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Standard Guide for Collection of Multi-Media Field Emission and Discharge Data Associated with Glycol Dehydration Units¹

This standard is issued under the fixed designation E 1752; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

^{ε1} NOTE—Subsections 6.3.4 and 7.2.5 were corrected editorially in November 2000.

1. Scope

1.1 *Purpose*—This guide covers the proper collection of field emission and discharge data associated with glycol dehydration units used in the natural gas production, processing, transmission, storage, and distribution industries.

1.2 *Background*:

1.2.1 Increasing regulatory pressure has made emissions of benzene, toluene, ethylbenzene, and xylene isomers (collectively known as BTEX) and volatile organic compounds (VOCs) from the still vent of glycol dehydration units a major concern of the natural gas industry. The Clean Air Act Amendments (CAAA) of 1990 have been the impetus for air toxics regulations, and several states are regulating or are considering regulating emissions from glycol units (1).² Liquid and solid waste discharges are exempt from Subtitle C (hazardous waste) regulation under the Resource Conservation and Recovery Act (RCRA), but may be regulated in the future (2).

1.2.2 Measurement of the waste streams from dehydrators is important to determine which units may have emissions above levels of regulatory concern. Measurements of air emissions from glycol dehydration units have been made from a variety of sampling points using different sampling protocols and analytical techniques since no standard methods have been developed by the United States Environmental Protection Agency (USEPA) or state regulatory agencies. Standard sampling methods do not exist for the liquid and solid waste streams since they are exempt from RCRA Subtitle C. The lack of standard protocols has meant that variations of this approach can result in very different emissions measurements (3).

1.2.3 Providing guidance on the collection of field emission and discharge data will allow the natural gas industry to quantify emissions and apply appropriate controls to comply with regulations.

1.3 *Summary*—This guide has several parts and an annex. Section 1 is Scope. Section 2 is Terminology that has definitions of terms commonly used with relation to glycol dehydration units in the natural gas industry. Section 3 is Significance and Use of this guide. Section 4 is a process description of glycol dehydration units. Section 5 is a discussion of the waste streams associated with glycol dehydrators. Section 6 presents the Approaches for Collecting Air Emission Data, while Sections 7 and 8 present the approaches for collecting liquid and solid waste discharge data, respectively. The annex includes a standard operating procedure (SOP) for the rich/lean glycol sampling method discussed in this guide.

1.4 The values stated in either inch-pound or SI units are to be regarded separately as the standard. The values given in parentheses are for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Terminology

2.1 *Definitions of Terms Specific to This Standard*:

2.1.1 *BTEX*—the compounds benzene, toluene, ethylbenzene, and xylene isomers.

2.1.2 *Clean Air Act Amendments (CAAA)*—the 1990 federal amendments to the Clean Air Act. These amendments address nonattainment areas, hazardous air pollutants, permitting, and enforcement.

2.1.3 *condensate*—water or light hydrocarbons that have changed from a vapor to a condensed liquid state.

2.1.4 *contactor (or absorber)*—a vertical pressure vessel where gas and glycol are intermingled countercurrently to remove water vapor from the gas.

2.1.5 *dehydration*—removal of water vapor from natural gas. Maximum water content of the dehydrated gas is normally 7 lbs (3175 g) H₂O/MMSCF.

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² The boldface numbers in parentheses refer to the list of references at the end of the text.

2.1.6 *flash tank*—a two- or three-phase separator that is used in the rich glycol stream to remove entrained gas and hydrocarbon liquid.

2.1.7 *gas absorption*—an operation in which a gas mixture is contacted with a liquid for the purposes of preferentially dissolving one or more components of the gas and to provide a solution of these in the liquid.

2.1.8 *gas/glycol heat exchanger*—a shell-and-tube, pipe-in-pipe, or other type heat exchanger employed to cool the lean glycol with the gas leaving the contactor before the glycol enters the contactor.

2.1.9 *glycol*—a liquid desiccant used to absorb water vapor from the gas. Triethylene glycol is the most common glycol used in natural gas dehydration.

2.1.10 *lean glycol*—glycol that has been regenerated and is essentially free of water.

2.1.11 *rich glycol*—glycol that has absorbed water.

2.1.12 *reboiler*—the vessel where water is boiled out of the glycol.

