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Emission standard of pollutants for petroleum refining industry

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General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China.

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Foreword

In order to implement “Environmental Protection Law of the People’s Republic of China”, “Water Pollution Prevention Law of the People’s Republic of China”, “Air Pollution Prevention Law of the People’s Republic of China” and other laws and regulations; to protect environment; to prevent pollution; and to promote technical progress and sustainable development of petroleum refining industry, this Standard is formulated.

This Standard specifies water pollutants, air pollutant discharge limits, monitoring and supervision management requirements OF petroleum refining industrial enterprises and the production facilities.

Odorous pollutants discharged and environmental noise of petroleum refining industrial enterprises shall follow relevant pollutant discharge standards; identification, treatment and disposal of generated solid wastes shall follow relevant solid waste pollutant control standards. Supporting power boiler shall follow “Emission Standard of Air Pollutants for Boiler” or “Emission Standard of Air Pollutants for Thermal Power Plants”.

This Standard is issued for the first time.

Water pollutants and air pollutants emission control shall be based on this Standard - for new facilities, it is implemented from July 1, 2015; for existing facilities, it is implemented from July 1, 2017. The relevant provisions in “Integrated Wastewater Discharge Standard” (GB8978-1996), “Comprehensive Emission Standard of Air Pollutants” (GB16297-1996), and “Standard of Smoke and Dust Emission for Industrial Kiln and Furnace” (GB9078-1996) shall not be implemented. Various regions may implement this Standard earlier than above dates, according to the demand of local environmental protection and economic and technical conditions, and approved by the People’s Government at the provincial level.

This Standard is the basic requirements for emission control over water pollutants and air pollutants for petroleum refining industry. For the items that are not required by local provincial people’s government, local pollutant emission standards may be developed; for items that have already been specified in this Standard, local pollutant emission standards may develop more stringent requirements than this Standard. If the requirements of environmental impact assessment document or sewage discharge license/permit are more stringent than this Standard or local standard, then implement in accordance with officially replied-approved environment impact assessment document or sewage discharge license/permit.

This Standard is organized and formulated by the Department of Science, Technology and Standards of the Ministry of Environmental Protection.

Drafting organizations of this Standard: Fushun Research Institute Of Petroleum and

Petrochemicals, and Chinese Research Academy of Environmental Sciences.

This Standard was approved by the Ministry of Environmental Protection on April 3, 2015.

This Standard shall be implemented from July 1, 2015.

This Standard shall be interpreted by the Ministry of Environmental Protection.

Emission standard of pollutants for petroleum refining industry

1 Scope of application

This Standard specifies emission limits, monitoring and supervision management requirements of water pollutants and air pollutants for petroleum refining industrial enterprises and the production facilities.

This Standard is applicable to emission management of existing pollutants for petroleum refining industrial enterprises or production facilities; it is also applicable to petroleum refining industry's construction projects' environmental impact assessment, environmental protection facility design, completion-acceptance inspection of environmental protection, and water pollutants and air pollutants emission management after being put into operation.

Gasoline storage tank at petroleum refining industrial enterprises and oil gas emission control during oil delivery process shall be implemented in accordance with provisions of this Standard; the relevant provisions of GB 20950-2007 shall not be implemented.

This Standard applies to those behaviors of pollutant emissions that are legally permitted. For site selection of new pollution sources and management of existing pollution sources within special protection areas, it shall follow "Water Pollution Prevention Law of the People's Republic of China", "Air Pollution Protection Law of the People's Republic of China", "Marine Environmental Protection Law of the People's Republic of China", "Solid Waste Pollution Prevention law of the People's Republic of China", "Environmental Impact Assessment Law of the People's Republic of China", and other laws, regulations and relevant provisions.

2 Normative references

The articles contained in the following documents have become part of this Standard when they are quoted herein. For the dated documents so quoted, the latest editions shall be applicable to this Standard.

