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ВОЗДЕЙСТВИЙ НА ОКРУЖАЮЩУЮ СРЕДУ

Brief Summary Report on
the Implementation of a Pilot Project

*Creating a System of Obsolete and Prohibited Pesticides
Destruction in the Russian Federation with the Use of Innovative
Technologies*

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1. Introduction

According to the results of persistent organic pollutants (POPs) inventory, considerable volumes of unfit for consumption or prohibited pesticides in the Russian Federation are stored in dilapidated and ill-suited for storage premises. In most cases the packaging is damaged and does not meet the requirements of the existing legislation. Preliminary findings of assessment of storage locations, composition and condition of obsolete and prohibited pesticides constitute no less than 40 thousand tons. They are factors of significant risk for the Arctic zone of the Russian Federation (AZRF). Resolving the issue obsolete and prohibited pesticides destruction in the AZRF and the Russian Federation in general is unfeasible without creating an obsolete and prohibited pesticides management system, including organizational and legal basis, a modern instrumental complex for destruction of various pesticides as well as an extensive regional network for collection, transportation, secure storage and destruction of pesticides.

The main goal of this project is to create institutional possibilities for the implementation of national plans and international projects to eliminate POPs in the Russian Federation and a methodology for gradual introduction (authorization) of an innovative POPs destruction technology.

In the framework of this project innovative technologies and technical solutions for pesticide destruction were selected that meet international requirements and are adapted to the Russian conditions.

Using stationary systems for pesticide destruction in the Russian Federation is complicated by geographical dispersion of obsolete and prohibited pesticides collection and storage locations, as well as by difficulty and high cost of transporting hazardous chemical wastes across the country. With regard to this, particular attention was paid to mobile modular installations.

This solution is innovative for Russia and does not have equivalents in Russian practice. Thus, it requires certain expenses for introduction to the Russian market.

As a result of research and analysis, high temperature adiabatic thermal treatment technology was chosen. It is carried out in a modular mobile installation developed by the University of Florence and marketed by an Italian company FEROTech. The selected technical solution is based on a standard installation of modular type for toxic wastes incineration additionally equipped with a special module for incineration of obsolete and prohibited solid pesticides (SCPWmk) and other halogen-containing toxic wastes. A special module can be added to the standard system, shall a necessity for liquid pesticide (LCPWmk) destruction arise.

A full set of documents has been completed that allows import, transportation and utilization of pesticide destruction technologies and equipment in the territory of the Russian Federation in accordance with the Russian legislation: Operating Procedure, Environmental Impact Assessment, Technical Specifications, Resolutions of Public Hearings, full scale test data, letter on submitting the documents for the state environmental assessment.

The outcome of the project is creating an institutional system of pesticides management and destruction as a mandatory requirement for transition to the practical stage of eliminating pesticides obsolete and prohibited in the Russian Federation.

2. Body

2.1. Selecting technologies and technical solutions suitable for pesticide destruction meeting international requirements and adapted to Russian conditions (on point 1.1. of the Terms of Reference).

This section gives an overview of different pesticide destruction methods, including *microbiological, burial* and *destruction through oxidation methods* (including under high temperatures).

The analysis of information on biological soil decontamination shows that currently there are no efficient *microbiological methods* to process large quantities of prohibited or obsolete plant protection chemicals. At the same time, low concentration of pesticides in the environment allows utilization of biological methods of their detoxification. Specialists recognize, in particular, usage of microorganisms for these purposes. This method is economically viable and time-efficient. Besides, it does not lead to environmental pollution resulting from toxic disintegration products.

According to the Russian legislation, solid toxic wastes are to be disposed through *burial method* for which solid and paste-like water-soluble pesticides have to be initially placed in special containers with metal and concrete walls.

Burying substandard pesticides in containers is very costly due to the necessity of using metal and concrete containers, their waterproofing and arranging underground bunkers. In addition to this, this method poses a great environmental threat due to the high probability of chemo- and bio-corrosion of container materials, which may lead to pesticides permeation into surface and ground waters.

It is well known that bio-corrosion annually causes 28% of total construction materials destruction in the world. Bio-corrosion processes are especially intensive if humidity and nutrients are present, which often are aplenty in the soil. Therefore, there are grounds to presume that in case of pesticides burial containers may get partially destroyed or start leaking over time which will entail pesticides' release into the environment.

Managed professionally and with the wall width being 0,2m, the process of toxic agents release and bio-corrosion of construction materials will stretch over years. However, the likelihood of environmental pollution by the buried pesticides is quite high.

The most widespread in the world are waste incineration systems and plasma destruction technology. Rotating furnaces are wide-spread solutions in Europe for waste incineration, including hazardous wastes. Over the recent years, the issues of cutting down operational costs and extending service period of lined coating have been resolved.

The described technical solutions of *high temperature oxidation* are mainly at the stage of research and laboratory development, and realized on the level of project documentation, and laboratory or experimental systems. These solutions have not been evaluated on an industrial scale (except for the systems using rocket engines and plasmochemical systems) and environmental impact assessment has not been carried out. The solutions suggested below can be considered as very promising, yet their refining and industrial introduction as well as refining their operation technology will require time.

Explosive combustion is a cheap and efficient method of waste management. Stored toxic waste has a danger of leaking into the environment. A great amount of oxidizers, used for explosives production earlier on, has been accumulated. The suggested solution allows dealing with the stock of toxic agents in the quickest and cheapest way without capital construction of detoxification plants. In addition to this, industrial application of this technology allows to produce a wide range of organic substances without causing environmental damage since syntheses toxic waste can be utilized. In the process of heat treatment in shock wave metal present in toxic waste turns into oxides and salts and therefore can be recycled and constitute secondary raw materials. Compositions of non-hazardous toxic wastes with hazard class higher than 4 can be used for producing blasting agents, provided blast integrity and environmental safety measures are adhered to in the blast location. Technology of explosive

combustion can also be applied for neutralizing toxic agents in warehouses and in polygons.

Incineration is the most common industrial/consumer waste destruction method.

The goal of waste incineration is reduction of its quantity and level of danger for the environment. Moreover, in the process of incineration potentially hazardous substances formed during incineration are captured or destroyed. Incineration facilities are designed for high temperature oxidation at 850-1400°C. Incineration processes can also provide for energy recovery and extraction of chemical substances fit for further use.

The most famous installations for industrial and domestic waste incineration in the world use the following types of furnaces:

- static furnaces,
- fluidized bed furnaces,
- rotating furnaces,
- chamber furnaces with waste injection (injection furnaces),
- cyclone furnaces.

Rotating furnaces are wide-spread in Europe for waste incineration, including hazardous waste. Over the past years the issues of cutting down operational costs and extending service period of coating have been resolved.