2.1.13 *resource conservation and recovery act (RCRA)*—a federal regulatory measure for monitoring liquid and solid waste discharges. Subtitle C of the RCRA, as amended by the 1984 Hazardous and Solid Waste Amendments (HSWA) regulations, provides EPA the statutory authority to adopt a complex set of regulations for identification and management of hazardous waste from “cradle to grave,” that is, from the initial generation through the treatment, transportation, storage, and disposal of wastes.

2.1.14 *still column*—vertically mounted fractionation column on top of the reboiler.

3. Significance and Use

3.1 This guide on the proper collection of emission and discharge wastes from glycol dehydrators is applicable to any natural gas industry and supplier that operates glycol dehydra-

tion units and that needs to identify which glycol units may have emissions above regulatory levels.

3.2 The emission and discharge sampling methods discussed in this guide are not regulatory standards. Standard protocols have been developed by the Gas Research Institute (3) and other gas associations (4) and some state regulatory agencies such as the Louisiana Department of Environmental Quality (LDEQ) (5) and the Texas Natural Resource Conservation Commission (TNRCC) (6) are accepting these data. This guide is **not** intended to instruct the user on how to perform the sampling using these protocols, but to make the user aware of certain practical considerations generally associated with sampling these waste streams.

4. Process Description

4.1 *Introduction*— Glycol dehydration units are commonly used in the natural gas industry to remove water from natural gas streams to prevent corrosion and hydrate formation in pipelines. Up to 40 000 glycol dehydration units may be in operation in the United States (7). TEG is commonly used as the dehydrant since it is more stable than other glycols (for example, ethylene glycol) at high temperatures. A brief description of a typical glycol dehydration unit is presented as follows.

4.2 Fig. 1 is a simplified flow diagram for a glycol dehydration unit. A glycol dehydration unit usually consists of an absorber, a flash tank, heat exchanger(s), filter(s), a glycol reboiler still, and associated pumping and piping equipment. The moist natural gas enters the bottom of the absorber, where it is contacted countercurrently with the cool, lean glycol that absorbs the water. The dry gas exits the top of the absorber.

4.3 The rich glycol (containing water) leaves the bottom of the absorber and often goes through a gas-driven balance pump to a flash tank, which is normally present only on larger units. The flask tank separates much of the natural gas captured under

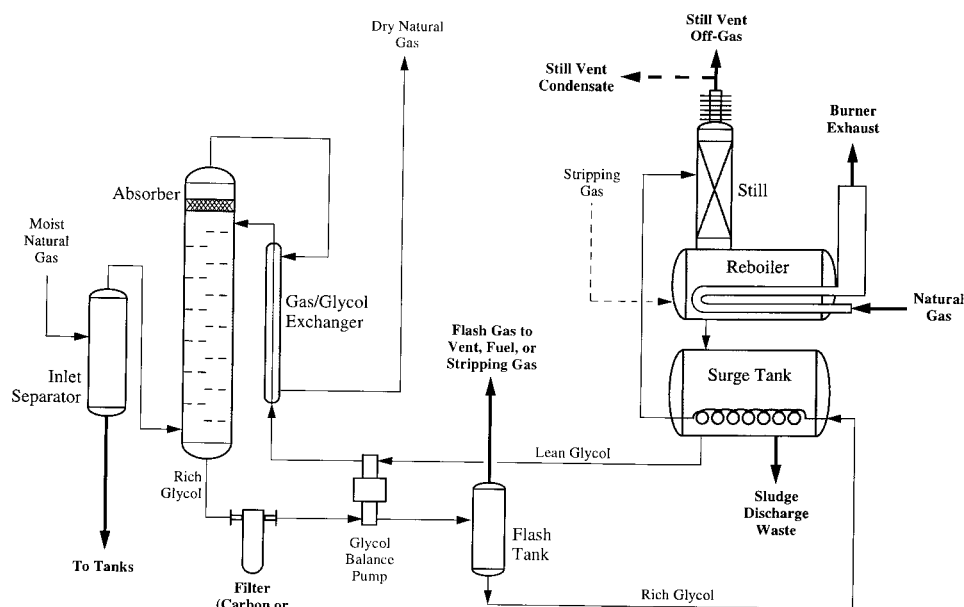


FIG. 1 Typical TEG Dehydrator Waste Streams

high pressure from the glycol; the flash gas may be used as a fuel source. After a series of heat exchangers and filters, the rich glycol enters the still and reboiler, where water is distilled and stripped from the glycol (some units inject a stripping gas to produce higher-purity glycol at normal reboiler temperatures). The lean glycol is pumped back to the top of the absorber from the surge tank.