GB 20950 - 2007 Emission standard of air pollutant for bulk gasoline terminals

GB/T 6920 Water quality - Determination of pH value - Glass electrode method

GB/T 7469 Water quality - Determination of total mercury potassium

GB/T 7470 Water quality - Determination of lead - Spectrophotometric method with dithizone

GB/T 7475 Water quality - Determination of copper, zinc, lead and cadmium - Atomic absorption spectrometry

GB/T 7485 Water quality - Determination of total arsenic - Silver diethyldithiocarbamate spectrophotometric method

GB/T 8017 Standard test method for vapor pressure of petroleum products (Reid Method)

GB/T 11890 Water quality - Determination of benzene and its analogies gas chromatographic method

GB/T 11893 Water quality - Determination of total phosphorus - Ammonium molybdate spectrophotometric method

GB/T 11895 Water quality - Determination of benzo (alpha) - pyrene - Acetylated paper chromatography with fluorescence spectrophotometric method

GB/T 11901 Water quality - Determination of suspended substance - Gravimetric method

GB/T 11910 Water quality - Determination of nickel - Dimethylglyoxime spectrophotometric method

GB/T 11912 Water quality - Determination of nickel - Flame atomic absorption spectrometric method

GB/T 11914 Water quality - Determination of the chemical oxygen demand - Dichromate method

GB/T 14204 Water quality - Determination of alkylmercury - Gas chromatography

GB/T 15432 Ambient air - Determination of total suspended particulates - Gravimetric method

GB/T 15439 Air quality - Determination of benz[a]pyrene in ambient air - High performance liquid chromatography

GB/T 15503 Water quality - Determination of vanadium - BPHA extraction spectrophotometric method

GB/T 16157 The determination of particulates and sampling methods of gaseous pollutants emitted from exhaust gas of stationary source

GB/T 16489 Water quality - Determination of sulfide - Methylene blue

spectrophotometric method

HJ/T 27 Stationary source emission - Determination of hydrogen chloride - Mercuric thiocyanate spectrophotometric method

HJ/T 38 Stationary source emission - Determination of nonmethane hydrocarbons - Gas chromatography

HJ/T 40 Stationary source emission - Determination of benzo(a)pyrene - High performance liquid chromatography

HJ/T 42 Stationary source emission - Determination of nitrogen oxide - Ultraviolet spectrophotometric method

HJ/T 43 Stationary source emission - Determination of nitrogen oxid - N(1-naphtye) - Ethylenediamine dihydrochloride spectrophotometric method

HJ/T 45 Stationary source emission - Determination of asphaltic smoke - Gravimetric method

HJ/T 55 Technical guidelines for fugitive emission monitoring of air pollutants

HJ/T 56 Determination of sulphur dioxide from exhausted gas of stationary source Iodine titration method

HJ/T 57 Determination of sulphur dioxide from exhausted gas of stationary source Fixed - potential electrolysis method

HJ/T 60 Water quality - Determination of sulfides - Iodometric method

HJ/T 63.1 Stationary source emission - Determination of nickel - Flame absorption spectrophotometric method

HJ/T 63.2 Stationary source emission - Determination of nickel - Graphitic furnace atomic absorption spectrophotometric method

HJ/T 63.3 Stationary source emission - Determination of nickel - Dimethylglyoxime with n - Butanol by spectrophotometry

HJ/T 70 High - chlorine wastewater - Determination of chemical oxygen demand - Chlorine emendation method

HJ/T 75 Specifications for continuous emissions monitoring of flue gas emitted from stationary sources (on trial)

HJ/T 76 Specification and test procedures for continuous emission monitoring systems of flue gas emitted from stationary sources (on trial)

HJ/T 91 Technical specifications requirements for monitoring of surface water and waste water

HJ/T 132 High - chlorine wastewater - Determination of chemical oxygen demand - Potassium iodide alkaline Permanganate method

HJ/T 195 Water quality - Determination of ammonia - nitrogen Gas - phase molecular absorption spectrometry

HJ/T 200 Water quality - Determination of sulfide Gas - phase molecular absorption spectrometry

