
Cable-sealing compound (PREN)	Inert	Incinerating or dumping ground	Compound formed by two components: epoxy resin and polyamine-based hardening agent	Results refer to the sealing compound, mixed and aged.
Armorcast wire splicing set	Inert	Dumping ground	Miscellaneous: metallic compounds, putties and armorcast bandage (contains isocyanates)	Results refer to the splicing set comprising all its elements.
ER splicing set	C37/ /H11 RTP	Incineration of encapsulant	Inert and encapsulating components based on diisocyanate of diphenyl methylene and polyol	Results refer to the characterization of the splice when formed.
PVC joint cleaner	C40/ /H5/H2B/( /7) RTP	Recycling	Methylene chloride	Exposure limit: 500 ppm.
Petroleum jelly cleaner	C41/ /H4/2B RTP	Recovery, incineration	Mixture of D-limonene with 5% of liquid vaseline	
Methyl ethyl ketone cleaner	C41/ /H4/H2A RTP	Recycling	Methyl ethyl ketone	Exposure limit: 200 ppm (590 mg/m <sup>3</sup> ).
Trichloro-trifluoroethane liquid	C40/ /H14 RTP	Recycling	Freon 113 (TTE)	Exposure limit: 1000 ppm (7600 mg/m <sup>3</sup> ). Among the substances that destroy the ozone layer.
Lubricant for fibre-optic cable	Inert	Biological purifier	Aqueous solution of a synthetic polymer, e.g. polypropylene glycol	
Epoxy putty	Inert	Dumping ground	Bisphenol A-based epoxy; polyamine or polyamide hardener; triethyl-tetramine	Results refer to the hazardousness of the aged product's residues.
TA 100 to TC 1600 concrete posts	Inert	Controlled dumping ground	Reinforced concrete	
Polyethylene pipes	Inert	Mechanical recycling	Low-density polyethylene	A cytotoxic effect was observed, probably due to external contaminants.
PVC pipes	Inert	Mechanical recycling	Polyvinyl chloride	A cytotoxic effect was observed, probably due to external contaminants.

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