According to the information available to the Consultant, in the Russian Federation chamber furnaces are used for incineration of organochlorine waste in OJSC Kaustik (Sterlitamak), OJSC Sayanskkhimplast, and OJSC Usolyekhimprom.

Incineration and other physical and chemical methods of pesticide residues decomposition are justified when their content in waste is high. At present the main methods of disposal of the listed substances are based on high temperature (above 1200°C) treatment of destructed waste followed by shock cooling of combustion products and complex system of their filtration ensuring dioxins and

furans absorption. Plasmochemical method, filtration combustion, and flame treatment (thermal oxidation) can become the most promising treatment methods. Despite considerable differences, all the above mentioned methods share high temperature oxidation with a rather complex system of flue gas treatment. Therefore, ecotoxicant destruction installations are quite complex industrial facilities.

Below you can find a brief description of three advanced solutions that are currently being developed by Russian researchers. Their work is still at the stage of laboratory research, and industrial samples are not available yet. The description of these solutions is complemented by a brief description of systems tested at an industrial scale and findings of research on emission of dioxins and furans by these installations in the process of PCBs destruction.

Thermal treatment of specially prepared waste. Pesticides and other waste are mixed with alkali solution, added to clay. The mix is processed into granules, and kilned at a temperature of 1200-1250°C during 7-10 minutes. Partial hydrolysis takes place when alkali is mixed with waste. Thermal treatment causes further hydrolysis of organic compounds and their thermal decomposition. Generated acid gases are neutralized and stay in clay as salts. Hardening of the surface layers and adsorptive property of clay hinder removal of chemically non bonded decomposition products from the body of granules. A small amount of evolving fumes undergoes water scrubbing. Alkali solution used for gas purification is further redirected in full for forming the mixture.

Special researches aimed at detecting dioxins in gas emissions and dioxine granules after the kilning demonstrated their total absence while incineration of domestic (non-toxic) wastes in a multichamber kiln (currently, the most frequently employed method) results in dioxin emission of 11.6-780g/h.

Advantages of this method over its well-known equivalents are the following: absence of sewage waters, reduction of volume and toxicity level of gas emissions into the atmosphere, absolute absence of organic compounds, including

dioxins, in gas emissions and disposal material, toxicity of gas emissions is reduced by 3-5 times¹.

Combined destruction method with the use of plasma and plasmochemical reactor. Burning non-standard pesticides in special high temperature incinerators is an effective method of their disposal that allows avoiding dioxin and other pyrolysis products formation. However, such incinerators are limited in developed countries, and there are none in Russia yet. At the same time high temperature (plasma) treatment of non-standard pesticides represented by low-concentration mixes of highly toxic active ingredients with inert fillers like gypsum, silica white, kaolin, etc. has low efficiency. Therefore, it is suggested to divide the disposal process into two main stages: low temperature one (up to 1000°C) allowing to separate to the maximum toxic components and inert fillers, and high temperature one (plasma one – above 1400°C) leading to complete destruction of compounds into atoms.

Based on the research of primary pyrolysis of pesticides, a plasma pyrolysis method of disposal has been developed. Cost-effective and environmentally benign, it suggests disposal of non-standard pesticides through two-stage pyrolysis with different temperature settings. At the first stage decomposition of preparative forms of pesticides is effectuated at the temperature of 300-700°C. During the second stage implying the use of plasma jet only the gas phase of primary pyrolysis products is disposed at the temperature of $\geq 1500^\circ\text{C}$.

This method of pesticide disposal uses the following procedure: preparative forms of pesticides (dusts, wettable powders, granular compounds, etc.) are loaded into the primary pyrolysis kiln through a feeder, where the primary stage of pyrolysis is performed at the temperature of 300-700°C. During this stage desorption and transformation of organic substances into gas phase take place. As a result, pesticides are divided into combustible (organic and boiling at low temperatures) and noncombustible (mineral) ones comprising preparative forms of disposed pesticides.

¹ Materials of Ural exhibition “Innovations 2010”, 2010, Yekaterinburg.

Mineral detoxified components are taken out of the furnace. These components will be used later on as construction materials or disposed at dumps as 4-5 hazard class.

At the second stage gas flow coming out of the primary pyrolysis kiln and carrying active ingredients and other toxic products of primary pyrolysis is directed into the plasma jet reactor where at the temperature of $\geq 1500^{\circ}\text{C}$ molecules of gas phase toxic agents are decomposed to the atomic state. Pyrolysis in the plasma jet reactor at only the gas phase considerably simplifies and reduces the cost of disposal process. Gas offtake system forces plasma pyrolysis products (atoms and diatomic molecules) to pass through hardening system and separation of plasma pyrolysis products which prevents formation of complex molecules of secondary toxic substances (e.g. fosgene, dioxins, etc.) with further separation and collection of halogen, phosphorus, and sulphur compounds as well as other elements that are transformed into low toxicity ones and buried in the landfill as IV-V class waste or other products recycled as raw materials.

The Consultant is familiar with 9 plasma technologies of toxic waste destruction, including PCB and non-standard pesticides developed in the Russian Federation:

- technology of plasmochemical PCB destruction by *Applied Chemistry Russian Research Center*;
- system by *Technolog Research and Production Association JSC (Sterlitamak)* for plasmochemical treatment of liquid organic and organochlorine industrial waste (developed with the assistance of *M.V. Keldysh Reseach Center*);
- mobile experimental production system by *TechEcoPlasma*;
- plasma jet shaft system by *ITMO (Minsk, Belarus)*;
- plasma jet shaft system by *Radon Moscow Research and Production Association*;
- plasmochemical reactor with liquid metal electrodes by *International Research Center of Thermal Physics and Energy (Novosibirsk)*

- plasma-pyrolytic test system for disposal of prohibited pesticides by *Krasnodarsky State University*;
- plasma thermal converter by *Plateks JSC*;
- incineration chamber furnace by *NovosibirskNIIkhimmash OJSC* and *Institute of Theoretical and Applied Mechanics, Siberian Branch of the Russian Academy of Sciences*.

Russian plasma technologies for POPs destruction demonstrate a wide range of development, introducing experimental production facilities with different construction and organizational peculiarities. A number of these developments demonstrate versatility and can effectively process complex and mixed waste containing organic and mineral components.

The weakness of the majority of plasma technologies (including foreign ones) is limited life span of plasma jets working on inert as well as oxygen-containing gas. In the overwhelming majority of cases operational life does not exceed several hundred hours. Operating space includes zones with extremely high temperatures (from thousands to dozens of thousands degrees) which entails special requirements for the choice of construction and reactor walls materials that have to be heat resistant and chemically inert towards waste materials. Process control and automation systems play a crucial role in applying plasma technologies for hazardous wastes destruction.