HJ/T 373 Technical specifications of quality assurance and quality control for monitoring of stationary pollution source (on trial)

HJ/T 397 Technical specifications for emission monitoring of stationary source

HJ/T 399 Water quality - Determination of the chemical oxygen demand - Fast digestion - Spectrophotometric method

HJ 478 Water quality - Determination of polycyclic aromatic hydrocarbons. Liquid-liquid extraction and solid-phase extraction - High performance liquid chromatography

HJ 484 Water quality - Determination of Cyanide Volumetric and Spectrophotometry method

HJ 493 Water quality sampling - technical regulation of the preservation and handling of samples

HJ 494 Water quality - Guidance on sampling techniques

HJ 495 Water quality Technical regulation on the design of sampling programmes

HJ 501 Water quality - Determination of total organic carbon - Combustion oxidation nondispersive infrared absorption method

HJ 502 Water quality - Determination of volatile phenolic compounds - bromine method

HJ 503 Water quality - Determination of volatile phenolic compounds - 4 - AAP spectrophotometric method

HJ 505 Water quality - Determination of biochemical oxygen demand after 5 days (BOD5) for dilution and seeding method

HJ 535 Water quality - Determination of ammonia nitrogen - Nesslers reagent spectrophotometry

HJ 536 Water quality - Determination of ammonia nitrogen - Salicylic acid

spectrophotometry

HJ 537 Water quality - Determination of ammonia nitrogen - Distillation - neutralization titration

HJ 544 Stationary source emission. Determination of sulfuric acid mist. Ion chromatography (on trial)

HJ 548 Stationary source emissions. Determination of hydrogen chloride. Silver nitrate titration method (on trial)

HJ 549 Ambient air and waste gas. Determination of hydrogen chloride. Ion chromatography (on trial)

HJ 583 Ambient air. Determination of benzene and its analogies using sorbent adsorption thermal desorption and gas chromatography

HJ 584 Ambient air - Determination of benzene and its analogies by activated charcoal adsorption carbon disulfide desorption and gas chromatography

HJ 597 Water quality - Determination of Total mercury - Cold atomic absorption spectrophotometry

HJ 629 Stationary source emission - Determination of sulphur dioxide. Non - dispersive infrared absorption method

HJ 636 Water quality - Determination of total nitrogen - Alkaline potassium persulfate digestion UV spectrophotometric method

HJ 637 Water quality - Determination of petroleum oils and animal and vegetable oils - Infrared spectrophotometry

HJ 639 Water quality - Determination of volatile organic compounds - Purge and trap/gas chromatography - mass spectrometer

HJ 644 Ambient air - Determination of volatile organic compounds - Sorbent adsorption and thermal desorption/gas chromatography mass spectrometry method

HJ 646 Ambient air and stationary source emissions - Determination of gas and particle - phase polycyclic aromatic hydrocarbons with gas chromatography/mass spectrometry

HJ 647 Ambient air and stationary source emissions - Determination of gas and particle - phase polycyclic aromatic hydrocarbons - High performance liquid chromatography

HJ 665 Water quality. Determination of ammonium nitrogen by continuous flow analysis (CFA) and Salicylic acid spectrophotometry

HJ 666 Water quality - Determination of ammonium nitrogen by flow injection analysis (FIA) and Salicylic acid spectrophotometry

HJ 667 Water quality - Determination of total nitrogen by continuous flow analysis (CFA) and N-(1-naphthyl) ethylene diamine dihydrochloride

HJ 668 Water quality - Determination of total nitrogen by flow injection analysis (FIA) and N-(1-naphthyl) ethylene diamine dihydrochloride spectrophotometry

HJ 670 Water quality - Determination of orthophosphate and total phosphorus - Continuous flow analysis (CFA) and Ammonium molybdate spectrophotometry

HJ 671 Water quality - Determination of total phosphorus - Flow injection Analysis (FIA) and Ammonium molybdate spectrophotometry