4.4 Since some dehydrators may produce emissions that are above the regulatory limits even with optimum operating conditions, several technologies have been developed to control emissions from glycol dehydrators. The two most common methods for controlling emissions are condensation and combustion (incineration).

4.4.1 Combustion of the vent stream is difficult, however, due to the possibility of condensation of hydrocarbons and water in the flare. Condensation of the flare results in smoking and incomplete combustion of the vapors. Operating costs for flares and incinerators are relatively high because no hydrocarbons are recovered for sale, and supplemental fuel is often required to sustain an adequate flame temperature (8).

4.4.2 Because of the difficulties associated with combustion, condensation has become the most widely used method of controlling emissions from glycol dehydrators. Condensers convert condensable components in the vapor phase to the liquid phase by reducing the temperature of the process stream. Condensers not only reduce emissions but also recover condensable hydrocarbon vapors that may increase production. The main types of condensers currently used by the gas industry are: air-cooled, glycol-cooled, water-cooled, and direct-contact quench condensers (8).

5. Waste Streams

5.1 *Introduction*— Possible waste streams generated by glycol units are shown in Fig. 1. Seven of the waste streams occur on many glycol units: still vent gas, burner flue gas, flash gas, water condensate, waste glycol, reclaimer waste, and spent filters. These waste streams and associated sampling considerations are presented as follows.

5.2 *Waste Streams and Sources:*

5.2.1 *Still Vent Gas*— During the absorption process, the glycol, that has a high affinity for aromatic compounds, removes BTEX and, to a lesser extent, other VOCs from the natural gas. (The BTEX compounds are usually present in the natural gas at levels of less than 1000 parts per million by volume, although concentrations can be higher in some cases.) Since the boiling points of BTEX range from 80 to 140°C, most of these compounds are not lost in the flash tank but are boiled from the glycol in the still. Although many of the lighter hydrocarbons may be removed from the glycol in the flash tank, some remain in the glycol and are also separated in the still. These separations in the still result in BTEX and other VOCs being present in the still vent gas, that is typically released to the atmosphere. This stream is the major source of air emissions.

5.2.2 *Burner Flue Gas*— Many glycol units use a gas-fired burner as the heat source for the reboiler. Since the natural gas combustion in these burners should be fairly complete, these burners should emit only minor quantities of VOCs. However,

there will be some NO_x emissions as well as emissions of the combustion products of any gas contaminant.

5.2.3 *Flash Tank Vent Gas*—The flash tank removes a large fraction of the light gases absorbed by the glycol at high pressure by reducing the pressure of the rich glycol stream leaving the bottom of the absorber. The flash gas is often used as fuel, but may be vented as a waste stream at some units.

5.2.4 *Water and Hydrocarbon Condensate*—Many units also collect a water and hydrocarbon condensate from the reboiler still vent gas. As the still vent gas passes through the stack above the distillation section of the column, some condensation may occur on the stack walls. The condensate may be collected through a drain leg off the stack and will likely be contaminated with hydrocarbon species. Still other units install condenser control technologies to recover additional liquid hydrocarbons from the still vent gas.

5.2.5 *Waste Glycol/Reclaimer Waste*—The glycol solution is occasionally replaced in units when it becomes fouled with contaminants such as heavy hydrocarbons, well-treating chemicals, corrosion products, degradation products, and salts. The contaminated glycol may be sent to a vacuum reclaimer for recovery.

5.2.6 *Spent Filters*— Filtration is used to remove low levels of contaminants from the solution and maintain solution quality. Sock filters are typically used in glycol units to remove particulates, while carbon filters are used to remove heavy hydrocarbons and surfactants from solution. These filters must be replaced on a regular basis.