In general the level of technical and technological completeness of Russian plasma technologies for providing environmental safety, stability, and reliability during the process of POP destruction is far from the required one which makes it difficult at this stage to recommend them for wide industrial use.

Destruction of liquid waste in cyclone furnaces. Flame treatment allows receiving practically non-toxic gaseous products of complete oxidation removed into the atmosphere and mineral part (ash) removed into landfills or for recycling.

In a number of cases, depending on the chemical composition of waste, flue gases may contain sulfur, phosphorus, nitrogen oxides, and hydrogen chloride. In these cases special separators and detoxifiers of toxic components should be used.

Depending on the physical state and qualities of waste the furnaces used for flame treatment are shaft, chamber, drum rotating, cyclone or other ones.

Liquid waste can be effectively burnt in cyclone furnaces which have an advantage of peculiar aerodynamics (vortex structure of gas flow) providing for high intensity and stability of incineration process with insignificant heat losses and minimal excess air. This allows creating small scale units with high heat load, exceeding that of chamber, shaft, and drum furnaces by dozen times.

Destruction through Supercritical Water Oxidation. The SCWO method consists in treatment of water mixtures containing hazardous and toxic substances with supercritical water at the temperature of 400-600°C and pressure of 200-300 atm. In this state supercritical water acts as a practically universal solvent and powerful oxidizer. This allows almost 99.99% of detrimental compounds in base mixture to turn into environmentally safe H₂O and CO₂. Nitrogen-containing organic compounds and ammonium-containing substances decompose and gaseous nitrogen is separated. Chlorine, fluorine, phosphorus, and sulphur form acid radicals and separate easily as mineral acids or salts when relevant cations are added to the solution. Majority of stable in these conditions inorganic compounds are poorly soluble in supercritical water and precipitate or effervesce at cooling or pressure release. The process of oxidation itself is carried out at very high speed.

According to the developers of the method, the currently estimated degree of completion of the installation is approximately 60%. Up to 70% of the necessary equipment can be produced by the companies located on the territory of the Russian Federation. Experimental sample has passed laboratory tests. Estimated cost and timeframe for developing project design documentation and creating mobile automated complex for pesticide destruction constitute in total from 50 to 60 mln roubles and with the 1.5-2 years term from the launch of funding.

The above mentioned solutions are very promising but their development to the level of technological industrial solutions will take both time and considerable mineral resources.

There is another technology developed in the Russian Federation – *technology of high temperature oxidation with the use of rocket engine*. This technology is more famous by the name “Papusha Rocket Technology” (PRT) that it owes to its developer, Doctor of Technical Sciences A.I. Papusha. This innovative technology of hazardous chemical waste disposal is patented in Russia (patent №2005519 as of February 1, 1994) and is being used successfully.

Polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) are by-products in a lot of chemical technologies. They belong to the list of POPs, and the risk of them spreading in the environment has been acknowledged as a world problem. One of the main sources of their release into the environment is *waste thermal treatment plants*.

The researches conducted demonstrated that various waste thermal treatment causes PCDD/Fs synthesis. Content of these substances in flue pyrolysis gases can be minimized by strictly following pyrolysis mode and maintaining the temperature at least at 1200 °C, as well as by conducting the process in specially constructed double chamber furnaces. In order to comply with European norms of PCDD/Fs content in emissions, flue gases have to undergo treatment with effective sorbent filters. Requirements to strictly follow pyrolysis and rocket engine operational conditions considerably restrict their application, and that includes requirements towards personnel qualification, general production culture and etc.

Based on technology and technical solution selection, the following *requirements* apply to high temperature waste destruction system, suitable for obsolete pesticides and pesticide waste destruction in the Russian Federation. The installation has to:

- implement the technical solution based on the usage of a rotating furnace and afterburner and include an efficient flue gas treatment system;
- be effectively operated in different weather and climate conditions by the personnel that does not have to fit high qualification requirements;
- follow technical solutions that have to ensure its functioning without formation of wastewaters that have to be released into the environment;

- satisfy EU requirements regarding possible release of dioxins and furans into the environment;
- correspond to modularity principles, e.g. ability of charging modules to be used for various waste destruction, or different numbers of gas cleaning modules to be connected depending on the waste composition and requirements towards the level of flue gas cleaning;
- correspond to mobility principles, and have the ability to be transported to location, assembled, started and operated within specific time, quickly dismantled and transported to a new location by road or rail;
- technological and technical solutions should preferably comply with the best available technologies (in accordance with the EU Directives).

While selecting a system that allows resolving the issue of destruction of toxic chemicals united under the name of pesticides, one should apply the principles of price-quality ratio. It is apparent that low volumes increase the possibility of applying biochemical methods and incineration is more suitable for higher volumes. At the same time, preference should be given to already existing systems (Italy, Germany) that have been in industrial use since producing systems in Russia at a price of 50-60 million roubles seems very attractive and needs to be realized but their production time can get extended, considering the current state of Russian industry, and therefore expenses may increase by 2 or more times. Consequently, it is inappropriate to compare the advantages of the developed systems. Apparently, it is necessary to choose existing ones the output of which satisfies the requirements of national and international standards.

Taking into account the current level of technological solution and laboratory report of pollutant emissions, carried out by CAC RMA «Taifun», preference is given to two-tank systems, which comprise an afterburner next to the main combustion chamber. This said, rotating furnaces are preferable for incinerating the aforementioned waste. They make it possible to maintain the required heat condition and time waste is kept in the chamber.

Equipment produced in Germany, for instance, designed to eliminate chemical weapons, is based on two-tank scheme, but it is turned out only in stationary designs, which are prone to accumulate waste water when in use. What's more, it is, reportedly, extremely costly – its price being by an order of magnitude as much as an estimated cost of a range of Russian units requiring some modification. A viable alternative to the German equipment is an Italian one, which we will be talking of below, that can be used for the destruction of pesticides and conforms to the afore-formulated criteria. Its cost is comparable to the estimated cost of a range of Russian units requiring some modification. A package-type mobile unit, designed by the University of Florence and introduced into the market by the Italian company, FEROTech, was selected as a technological equipment for thermal destruction of dated and banned pesticides and other toxic chemicals.

The selected technical solution is based on a package-type unit used for the incineration of toxic waste, fitted out with a special module for the incineration of solid and liquid pesticides and other halogen-containing waste (incl. PBCs). At the same time, should there ever be the need to destroy liquid chemicals, among them pesticides, basic unit can be enlarged with a special module.