HJ 673 Water quality - Determination of vanadium by graphite furnace atomic absorption spectrometric method

HJ 675 Determination of nitrogen oxide emissions from stationary sources by acid - base titration method

HJ 686 Water quality - Determination of volatile organic compounds -

HJ 692 Stationary source emission - Determination of nitrogen oxides - Non-dispersive infrared absorption method

HJ 693 Stationary source emission - Determination of nitrogen oxides - Fixed potential by electrolysis method

HJ 694 Water Quality - Determination of Mercury, Arsenic, Selenium, Bismuth and Antimony - Atomic Fluorescence Spectrometry

HJ 700 Water quality - Determination of 65 elements - Inductively coupled plasma - mass spectrometry

HJ 732 Emission from stationary sources - Sampling of volatile organic compounds - Bags method

HJ 733 Guideline for the Determination of Volatile Organic Compound Leaks and Uncovered Liquid Surface Emissions

HJ 734 Stationary source emission - Determination of volatile organic compounds - Sorbent adsorption and thermal desorption gas chromatography mass spectrometry method

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1 Petroleum refining industry

The industry that produces gasoline fractions, diesel oil fractions, fuel oil, lubricating oil, petroleum wax, petroleum asphalt and petrochemical materials based on raw materials of crude oil, heavy oil, etc.

3.2 Petroleum refining industry wastewater

The wastewater that is generated during petroleum refining industrial processes, including process wastewater, polluted rainwater (mixed with process wastewater for treatment), domestic sewage, circulating cooling sewage water, chemical sewage water, steam generator sewage water, waste heat boiler sewage water, etc.

3.3 Process wastewater

The wastewater that is discharged from production equipment after direct contact with material during production process of petroleum refining industry. Process wastewater includes oily wastewater, alkaline wastewater, sour water, aromatic hydrocarbon wastewater, salinity wastewater, etc.

3.4 Polluted rainwater

The rainwater of surface runoff in petroleum refining industrial enterprises or production facility area, of which the pollutant concentration is higher than the direct emission limits as specified in this Standard.

3.5 Alkaline wastewater

The wastewater that is generated during alkali refining of oils and gas products in petroleum refining industry and desulfurization amine liquid regeneration process.

3.6 Sour water

The wastewater, generated during petroleum refining industrial processes, that contains sulfur ≥50 mg/L and ammonia nitrogen ≥100 mg/L.

3.7 Aromatic hydrocarbon wastewater

The wastewater that is discharged by production equipment, after direct contact with material during aromatic hydrocarbons (benzene, toluene, xylene, styrene) production process.

3.8 Wastewater collection and transportation system

Any organic liquid that can release volatile organic compound and meets one of the following conditions: (1) at 20°C, true vapor pressure of volatile organic liquid is greater than 0.3 kPa; (2) at 20°C, in mixture, total concentration of pure organic compounds of which the true vapor pressure is greater than 0.3 kPa is equal to or greater than 20% (weight ratio).

3.17 True vapor pressure

Vapor pressure when rate of gasification of organic liquid is zero, also known as bubble point vapor pressure, obtained by conversion of Reid vapor pressure measured based on GB/T 8017.

3.18 Leakage detection value

Adopting the prescribed monitoring methods, the net value (counted in carbon) OF concentration of organic matter at leakage point of equipment (pumps, compressors, etc.) or pipeline components (valves, flanges, etc.) detected by detecting instruments LESS background values of environment.

3.19 Process heater

Equipment in which the fuel is burned to heat the flowing liquid or gas in pipe.

3.20 Catalytic cracking gas

Flue gas that is exhausted through scorching regeneration process by carbon deposit catalyst in regenerator, during catalytic cracking unit production process.

3.21 Acid gas recovery unit

Device of converting hydrogen sulfide in acid gas generated by petroleum refining to elemental sulfur or sulfuric acid.

3.22 Air oxidation reactor

Reactor that uses air, or the combination of air and oxygen as oxygen source.