5.3 *Sampling Considerations:*

5.3.1 *Still Vent Gas*— It is difficult to directly measure BTEX and VOC emissions by sampling the still vent stream. The stream temperature is in the range from 200 to 225°F (93.3 to 107.2°C) and may contain 90 + % water, as well as levels of organic compounds that may often be in the percent range. Problems associated with sampling and analyzing this stream include the following (3):

5.3.1.1 Measuring organic compounds in the presence of high levels of water or removing the water without biasing the organic compound measurements,

5.3.1.2 Collecting a representative, homogeneous sample from a low flow rate stream that may have condensing material, and

5.3.1.3 Accurately measuring the low, fluctuating flow rate of this stream.

5.3.2 *Burner Flue Gas*— The USEPA has characterized emissions from natural gas combustion and established factors for estimating these emissions (2). Therefore, sampling is typically not performed on this stream and emission data collection methods will not be discussed in the remainder of this guide.

5.3.3 *Flash Tank Vent Gas*—Since the flash tank vent gas is often used as a fuel or stripping gas, sampling is typically not performed on this stream (2). Therefore, emission data collection methods will not be discussed in the remainder of this guide.

5.3.4 *Water and Hydrocarbon Condensate*—The water and hydrocarbon condensate collected from the reboiler still vent gas and condenser control technologies are typically routed to

a three-phase separator (liquid hydrocarbon, water, and noncondensable gas). The noncondensable gas is recycled to the reboiler. Each liquid phase is pumped to a separate waste storage tank. Alternately, the combined liquid streams may be sent to a single storage tank. Problems associated with sampling these liquid streams include the following:

5.3.4.1 Collecting a representative sample of each liquid phase,

5.3.4.2 Accurately measuring the flow rates of the liquid hydrocarbon and water streams since the separator discharge pumps may not run continuously. This is especially a problem when the liquids are not segregated in separate tanks.

5.3.5 *Waste Glycol/Reclaimer Waste*—Waste glycol is usually pumped to storage drums or tanks and then shipped off site for reclamation. The main problem associated with sampling this waste stream is sample homogeneity.

5.3.6 *Spent Filters*— Spent filters are typically stored in drums or dumpsters. The main problem associated with sampling this waste stream is obtaining a representative sample.

6. Approaches for Collecting Air Emission Data

6.1 *Introduction*— There are two often-used approaches for measuring the air emissions from the still vent stack: a rich/lean glycol mass balance (RL) and total capture stack condensation (TCC). Using the RL approach, emissions are calculated from the mass differences between the analytes in the rich and lean samples and the glycol flow rate. The glycol samples may be collected at atmospheric or pressurized operating conditions. Using the TCC approach, the total emissions to the atmosphere from the still vent are collected and separated into three phases (hydrocarbon liquid, water, and noncondensable gas) by chilling the still vent stream with an ice bath. Emission modeling programs such as GRI-GLYCalc³ can also be used to estimate emissions of BTEX and other VOC from the regenerator still vent gas. Some of the practical considerations recommended when using these sampling approaches are listed below as follows.

6.2 *Practical Considerations for RL Methods*—Glycol dehydration units have different types of hardware (for example, gas-driven or electric pumps, flash tanks, charcoal filters, heat exchangers) and variations in their glycol piping configurations that must be considered before sampling. Gas-driven pumps (for example, Kimray) inject gas into the rich glycol, that results in a larger noncondensable gas fraction in the rich glycol sample line. Some units are equipped with flash tanks, that will remove a portion of the noncondensable gas from the rich glycol line. Charcoal filters may be present and may absorb hydrocarbons from the glycol. Glycol dehydration units may have none, one, or a combination of several heat exchange systems found at different locations (for example, before or after flash tanks) on different units. (Several heat exchange systems found on glycol dehydration units include: concentric pipe rich/lean glycol; rich glycol passed through a coil in the surge tank; rich glycol preheated in the still; and concentric pipe lean glycol/outlet natural gas.) All of these factors play a

role in the temperature, pressure, and the amount of gas/foam encountered during glycol sampling (3, 4).

6.2.1 The rich and lean glycol samples should be collected at locations where the glycol stream will be at the lowest possible temperature and pressure. A cooling coil should be used when collecting the rich glycol samples to minimize the loss of volatiles. Sampling points should not be at the top or bottom of filters or anywhere in the glycol stream where gas or liquid can accumulate.

6.2.2 The rich glycol should always be sampled at a point between the glycol pump and the reboiler. The sample point can be selected based on the flow chart in Fig. 2.

6.2.2.1 Sampling the rich glycol stream at units that have sampling points at high pressure (greater than 100 psig (689.5 kPa)), a high noncondensable gas flow rate (no flash tank), and a Kimray gas-driven pump results in a glycol sample that spews (especially in conjunction with the strokes of the Kimray pump) from the line as an aerosol.

