Reduction and phase-out of PFOS in priority sectors in China

Terms of Reference (TOR) for CS-23

Evaluation of high temperature incineration for PFOS/PFOS containing waste destruction in China

**1. Background**

In May 2009, the fourth meeting of Conference of the Parties to *the* *Stockholm Convention on Persistent Organic Pollutants (POPs)* (hereinafter referred to as *the Convention*) has passed an Amendment, which added 9 new POPs, including perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride (PFOS/PFOSF), into the Convention. PFOS and PFOSF were listed in Annex B and the Convention detailed 12 "specific exemptions" and 8 "acceptable uses". On August 30, 2013, the NPC Standing Committee approved this amendment, which officially took effect in China on March 26, 2014.

It is once reported that China was the world's only country, which produces PFOSF (raw materials for the synthesis of PFOS). The annual PFOSF production in China was widely used in firefighting, electronics, metal plating, pesticides, oil drilling and other industries and fields. PFOS production and use involves a wide range of industries, diversified products, which puts the compliance of obligation of Convention in very difficult situation. On March 11, 2019, the Ministry of Ecological Environment and other eleven ministries jointly issued a bulletin (bulletin No. 10, 2019). Since March 26, 2019, PFOS could only be used in 7 acceptable purposes including firefighting and metal-plating in closed-loop.

To implement the amendment requirements, and to promote PFOS reduction and phase-out in China, Foreign Environmental Cooperation Center of Ministry of Environment and Ecology (FECO) cooperated with the World Bank (WB) developed the *Reduction and phase-out of PFOS in priority sectors in China* project (hereinafter referred to as *the PFOS Project*). The PFOS project is aimed to help China fulfill the Convention’s obligation of reduction and phase-out of PFOS.

In line with *the Convention*’s requirements on the management and disposal of inventory and wastes containing POPs, China needs to identify obsolete inventory and wastes containing PFOS/PFOSF and dispose them environmentally soundly. The typical PFOS/PFOSF containing wastes in China include: 1. production process left wastes: fluoride-containing waste liquid, sludge and residue generated during the preparation, production and synthesis of PFOS/PFOSF; 2. waste products: PFOS containing firefighting surfactants and foam extinguishers, chromium mist inhibitors, additives for oil drilling and pesticide/insecticides; 3. the sludge from sewage treatment plants in fluorine-containing chemical and electroplating industrial parks. Investigations unveil that chromium plating producers in particular keep a number of PFOS containing chromium mist inhibitors, which need to be treated environmentally soundly.

Both the Stockholm and Basel Conventions acknowledge that incineration at high temperature is the only demonstrated method to destroy/dispose PFOS. Most prefectures in China have built hazardous waste disposal facilities with high temperature incinerator , and some fluorine chemical enterprises are equipped with in-house incineration facilities for disposal. However, China has not yet followed the requirements of the *Convention* to evaluate incineration facilities and technology for PFOS containing wastes; there is no clear understanding of the decomposition rate of PFOS and the pollutant emission during the disposal process, as well as the pre-treatment and incineration process parameters required for the incineration at high temperature.

Therefore, it is scheduled to hire a competent candidate to verify and evaluate the incineration disposal technology of PFOS containing wastes, and clarify the technical requirements, treatment results and pollutant emission of incinerating PFOS containing wastes at high temperature incinerator .

**2. Objectives**

The objectives of this assignment include:

* Conduct the high-temperature incineration test campaign of typical PFOS containing wastes.
* Research the material balance during PFOS incineration and determine the decomposition rate of PFOS containing wastes.
* Clarify the technical requirements for high-temperature incineration of PFOS containing wastes in China.
* Evaluate the pollutant emission during high-temperature incineration of PFOS containing wastes.

**3. Task assignments**

To achieve the above objectives, the consulting firm is required to carry out the following tasks:

**3.1**  **Select typical PFOS containing wastes for environmentally sound disposal by way of high-temperature incineration**

3.1.1 Prepare and conduct implementation plan of high-temperature incineration of PFOS containing wastes

The consulting firm and FECO will jointly define typical types of PFOS containing wastes and disposal quantity. (FECO provides the PFOS containing wastes).

The consulting firm shall outline the disposal, sampling and testing plan of PFOS containing wastes (at least two kinds of typical PFOS containing wastes, including but not limited to: PFOS containing chromium mist inhibitors, firefighting foams with PFOS). The disposal plan shall clarify pretreatment requirements for PFOS containing wastes, dosing method, the scheme of disposal operating, dosing rate and key incineration parameters, including but not limited to: the operating temperature of the first and second combustion chamber of the incinerator. Based on evaluation and research, the consulting firm shall prepare the sampling and testing plan: a. Measure the PFOS content in the main input and output materials during incineration disposal for further calculation of PFOS material balance and the decomposition rate; 2. Record the operating parameters of the tests; 3. Test the concentration of conventional pollutants of flue gas (including HF concentration).