3.23 Malfunction/upsets

Operating condition of which the production process parameters of production facilities are not in a planned manner based on device designed flexibility changes.

3.24 Stack height

Height that is counted from ground plane of stack/exhaust (or the main building structure) to stack/exhaust outlet.

3.25 Standard condition

$$\rho_{benchmark} = \frac{21 - O_{benchmark}}{21 - O_{measured}} \times \rho_{actual} \quad (2)$$

Where,

$\rho_{benchmark}$ — Benchmark emission concentration of air pollutants, mg/m^3;

$O_{benchmark}$ — Benchmark oxygen content of dry flue gas, %;

$O_{measured}$ — Measured oxygen content of dry flue gas, %;

ρ_{actual} — Measured emission concentration of air pollutant, mg/m^3.

5.2 Pollution control requirements of volatile organic liquid storage tank

5.2.1 The following pollution control requirements of organic liquid storage tank shall be implemented by new facilities from July 1, 2015 and by existing facilities from July 1, 2017.

5.2.2 Volatile organic liquids of which the storage true vapor pressure is ≥76.6kPa shall adopt pressurized storage tank.

5.2.3 Volatile organic liquid tank with design volume ≥150m^3 of which the storage true vapor pressure is ≥5.2kPa, but <27.6kPa; and volatile organic liquid tank with design volume ≥75m^3 of which the storage true vapor pressure is ≥27.6kPa, but <76.6kPa shall meet one of the following requirements:

a) Adopt covered floating roof tank: Liquid-mounted seal, mechanical shoe seal, double seals and other efficient sealing ways shall be adopted between floating disc and tank wall of covered floating roof tank.

b) Adopt external floating roof tank: Double seal shall be adopted between floating disc and tank wall of external floating roof tank; and primary sealing shall adopt liquid-mounted seal, mechanical shoe seal and other efficient sealing ways.

c) Adopt fixed roof tank: Sealing exhaust system shall be installed onto organic waste gas recycling or processing device; the air pollutants shall conform to the provisions of Table 3 and Table 4.

5.2.4 Opening of floating disc of floating roof tank, crack sealing facilities and sealing facilities between floating disc and tank wall shall all be airtight in operating conditions. If it is detected that sealing facilities cannot be airtight and maintenance is technically unfeasible within 15 days without shutting down the process unit, then the maintenance may be delayed, but shall not be later than the most recent shutdown period.

5.2.5 Floating disc shall be inspected at least once every 6 months; the state of floating disc sealing facilities shall be recorded for each inspection; the record shall be kept for

more than one year.

5.3 Leakage pollution control requirements of equipment and pipeline components

5.3.1 Leakage pollution control requirements of following equipment and pipeline components shall be implemented by new facilities from July 1, 2015 and by existing facilities from July 1, 2017.

5.3.2 Volatile organic compounds shall receive leakage detection and control when flowing through following equipment and pipelines:

a) Pump;

b) Compressor;

c) Valve;

d) Opening valve or opening pipeline;

e) Flange and other connecting pieces;

f) Pressure relief device;

g) Sampling connection system;

h) Other sealing devices.

5.3.3 Leakage detection period

Adopt different leakage detection periods according to the types of equipment and pipeline components.

a) Pumps, compressors, valves, opening valves or opening pipelines, gas/vapor pressure relief devices and sampling connection systems shall be tested once every three months.

b) Flange and other connecting pieces and sealing devices shall be inspected once every 6 months.

c) Equipment and pipeline components that are going into initial operation and that are flown through by volatile organic compounds shall be detected for the first time within 30 days after going into operation.

d) Equipment and pipeline components that are flown through by volatile organic compounds shall be visually observed weekly to check whether liquid drops from the sealing.

5.3.4 Leakage identification

It is deemed as leakage when following cases occur:

a) For equipment and pipeline components that are flown through by organic gases and volatile organic liquids, adopt a flame ionization detector (methane or propane as calibration gas); leakage detection value is greater than or equal to 2000 μmol/mol.

b) For equipment and pipeline components that are flown through by other volatile organic compounds, adopt a flame ionization detector (methane or propane as calibration gas); leakage detection value is greater than or equal to 500 μmol/mol.