6.2.2.2 Units that have rich glycol sample points at low pressure (less than 5 psig (34.5 kPa)), a low noncondensable gas flow rate (flash tank), an electric pump, and a cool glycol stream (glycol temperature less than 70°F (21.1°C)) can result in a viscous foamy glycol sample that flows very slowly through the cooling coil (a cooling coil is not necessary or practical in these situations).

6.2.3 If a charcoal filter is in line between the reboiler and the contactor, the lean glycol should be sampled at a point between the reboiler and charcoal filter. If a charcoal filter is not in line between the reboiler and the contactor, the lean

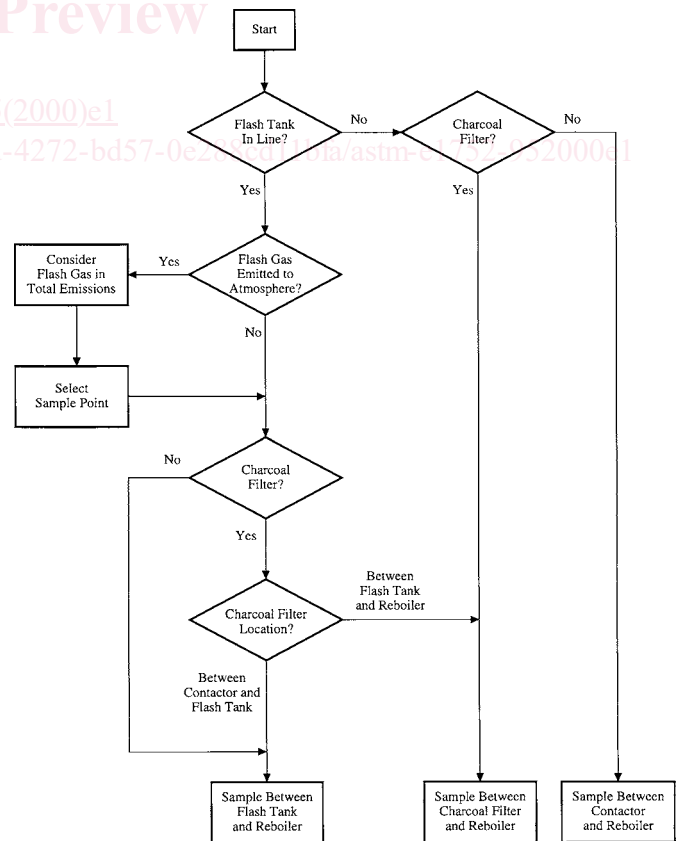


FIG. 2 Selection of the Rich Glycol Sample Port

³ GRI-GLY Calc is a registered trademark of Gas Research Institute, available from Radian International LLC, P. O. Box 201088, Austin, TX 78720-1088.

glycol should be sampled at a point between the reboiler and the contactor. In both instances, the sample point should be selected on the low pressure side of the glycol pump. Also, sample points for the lean glycol may be very hot ($>300^{\circ}\text{F}$ (149°C)), especially if collected before any heat exchange device.

6.2.4 Kimray gas-driven pumps and electric pumps are used to determine the glycol flow rate. When Kimray glycol pumps are set up to run at or below their minimum recommended stroke rates, wide variations in glycol circulation rates may occur. Sampling and flow rate measurement should be conducted under conditions in which the glycol pumps are running within their recommended flow rate ranges.

6.2.5 Samples should be analyzed by GC/FID using EPA Methods 8020 and 8260⁴ or the direct injection approach outlined in Appendix X1 of this guide.

6.3 *Practical Considerations for TCC Methods*—There are many equipment variations to glycol dehydration units. The specific unit configuration and the process parameters must be considered before sampling to determine emissions from a specific unit. Units that do not have flash tanks or that have flash tanks maintained at low temperatures and high pressures may have condensable gas flow rates that could result in backpressure on the reboiler when the TCC apparatus is attached. When condensing the still vent stream on a glycol unit, one should make sure to minimize backpressure (preferably less than six inches of water column) on the reboiler. Depending on its size, the total capture device can normally only be used to condense the still vent stream on dehydration units drying less than 10 MMSCFD (3).