An undeniable advantage of this system is a modular composition of the system of waste gas purification. The system of waste gas purification is one of the most essential elements of the waste destruction system. Ready-to-use modular systems, each of which provides the guaranteed degree of waste gas purification – first and foremost – from polychlorinated dibenzo-para-dioxides, make for the achievement of essential indices of the waste gas purification, when the gases are gradually introduced.

Thus, the existent basic unit can, depending on certain tasks/waste at a certain place, be fitted out with several diverse modules, which substantially boosts its efficacy and, in the long run, leads to the cutting of the aggregate expenditure.

Technologies and components, used in making this unit, are certified as to the conformance to the EU directives and Russian provisions and requirements, as

well as technical specifications, developed exclusively for this type of units in compliance with the requirements introduced by the RF certification bodies.

A competitive advantage is not only price that is comparable with the additional investments needed to adapt Russian installations but also a possibility to produce installations in Russia.

Clearly, installations will not be purchased at the expense of the state budget or of the budgets of constituent entities of the Russian Federation. Private investments will be needed that are easier to attract when operable industrial samples exist along with an opportunity to organize production and maintenance process in the Russian Federation.

The Summary Report presents a detailed description of the technology, installation configuration as well as its technical and productivity characteristics.

2.2. Development of an operating procedure in accordance with requirements of the best available technologies for pesticide destruction and regulatory requirements of the Russian Federation. Shaping “technology-equipment” complex of specific composition for submitting it to the regulatory authorities of the Russian Federation (on point 1.2. of the Terms of Reference)

Having analyzed a number of existing technologies and technical solutions, instrumental in the destruction of pesticides, we have singled out the high-temperature adiabatic heat-treatment technology that is carried out in a package-type mobile unit, designed by the University of Florence and marketed by an Italian company FEROTech. The adopted technical solution rests on a basic package-type unit used for the incineration of toxic waste, fitted out with a special module for the incineration of dated and banned solid pesticides (SCPWmk) and other halogenous toxic waste. For the destruction of liquid chemicals, including incineration of dated and banned liquid pesticides (LCPWmk), basic installation, underlying this solution, can be extended with a special module.

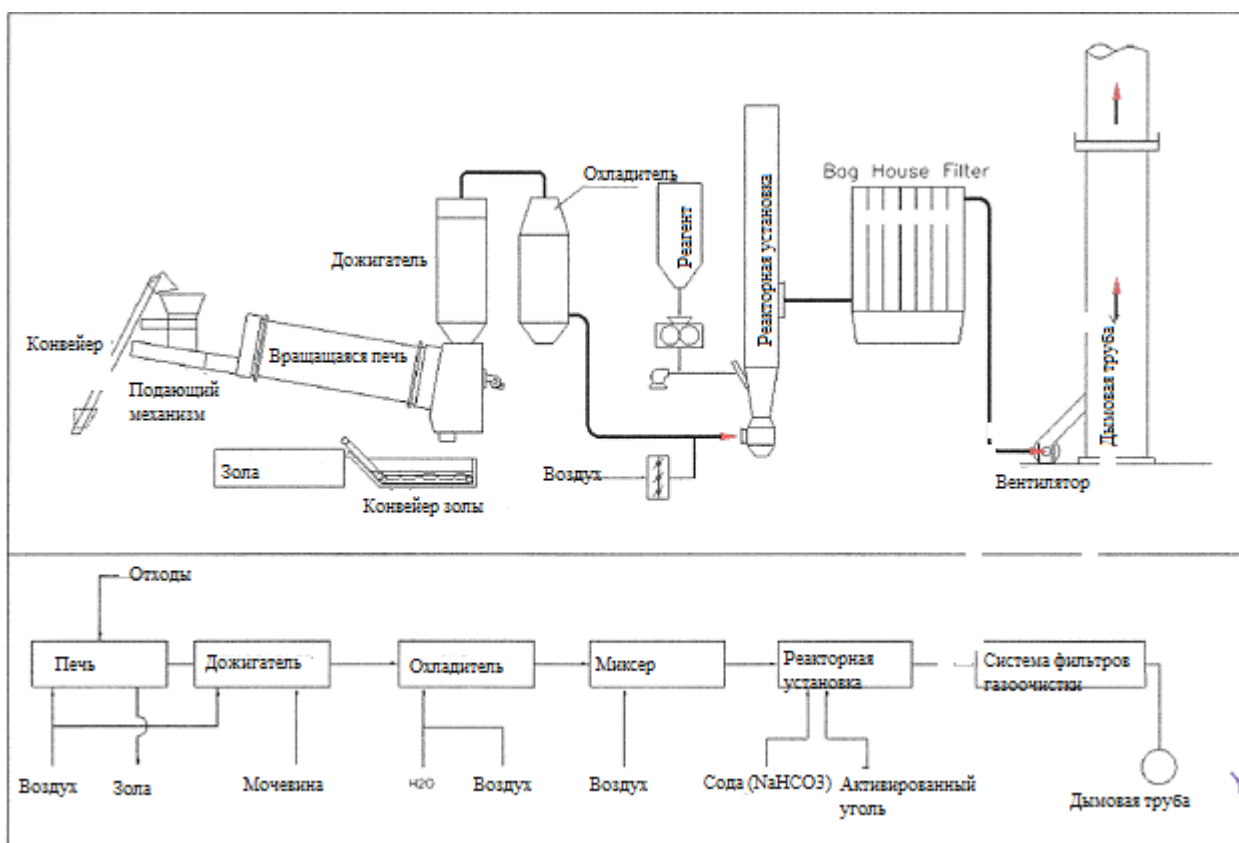
The goal of the work is to develop an industrial operating procedure for obsolete and prohibited liquid and solid pesticides incineration in mobile modular integrated equipment (LCPWmk and SCPWmk) with regard to the Russian legislative and normative as well as normative and legal requirements.

In the process of work conducted descriptions of the existing hazardous wastes mobile incineration installations were studied and the following was analyzed:

- separate constructive and technological components and parts of mobile modular integrated equipment (LCPWmk and SCPWmk);
- existing directive, normative and legal, normative and technical documents regulating constructive and technological specifications of equipment and technologies for hazardous wastes incineration, including obsolete and prohibited pesticides in liquid and solid phases.

Pic. 1 demonstrates a mobile hazardous wastes destruction installation by an Italian company FEROTech for the incineration of pesticides and other toxic

chemicals (unfit for utilization, expired etc.) accumulated in the Russian Federation.



Pic 1. The scheme of a mobile unit for the incineration of the expired and banned solid pesticides

The unit consists of a rotating furnace, a container for ashes, an afterburner, a cooler, a reactor, a system for the reagent introduction- sodium bicarbonate and absorbent coal, gas-purifying filters, an exhaust pipe and a control system.