5.3.5 Leakage repair

a) When leakage is detected, repair shall be done as soon as possible, usually no later than 15 days after leakage is found.

b) First time (trial) maintenance shall be no later than 5 days after the leakage is detected. First time (trial) maintenance shall include (but are not limited to) relevant measures described below: tightening the sealing nut or gland, sealing and washing at design pressure and temperature.

c) If maintenance is technically infeasible within 15 days without shutting down the process unit when leakage is detected, then the maintenance may be delayed, but it shall not be later than the most recent downtime period.

5.3.6 Recordkeeping requirements

Leakage test shall record test time and test equipment readings; during repair, there is a need to record repair time and confirm repair completion time; record the reading of testing instrument after repair and the record shall be kept for more than 1 year.

5.4 Other pollution control requirements

5.4.1 Following pollution control requirements shall be implemented by new facilities from July 1, 2015 and by existing facilities from July 1, 2017.

5.4.2 Wastewater pretreatment

For alkaline wastewater, sour water, aromatic hydrocarbon wastewater, flue gas desulfurization and denitration wastewater, chemical cleaning wastewater during equipment and pipeline overhaul, and maintenance process, they shall be separately collected, stored and preprocessed.

5.4.3 Wastewater gathering, transportation, storage, and processing facilities

Wastewater facilities that are used for collection, transportation, storage and processing of wastewater that contains volatile organic compounds and odorous substances shall be

sealed; gases generated shall be switched in organic waste gas recycling or processing device; and air pollutants emission shall conform to the provisions of Table 3 and Table 4.

5.4.4 Volatile organic liquid's vehicle-loading, transportation and connection

The facilities that load oil to railway tanker at oil loading and unloading stage; load oil to vehicle-tanker at oil delivery console; load crude oil and refined oil product (gasoline, kerosene, jet fuel, chemical light oil, organic chemicals) shall be sealed for oil loading and shall have oil gas collection, recycling or treatment device; the air pollutant emission shall conform to the provisions of Table 3 and Table 4.

Trucks and ships shall adopt top immersion mode or bottom loading mode; for top immersed loading mode, the height from oil outlet to tank bottom shall be less than 200mm.

When bottom oil loading is completed and quick connector is disconnected, spill of oils shall not exceed 10mL and shall be the average value of 3 consecutive disconnection operations.

5.4.5 Acid gas recovery device

Process capability of acid gas recovery device shall ensure that - it is able to completely process the generated acid gas, when crude oil with maximum sulfur content is processed and the processing unit is under maximum load. Configuration of desulfurization solvent regeneration system, acid water treatment system, and sulfur recovery device shall ensure that it does not discharge acid gas to acid gas flare when one set of sulfur recovery devices breaks down.

5.4.6 Organic waste gas collection, transportation, and processing

The following organic waste gas shall be connected to organic waste gas recovery or processing device; its air pollutant emission shall conform to the provisions of Table 3 and Table 4.

a) Tail gas that contains volatile organic compounds and that is generated by air oxidation reactor;

b) Waste gas that is conveyed by organic solid materials;

c) Gas discharged by vacuum pump for keeping vacuum of vessel that contains volatile organic compounds;

d) During malfunction, waste gas that contains volatile organic compounds and that is discharged by production equipment through safety valve;

e) Waste gas, in production equipment and equipment startup and shutdown process, that does not meet requirements of this Standard.

7.2 Petroleum refining industrial enterprises shall comply with pollutant control requirements specified in this Standard in any circumstances, and take necessary measures to ensure the normal operation of pollution control facilities. Environmental protection departments at all levels may immediately take samples on spot or take monitoring results as the basis of judging whether sewage discharge behavior meets emission standard and implementation of relevant environmental protection measures.

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