6.3.1 The TCC method should be carried out during both on and off reboiler firing cycles. Glycol reboiler firing cycles create positive and negative still vent flow. During reboiler firing, water and hydrocarbons are distilled from the glycol and their vapors create positive still vent flow. When the reboiler is off, the glycol begins to cool, and no more vapors are separated from the glycol. The existing vapors cool and their volume is reduced, which can result in reverse (negative) flow in the still vent line. Cyclic flow is common in glycol dehydration units and can be minimized or eliminated by maintaining a control of $\pm 2.5^{\circ}\text{F}$ (1.4°C) on the reboiler fire box. Due to the possibility of negative still vent flow, care must be taken when sampling the gas stream (noncondensable gas) to ensure that ambient air does not contaminate the sample.

6.3.2 When sampling with the TCC method, there are aqueous, liquid hydrocarbon, and gas phases that have to be sampled and measured. The total hydrocarbon emissions will be determined from the concentration of hydrocarbons in each phase coupled with the total volume of each phase collected during a given run time. If the ratio of water to condensed hydrocarbon is less than 16:1, then the contribution of the water phase to the total hydrocarbon emissions is probably negligible (less than 1 % of the emissions contained in the condensed hydrocarbon). The contribution of the noncondensable gas phase to total emissions is dependent on the noncon-

densable gas flow rate and composition; the noncondensable gas phase is often a significant portion of the total VOC emissions and may also contain significant amounts of BTEX on units without flash tanks.

6.3.3 Either a Tedlar bag or canister may be used in collecting the noncondensable gas sample. Tedlar bags are more widely used but are limited to short hold times due to the diffusion of the gases through the bag walls and the potential for light degradation. They are also difficult to ship because they do not have fixed walls. Therefore, they are better suited for sites that are relatively close so that the Tedlar bags may be driven to the laboratory. By contrast, canisters are not used as widely and tend to be more expensive because of the cleaning procedures needed to reuse them. However, they are easily shipped and are well-suited for remote locations.

6.3.4 Liquid samples should be analyzed using EPA Methods 8020 and 8260⁴ or the analytical methods outlined in Ref (3). The gas samples should be analyzed using modified EPA compendium Method TO-14 or GPA Methods 2261 and 2286 as outlined in Ref (3).

6.4 The BTEX and other VOC emissions may be estimated using GRI-GLYCalc³ or other commercial software packages. The GRI-GLYCalc uses the inlet natural gas composition and process data, along with fundamental chemical engineering thermodynamics, to make the emissions estimates. (The natural gas may be collected and analyzed using the procedures outlined in GPA Methods 2166 and 2286 or modified EPA TO-14.) The GRI-GLYCalc³ tends to overpredict BTEX and VOC emissions, rather than underpredict, so emission estimates are conservatively high. Although this approach is less rigorous than the RL and TCC methods described above, it may be used as a rapid, inexpensive screening tool for determining which dehydration units are likely to be in compliance with applicable regulatory emissions levels.

7. Approaches for Collecting Liquid Waste Data

7.1 *Introduction*— The methods and practical considerations recommended when collecting samples from the liquid waste streams associated with glycol dehydrators are discussed as follows.

7.2 *Water and Hydrocarbon Condensate*—Direct pour/grab and scoop sampling techniques may be used to collect water and hydrocarbon condensate samples from waste storage tanks (9).

7.2.1 Direct pour sampling involves the transfer of a waste sample from the source directly into the sample container. This collection method should be used when a discharge port is available on the tank, and when there is no means of compositing the waste stream. Prior to collecting the sample, the port and related piping should be purged to ensure that the sample is representative of the material in the vessel. Small containers may be sampled by directly pouring from the container into the sample bottles. Sample homogeneity is a potential concern.

7.2.2 Direct grab sampling consists of dipping a borosilicate beaker or weighted sample bottle into a process or storage vessel. The weighted sample bottle typically consists of a glass or plastic bottle with a sinker and stopper, in addition to a line that is used to lower, raise, and open the bottle. The weighted bottle should be lowered into a tank to the desired level or layer

⁴ Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20036.

and then opened and filled. Multiple random samples should be composited into a 5-gal (18.9 L) carboy and distributed to the appropriate sampling containers.

7.2.3 Disposable scoops should be used to collect samples of high-viscosity liquid wastes. These samples should be composited directly into wide-mouth bottles by collecting several scoops of material.