According to the results of the assessment and public hearings conducted in Italy, technological process for hazardous wastes incineration, including obsolete and prohibited liquid and solid pesticides, in modular integrated equipment developed by the University of Florence and marketed by the Italian company FEROTech, has been recognized the Best Available Technology (BAT).

Operating procedure and equipment of the installation ensure compliance with the requirements of the Waste Incineration Directive – EU H-Waste Directive 2000/76/EC.

Here are several factors making the FEROTech installation attractive:

- The technical solutions proposed have already been realized, there are fixed as well as mobile solutions. It is possible to test operability of the solutions under actual industrial operation conditions.
- The technology/solution considered are among the best available technologies (BAT).
- An approbated technological solution is employed: a rotating furnace for afterburning. The necessary temperature mode and time of waste incineration are ensured in combustion chambers.
- Modular (scalable) flue gases purification system allows to achieve emission levels required in the EU and in the RF by introduction of supplementary modules.
- There is no sewage waters discharge.
- Thermo insulation materials are used in the rotating furnace, which ensure equipment replacement interval of at least a year.
- Special replaceable load modules allow loading various types of wastes, solid as well as liquid.
- There is no need to employ high-qualified staff to maintain the installation during its operation.
- It is possible to produce a significant part of the equipment at Russian plants; during the first stage at least of "metal-intensive" equipment. This impacts cost of installations and allows creating new workplaces.
- The major advantage is mobility of the installation. Transportation can be done in 3-5 (depending on configuration) containers. Mounting and launching can be done within one working week. Demounting can be completed within several days with a possibility of immediate transportation of equipment to a new location. Such a solution allowing a possibility of transporting equipment by sea is particularly important for destruction of pesticides accumulated in Norilsk Region.

Obsolete and prohibited pesticides incineration operating process (procedure) was analyzed as part of this work for two configurations: SCPWmk for solid

wastes incineration and LCPWmk for liquid pesticides incineration. Study was conducted in order to develop an industrial technological procedure on obsolete and prohibited liquid and solid pesticides incineration with account of the Russian legislative, normative as well normative and legal requirements. Russian legislative, normative as well as normative and legal requirements were determined, analyzed and assessed:

- environmentally safe flue gas discharge;
- environmentally safe disposal (by burying) of pesticides incineration waste;
- safe operating procedure implementation;
- organizing safe workplaces;
- organizing monitoring and control;
- environmental protection;
- process of obsolete and prohibited pesticides incineration;
- environmentally safe disposal and storage of pesticides at industrial facilities, a warehouse;
- storage of waste (dust, reactor waste) resulting from pesticides incineration;
- sustainable natural resources usage – water.

According to the results of the assessment and public hearings, which were conducted on the request of ISCEIA, technology of pesticide wastes incineration in equipment for incinerating under high temperatures has been recognized the Best Available Technology (BAT) in Italy.

The researches were conducted in Italy and in Russia according to requirements of EU Directive on a waste 2000/76/EU.

Strictly controlled thermal treatment (at 1000-1400° C with specific heating value from 3500 kcal/kg to 15000 kJ/kg) will continue playing an important role for safe and efficient treatment of organic toxic wastes, which industry has produced and continues to produce.

Environmental pollution control in the part of metrological support is conducted in accordance with state standard (GOST) 8.589-2001.

The object of study is technological process of obsolete and prohibited liquid and solid pesticides incineration in mobile modular integrated equipment (LCPWmk and SCPWmk) from viewpoint of compliance with the requirements of the Russian nature protection legislation

Requirements to environmentally safe placement of obsolete and prohibited pesticides at industrial sites, in a warehouse

- Working with pesticides (including poisonous chemicals) is allowed only with means of individual protection specified in normative or technical documentation on specific substances.
- Pesticides (poisonous chemicals) of first hazard class unfit for further utilization in accordance with their purpose are subject to storage in packaging ensuring impermeability and excluding the possibility of environmental pollution by pesticides (poisonous chemicals) resulting from storage and further transportation to disposal sites (elimination, destruction) [SP 3183-8429].
- Substances of second hazard class can be packed in multilayer packaging consisting of polymer materials with special lining (depending on the specifics of pesticide (poisonous chemicals)).
- All works related to loading, transporting and off-loading of obsolete and prohibited pesticides (poisonous chemicals) have to be done with the use of equipment.
- When transporting obsolete and prohibited pesticides (poisonous chemicals) and packaging is not allowed in presence of individuals with the exception of driver and accompanying staff.
- Manual (by hands) loading, packaging, splitting, weighing and filling containers with pesticides (poisonous chemicals) is not allowed.

- Leaving obsolete and prohibited pesticides (poisonous chemicals) spread or spilled in containers is not allowed.
- Cleaning in polluted containers is to be done in accordance with the requirements to decontamination (elimination, destruction) listed on the container label (utilization instructions).
- Unwrapping pesticides (poisonous chemicals) is not allowed:
 1. when pollution level of the working area exceeds value limits established by the current hygienic standards (air EVL in the working area in accordance with the HS 2.2.5.1313-03);
 2. without control of hazardous substances concentration in the working area.
- Continuous control is to be ensured in the warehouse area as well as in the area of sanitary protection with utilization of analytical and instrumental control methods in order to prevent negative impact of pesticide wastes on the living conditions for the population.
- Installation is equipped by built-in exhaust units to capture hazardous substances.

Requirements to storage of obsolete and prohibited pesticides prior to destruction

- Storage of obsolete and prohibited pesticides (poisonous chemicals) is to be conducted in accordance with the recommendations on utilization as well as in accordance with the existing environmental security requirements, sanitary and epidemiologic norms and standards (SanPiN 1.2.1077-01).
- Storage of obsolete and prohibited pesticides is conducted in special storages, specially designed rooms compliant with the environmental safety requirements, construction, sanitary and epidemiologic norms and standards. Harm to human health and environment resulted from pesticides storage has to be excluded.