3.1.2 The consulting firm shall incinerate, sample and test the PFOS containing wastes as planned.

**3.2 Study the disposal performance of PFOS containing wastes incinerated at high temperature incinerator, pollutant emission and disposal technical requirements**

3.2.1 Disposal result and pollutant emission

The consulting firm shall calculate the decomposition rate of PFOS and its impact under different conditions; calculate the material distribution of PFOS based on the rate and concentration of input and output materials (flue gas, fly ash, slag and waste liquid) during disposal; and explore the material balance of PFOS.

The consulting firm shall study the emission impact of pollutants, especially the HF emission, under different conditions based on *Pollution control standard for hazardous wastes incineration.*

3.2.2 Technical requirements for high-temperature incineration

Referring to the results of this validation experiment and other disposal cases of PFOS containing wastes, the consulting firm shall put forward the pretreatment requirements based on the waste status (sludge, liquid or solid) and concentration of PFOS; shall propose the technical requirements for disposing PFOS containing wastes: dosing method, the scheme of disposal operating, dosing rate and the key incineration parameters, including but not limited to: the operating temperature of the first and second combustion chamber of the incinerator.

3.2.3 Operational cost analysis

The consulting firm shall analyze the operational costs of different types of hazardous wastes containing PFOS under different disposal conditions with this validation test, and put forward the best recommended disposal conditions of PFOS waste in different forms.

3.2.4 Disposal case report

The consulting firm shall take this validation test as a disposal case report, which elaborates details on collection, packaging, transportation, storage in factory, pretreatment, disposal, process monitoring, monitoring and evaluation, operation cost analysis and conclusion.

3.3 Propose technical requirements for high-temperature incineration of typical PFOS containing wastes specific to China

 The consulting firm shall propose the technical requirements for high-temperature incineration of typical PFOS containing wastes specific to China by considering the state of wastes containing PFOS/PFOSF. Typical PFOS containing wastes in China include: 1. production process left wastes: fluoride-containing waste liquid, sludge and residue generated during the preparation, production and synthesis of PFOS/PFOSF; 2. waste products: PFOS containing firefighting surfactants and foam extinguishers, chromium mist inhibitors, additives for oil drilling and pesticides/insectcides; 3. the sludge from sewage treatment plants in fluorine-containing chemical and electroplating industrial parks. Investigations unveil that chromium plating producers in particular keep a number of PFOS containing chromium mist inhibitors, which need to be treated environmentally soundly.

**3.4 Others**

(1) Participate in the workshops and trainings organized by FECO under this project.

(2) Attend the routine meetings organized by FECO under this project, and present the progress as required by the organizer.

**4. Outputs**

The outputs of this assignment including the following both in Chinese and in English:

1. Implementation plan of high-temperature incineration of PFOS containing wastes;
2. Implementation report on verification tests of high-temperature incineration of PFOS containing wastes (including test report);
3. Research report on verification tests of high-temperature incineration of PFOS containing wastes (disposal result, pollutant emission, disposal technical requirements and case report);
4. Technical requirements for high-temperature incineration of typical PFOS containing wastes in China.

**5. Schedule**

The duration of this assignment is January 2021 - December 2021.

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| No. | outputs | Estimated time of outputs |
| 1 | Implementation plan of high-temperature incineration of PFOS containing wastes | 2 months after contract signed |
| 2 | Implementation report on verification experiment of high-temperature incineration of PFOS containing wastes (including test report) | No more than 7 months after contract signed |
| 3 | Research report on verification tests of high-temperature incineration of PFOS containing wastes (disposal result, discharge, disposal technical requirements and case report) | No more than 10months after contract signed |
| 4 | Technical requirements for high-temperature incineration of typical PFOS containing wastes in China | No more than 12 months after contract signed |

**6. Qualification**

1. The candidate consulting firm/Academy/Institute should, as a minimum, have the following qualifications:
2. Permit for Operation of Hazardous Wastes and leading hazardous waste incineration facilities.（The incineration facilities must be listed in /corresponding to the Permit for Operation of Hazardous Wastes and it should be in normal operation. The hazardous waste incineration facility should be equipped with necessary pollution control facilities/measures and hold records of environmental monitoring in recent two years.）
3. At least 5 years’ experience in the hazardous waste management, disposal technology evaluation.
4. The one with experience in POPs or chemical incineration disposal is preferred
5. The team leader must meet the following qualifications
6. With professional title at least Senior engineer/ Associate professor/Associate researcher
7. More than 8 years working experienc hazardous waste management and disposal.
8. At least 3 projects relevant to the hazardous waste management, disposal technology evaluation are preferred.
9. Other Participants must meet the following qualifactions:
10. Intermediate professional title or with master degree.
11. More than 3 years working experience in hazardous waste management and disposal.

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| Personal | Number of people | Months per person | Total months per kind of expert |
| Team leader | 1 | 3 | 3 |
| Other Participants | 3 | 4 | 12 |
| Total months | 15 |