7.2.4 Field blank samples should be collected on site when possible.

7.2.5 Water and hydrocarbon condensate samples should be analyzed using EPA Methods 8020 and 8260 or the analytical methods outlined in Ref (3). Toxicity Characteristic Leaching Procedure (TCLP) testing, as described in 40 CFR Part 261 Appendix II, should be conducted if RCRA toxicity data are needed.

7.3 *Waste Glycol/Reclaimer Waste*—Direct pour/grab and composite liquid sampling techniques (COLIWASA) may be used to collect the waste glycol/reclaimer waste samples from waste storage tanks or drums (9).

7.3.1 Waste glycol stored in tanks should be sampled using the direct pour/grab techniques discussed in 8.2.1 and 8.2.2.

7.3.2 Waste glycol stored in drums should be sampled using a composite liquid sampler (COLIWASA). This device typically consists of a 4-ft (1.22-m)-long glass or PVC tube having an inside diameter of approximately 1.25 in. (31.75 mm), with a 0.25-in. (6.35 mm) diameter stainless steel (or TFE-fluorocarbon) rod with attached stoppers passing down the center through the length of the tube. The COLIWASA should be used by opening the stoppered lower end and slowly

lowering the tube into the liquid. As the tube passes through the drum, a composite sample is collected over the length of the drum. When the bottom of the drum is reached, the stopper should be pressed back into the tube openings, thereby trapping the sample within the tube. At this point, the COLIWASA contains a composite sample of the drum. When the COLIWASA is withdrawn, it may be emptied into the sample container. When compositing from multiple drums, each sample container should be proportionately filled from each drum.

7.3.3 Field blank samples should be collected on site when possible.

7.3.4 These waste samples should be analyzed using the TCLP procedures described in 40 CFR, Part 261, Appendix II.⁴

8. Approach for Collecting Solid Waste Data

8.1 *Introduction*— The methods and practical considerations recommended when collecting samples from the solid waste stream associated with glycol dehydrators are discussed as follows.

8.2 Filters should not be removed from a unit until differential pressure indicates that the filter should be removed. Care should be used when removing a filter from a high-pressure application.

8.3 The spent filters should be cut into pieces using a hack saw and scissors and composited. If possible, the composite should be made from three different sample filters (9).

8.4 These samples should be analyzed using the TCLP procedures described in 40 CFR, Part 261, Appendix II.⁴

Document Preview

APPENDIX

ASTM E1752-95(2000)e1
(Nonmandatory Information)

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X1. ATMOSPHERIC RICH/LEAN GLYCOL METHOD STANDARD PROCEDURE

X1.1 Purpose

X1.1.1 The purpose is to determine still vent emissions from triethylene glycol (TEG) dehydration units. Still vent emissions are calculated from the mass differences between the analytes in the atmospheric rich and lean glycol samples and the glycol flow rate.

X1.2 Scope and Applicability

X1.2.1 *Scope*—A procedure for collecting and analyzing samples taken from natural gas dehydration units that use TEG as the desiccant. Determining the glycol flow rate, calculating still vent emissions from a dehydration unit, and using VOC emission correction factors for units with high gaseous non-condensable still vent flow rates are also covered.

X1.2.2 *Applicability*— Still vent emissions may be estimated for benzene, toluene, ethylbenzene, and the xylenes (BTEX), as well as *n*-hexane, 2,2,4-trimethylpentane, C₅ to C₁₀ normal alkanes, cyclohexane, and total hydrocarbons.

X1.3 Safety

X1.3.1 Glycol samples may be under high pressure (potentially greater than 1000 psig (6895 KPa)) and may be hot (380°F (193°C)). Samples may have high levels of benzene and other aromatic and aliphatic hydrocarbons that pose exposure hazards. Natural gas present in the glycol sample lines is a potential fire or explosion hazard.

X1.4 Glycol Sampling Procedure

X1.4.1 Obtain atmospheric rich and lean glycol samples from natural gas glycol dehydration units. Collect these samples in 40-mL VOA vials at identified points on a glycol dehydration unit. The results of the rich and lean sample analysis, along with the glycol circulation rate, are used to perform a mass balance of air toxic emissions (*n*-hexane, benzene, toluene, ethylbenzene, xylenes, and other volatile organic compounds VOCs) from the glycol dehydrator still vent.