- EVLs of chemical substances in the air of the working area, atmospheric air and waters of open water bodies as well as ground waters are to serve as hygienic safety criteria for the functioning of operated or closed warehouse areas. EVLs of physical factors (with account of SanPiN 1.2.1077-01, SanPiN 12.1.6.1032-01, SanPiN 1.2.1330-03, SP 1.2.1170-02, SP 2.2.2.1327-03, GN 2.2.5.1313-03, GN 2.1.5.1338-03) are also considered hygienic safety criteria.
- When storing obsolete and prohibited pesticides (poisonous chemicals) compliance needs to be ensured with the requirements specified in packaging labels, recommendations on utilization of particular pesticides (poisonous chemicals), classification codes, including creation of conditions for separate storage of substances incompatible due to physical and chemical characteristics (fugitiveness, oxidation and other characteristics), flammability and explosiveness, ability to participate in chemical reactions and temperature modes for storage.
- When neutralizing pesticides (poisonous chemicals) in case of spills, warehouses are provided with sufficient amounts of deactivating substances specified in container labels of the obsolete and prohibited pesticides (poisonous chemicals) stored.
- Pesticides (poisonous chemicals) of the 1 (first) hazard class unfit for further utilization in accordance with the purpose are subject to storage in containers ensuring impermeability and excluding the possibility of environmental pollution by pesticides (poisonous chemicals) when storing and transporting to decontamination facilities (elimination, destruction).
- Substances of II (second) hazard class can be packed in multilayer containers made of polymer materials with special lining (depending on pesticide (poisonous chemical) specifics).
- Obsolete and prohibited pesticides (poisonous chemicals) with disintegrated packaging designed for incineration are subject to

- If required conditions for storage of obsolete and prohibited pesticides (poisonous chemicals) subject to decontamination (elimination, destruction) are not observed by economic operators possessing license for this type of activity, the economic operators ensure centralized collection of the mentioned substances and their transportation to warehouses where required storage conditions are observed. Third party access to the mentioned warehouses should be excluded.
- When decontaminating (eliminating, destructing) pesticide wastes (poisonous substances) in the area where they are stored, substances owners delegate responsible persons. Wastes incineration is done in the presence of the delegated persons.
- At the same time a document is elaborated, which specifies the name of the organization, name of the decontaminated pesticide (poisonous chemical), its volume, location and decontamination method (destruction, elimination), name of the delegated individual responsible for the works.

Monitoring and data registration

- Continuous monitoring and registration should at least monitor the incineration temperature, intensity of waste loading to the furnace, speed of flue gases discharge, carbon monoxide concentration in the lowest point of incineration area and in the point of gases discharge into the atmosphere.
- Monitoring, storage and submission of control data are usually included into the installation data control, management and collection system.
- Continuous observation and recording are necessary. This concerns at least the incineration temperature, speed of wastes loading and the

- System of full automatic control reduces the need in maintenance staff and ensures 100% control of the thermal treatment process that complies with any waste discharge assessment requirement.
- Gases discharged by the secondary chamber are cooled and purified in APCS. APCS eliminates particles (small solid parts) and remaining toxic components, for instance, metals that were not destroyed as a result of thermal treatment, to levels considered safe in the EU in accordance with the standards for the installation.
- Operation within the range of major incineration parameters is ensured by a system of monitors and computerized control.

Requirements to environmental protection during wastes incineration

- Technological process and equipment for obsolete and prohibited pesticides destruction ensures full compliance with the EU Directives.
- Decontamination process (destruction, elimination) of pesticides (poisonous chemicals) and containers they were stored in, products of pesticides (poisonous chemicals) degradation should not cause negative environmental impact.
- Technological processes of solid and liquid pesticides incineration:
 - conducted in accordance with BAT requirements (see Annex A);
 - conducted in accordance with the Russian legislation, including the national standards, construction standards and regulations as well as other normative documents (Part 18);
 - allowed if permitting conclusions of state environmental, sanitary and hygienic as well as other assessments are available, in cases when such assessment is seen as mandatory in the legislation of the Russian Federation;

- Paper or wooden containers from obsolete and prohibited pesticides are destroyed by incineration in locations specified in accordance with the legislation by state agencies for environmental control and sanitary and epidemiological welfare of the population.
- If an agreement with the obsolete and prohibited pesticides supplier is available, metallic and other special packaging from polymer materials can be returned to the supplier non-decontaminated but clean from the outside and tightly closed. If done otherwise, prior to destruction or elimination of such packaging it is subject to decontamination in accordance with the requirements listed in the recommendations for decontamination (destruction, elimination) of specific pesticides (poisonous chemicals).
- Incineration of obsolete and prohibited pesticides is done in accordance with requirements of the existing normative documents on high-temperature installations ensuring disintegration of compounds to non-toxic (non-dangerous) substances. Enterprise performing obsolete or prohibited pesticides incineration ensures regular control and monitoring of gas pollutants and dust discharges.
- Projects of mounting, reconstruction, remodeling, technical re-equipment, extending functions, conservation and elimination of modular installations for obsolete and prohibited pesticide wastes incineration should contain normative and technical as well as technological documentation on training, utilization, decontamination, elimination of sewage waste created, wastes, including ash residues, sulphur dioxide discharges into the atmosphere, nitrogen oxides and dust.
- Economic operators utilizing installations designed for wastes incineration have to ensure regular control and monitoring of environmental condition in the area where the installation is utilized and in the area of potential negative environmental impact of the installation in

Requirements to environmentally safe dumping of pesticide wastes (ashes, dust, residual matter from reactor).

- Rotating furnace discharges non-organic ashes and dust into a container.
- A total amount of ashes from the furnace and dust from the unit's modules is weighed on the electronic common balance VT-60 GOST 29329-92 (weighing capacity range 20 kg).
- Ashes, dust and other suspended matter are removed from the gas cleaning system (under an afterburner) by submerging with the application of a sleeve filter and cooler.
- This non-organic residue may be further used - if mixed with inhibitors - for the chemical bonding of components.

As a result stabilized and certified organic residual waste from the incineration of obsolete and prohibited pesticides may be declared fit for hazardous waste polygons.

- This said, during the 2004 Parliament hearings it was proposed to the Federal Assembly of the Russian Federation and the Government of the Russian Federation to incorporate into the draft of law project work, the development of the draft of the federal law *On Introducing Amendments and Additions to the Federal law On Secure Pesticides and Agrochemicals Management* in the following parts:
 - prohibiting the recycling of obsolete pesticides and agrochemicals through dumping. However, despite this provision has not yet been integrated into the Federal law, international experience has proved the importance of the technological procedures of destruction rather than dumping of the pesticide

wastes as regards efficient environmental protection from their harmful impact.

In the project of operating procedure the major construction indicators are determined as well as technical and operational indicators: ensuring functioning of mobile modular integrated equipment (LCPWmk and SCPWmk) with the condition of ensuring operators' security and security of running technological modes protecting environment from negative impacts resulting from flue gases, sewage waters, ash wastes and reactor wastes.

Degree of introduction. Draft operating procedure can be fine-tuned, approved and submitted to the permitting authorities of the Russian Federation after coordinating the draft with the producer of the mobile modular integrated equipment (LCPWmk and SCPWmk).

Efficiency of the operating procedure is determined by excluding negative environmental impacts and negative impacts on the operators of technological modes of obsolete and prohibited liquid and solid pesticides incineration in the mobile modular integrated equipment (LCPWmk and SCPWmk).

As a result of the study the following has been elaborated: contents and structure of a draft operating procedure for "technology-equipment" complex with regard to mobile modular integrated equipment (LCPWmk and SCPWmk) in accordance with BAT requirements corresponding obsolete and prohibited pesticides incineration in accordance with the normative requirements of the Russian Federation.

The project of operating procedure is given in the main report – section 2.2.(ToR 1.2)

2.3. Environmental Impact Assessment (EIA) in accordance with the procedures established by the legislation of the Russian Federation (on point 1.3. of the Terms of Reference)

The goal of this work was to assess environmental impacts (EIA) of pesticides destruction technology and equipment developed by FEROTech Company in order to minimize negative environmental impacts of the technology in case they are used to incinerate pesticides accumulated in the Russian Federation.

The selected equipment that is part of a mobile modular installation for hazardous wastes incineration, including solid and liquid pesticides, is certified as compliant with the best available technologies (BAT) for hazardous wastes incineration. This equipment is relatively inexpensive. The installation is equipped with modern devices to control discharges and emissions into environment and can be quickly produced, within a period of up to 10 months. FEROTech equipment is successfully utilized in different countries, for instance, in Italy and in the USA.

The mobile modular installation for pesticides incineration has a capacity of up to 100-200 kg/hr.

EIA of the selected technology and equipment for pesticides destruction was conducted in accordance with the requirements of the Federal law of the Russian Federation *On Environmental Protection and Provision on Assessing Environmental Impact of Economic and Other Activity in the Russian Federation*.

Impact assessment on specific environmental components was conducted by a calculation method in accordance with the methodologies adopted in the Russian Federation or by using materials on analogue installations.

A detailed EIA report includes the following components:

- brief description of technological processes.
- normative and legal basis for utilizing the proposed installation.

- overview of sources (substantiation of the need to use incineration, analysis of information on installations, substantiation of security and efficiency of operating the installation based on analysis on physical and chemical processes).

- types and sources of impact.

- impact on specific environmental components when the installation is operated (atmospheric air; water consumption and water disposal; waste management; noise level; physical radiation; impact on soil, vegetation and fauna).

- assessment of commissioning works impact.

- emergency situations.

- measures to protect environment.

- proposals for studies during installation approbation.

- proposals to conduct industrial environmental control and monitoring when operating the installation.

Conclusions of the University of Florence are included into Annexes. They cover choice of technology, reference on conditions for dispersal and background atmospheric air pollution, graphs with isolines for polluting substances and results of dispersal, protocol of waste hazard class assessment and measurement of noise level for analogue installations.

As a part of EIA, the existing normative and legal basis was analyzed that concerns thermal pesticides destruction. Technical decisions taken when creating the technology and configuration of the modular installation for destruction of obsolete and prohibited pesticides comply with requirements of environmental, sanitary and hygienic, explosion, fire and other standards existing in the Russian Federation. They ensure operating the installation without posing threat to human life and health if operational standards foreseen by specification documents are observed.

The need to incinerate obsolete and prohibited pesticides to ensure destruction has been substantiated. Conducted analysis of information on installations that can be used to incinerate pesticides demonstrated that the FEROftech installation proposed for operation is the best available technology

(BAT). Security and efficiency of operating installation was also substantiated based on the analysis of physical and chemical processes.

The list of the contaminants discharging into the atmosphere during functioning of the equipment «FEROtech» is determined according to equipment operating technology and equipment test reports.

The quantity of the contaminants which are discharging into the atmosphere during functioning of the equipment of modular type «FEROtech» for toxic waste incineration, solid and liquid pesticides, is calculated, proceeding from technology of this equipment.

During 1 year the equipment functioning 21,833 tons of contaminants discharge into the atmosphere, including: nitrogen dioxide - 12,187t; nitric oxide - 1,966 t; soot - 0,635 t; sulfurs dioxide - 3,175 t; carbonic oxide - 3,175 t; hydrochloric acid - 0,635 t; fluorides gaseous - 0,060 t.

Calculation of dispersion of contaminants in a ground layer of atmosphere during equipment functioning was made by the personal computer and the software "Ecologist" developed according to OND-86 (the certificate of Gosstandart of Russia № POCC. RU. 0001. 11. СПО2. СИ0001) and conformed to MGO Voyehova.

Calculations of dispersion of contaminants were conducted for the warm and cold periods of year, for the cores and dispersion emergencies. The area of Noginsk town on which installation approbation might be conducted was chosen as an operational site for calculations. The characteristic of dispersion conditions and background concentration of contaminants are accepted in calculations for this town.

Calculation was made for two variants:

- ***The Main variant.*** Calculation of contaminants concentration was made for a section around the functioning installation of modular type «FEROtech. For calculation the rectangle in the size 1000×1000 m (Hmax = 20 m.) with

- ***The Emergency variant.*** Calculation of concentration of contaminants was made for a terrestrial section around the functioning installation of modular type «FEROtech» and the emergency diesel engine-generator. The given variant of conditions is possible only if electricity switches off when launching of the emergency diesel engine-generator provides the loop termination of operating installation. the rectangle in the size 1400□1400 m (Hmax = 20 m.) with step of a rated grid of 100 m. is set for calculation

The analysis of the conducted calculation of contaminants dispersion has shown the following (data of the basic variant for the warm period of year) :

- concentration of 5 contaminants in a ground layer of atmosphere (nitric oxide, soot, sulfur dioxide, a hydrochloric acid, fluorides gaseous) on border 100 meter zone don't exceed 0,05 maximum concentration limits;
- concentration of a nitrogen dioxide on border 100 meter zone don't exceed 0,45 maximum concentration limits, and around 500 m from a source of emission concentration decreases to 0,38 maximum concentration limits
- Concentration of oxide carbon makes 0,40 maximum concentration limits in all rated points of a working platform, it directly connected with its rough value of background concentration (2 mg/m³) which remains invariable in all rated points of a working platform;
- Concentration of two groups summation (nitrogen dioxide and sulfur dioxide, sulfur dioxide and fluoric hydrogen), also installed as a result of calculation of dispersion of contaminants, on boundary 100 meter zone make 0,51 and 0,03 maximum concentration limits accordingly, and around 500 m from a source concentration discharge decrease to 0,42 and 0,01 maximum concentration limits accordingly.

Calculations show, that even at in the worst conditions of setting functioning, the concentrations of contaminations in atmosphere don't exceed 1 maximum concentration limit near a place of exhaust gases discharge. According to the conducted calculations there is no need to organize sanitary and protection area (SPA) around the operated installation and that is a significant advantage . According to standard requirements, SPA for such installations has to be 500 m. Such distance also ensures efficient reduction of noise level to bring it to the standard level. Question on the need of and size of the SPA has to be clarified after the installation is approbated.

The payment for atmosphere pollution should constitute 3485 rubles for the annual period of work.

The report also includes a section on waste management. This section contains a calculation of waste produced by the installation (ash), reactor, auxiliary facilities (diesel generators and lighting devices) and operating personnel.

Calculation on formation of particular kinds of waste during functioning of the installation «FEROtech» was conducted taking into account a work experience of installations-analogs using some the confirmed techniques:

- Collection of techniques by calculation of amounts of waste formation (S.-Peterburg, 2001)
- Methodical development «the Assessment of quantities of formed industrial wastes and consumption» (S.-Peterburg, 1997).
- The Directory. Water removal treatment facilities. Kiev: Budivelnyk, 1988.

Calculations have shown that as a result of annual work of installation it has been formed 85 - 87 tons of a waste, including 1st class of danger – 0,00196 t; 2nd class of danger – 0,0007 t; 3rd class of danger – 0,139 t; 4th class of danger – 82,05 t; 5th class of danger – 3,68 t. The basic part of a waste is made by ashes, under the available data it corresponds to the 4th class of danger.

The payment for disposal of the waste formed on the object, taking into account price indexation coefficients for 1 year of the period of work will constitute – 57754 rbl.

There is another section on installation water consumption and water disposal system (for human waste). During equipment functioning water consumption for industrial and household needs makes 14,25 m³/days (4987,8 t/year), water removal – 0,427 m³/days (149,45 t/year). It has been established that there is no discharge of contaminated waste waters caused by the work of the installation.

Equipment noise emission and radiation levels have been studied separately. According to the conducted calculations, on border standard C33 (500) during the installation functioning in emergency conditions the equivalent level of a sound doesn't exceed 10 dBA, the maximum level of a sound doesn't exceed 26,6 dBA. According to the data available on analogue installations, the considered installation meets sanitary standards and requirements.

Mechanical damage to land and vegetation covers may occur within 10m radius of the operated installation but the damage is not more significant than that from operating any other temporary installation.

EIA volume includes a set of measures aimed at ensuring the installation operation with minimum impact. Recommended protection measures supplement the set of environmental measures.

Proposals were made to conduct additional field studies after launching the installation in the Russian Federation.

It is expected that an environmental monitoring programme at the implementation phase will be developed based on the field study results.

All in all, beneficial environmental effect of the installation is by far more significant since it prevents release into the environment of pesticides that are otherwise harmful for plants, animals, and humans.

Based on the conducted EIA, a conclusion can be made that the technology and equipment of FEROTech installation for pesticides incineration meet the requirements of the Russian environmental legislation, and the installation can be recommended for approbation in a pilot area.

The EIA volume along with the other elaborated documents on the installation (operating procedure, technical specifications, etc.) can be used for conducting state environmental assessment, installation approbation, and environmental monitoring during installation's operation.

2.4. Organizing and implementing chemical and analytical support for the functioning of systems and equipment to destroy hazardous wastes in different modes of technological cycle.

Submitting field measurements by the accredited laboratory to the authorized agency of the Russian Federation for approval (on point 1.4. of the Terms of Reference).

Questions that arose during the EIA volume, operating procedure, and technical specifications development have been analyzed. Necessary adjustments have been made and a corresponding list has been compiled. The issues of organizing and implementing chemical and analytical support for the functioning of systems and equipment to destroy hazardous wastes in different modes of technological cycle and field measurements by the accredited laboratory have been defined.

Two meetings to discuss adjustments and conducting field measurements have been held with representatives of the developer and producer – the University of Florence and FEROTech.

A list of materials and questions for the developer and producer of mobile modular SCPWmk and LCPWmk technological equipment for obsolete and prohibited pesticide wastes incineration has been compiled. In November-December 2010, upon the request of the International EIA Center, an accredited specialized laboratory ECOL (Italy) conducted tests to assess emissions into the atmosphere (there is no discharge into the water) at different stages of the technological cycle of CIS/FEROTech installation operation. Records of tests conducted in compliance with EU Directives and based on methodology unified with the Russian Federation requirements did not reveal exceeding of the standard values.

Chemical-analytical support has been conducted by the independent laboratory accredited in EU under the program prepared by ISCEIA, and under the control of the representative of ISCEIA, with participation of the head of Chemical-analytical center SPA "Typhoon" (reports are given in the appendix to section 2.4 of the main report).

2.5. Conducting sanitary and epidemiological assessment of the technological process of pesticide destruction based on EIA and chemical and analytical support data (on point 1.5. of the Terms of Reference).

The following materials have been submitted for assessment:

1. Technical Specifications TS 2440-001-2010 “Installation for Pesticide Management (Incineration)”;
2. Operating procedure for modular installation for high temperature adiabatic pesticides incineration produced by FEROTech s.r.l.;
3. Environmental Impact Assessment (EIA) in compliance with procedures established by the Russian legislation;
4. Protocol on selecting ashes and slag samples produced as a result of pesticides incineration with modular installation for high temperature adiabatic pesticides incineration produced by FEROTech s.r.l., as of November 13, 2010;
5. Protocol on measuring emissions into the atmosphere by modular installation for pesticides high temperature adiabatic incineration produced by FEROTech s.r.l., produced as a result of pesticides incineration, as of November 2, 2010;
6. Protocol on tests aimed at defining polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans during the operation of modular installation for high temperature adiabatic pesticides incineration produced by FEROTech s.r.l., as of November 18, 2010;
7. Results of informing the public in accordance with the regulations of the legislation of the Russian Federation.

Analysis of submitted materials and results of integrated sanitary, toxicological and other researches on pesticides incineration security and efficiency conducted in the mode of technological operation of modular installation for high temperature adiabatic pesticides incineration produced by FEROTech s.r.l. (TS 2440-001-2010

“Installation for Pesticide Management (Incineration)”) has demonstrated that the installation can be used for pesticides incineration without posing danger for health.

Results of high temperature pesticides incineration with the use of modular installation for high temperature adiabatic pesticides incineration produced by FEROTech have demonstrated that in the process of operation complete thermal destruction of initial pesticides takes place, which is indicated by complete absence of pesticides in ashes and slug, as well as emissions into the atmosphere. Emission of pollutants into the atmosphere complies with the norms existing in the Russian Federation.

Ashes and slug waste produced in the process of pesticides incineration should be classified as 3 hazard class (moderately hazardous) according to Sanitary Rules 2.1.7.1386-03 “Defining Classes of Production and Consumption Toxic Wastes”, in the meantime according to the Order №511 of Ministry of Natural Resources ashes and slug can be classified as 4 hazard class (low hazardous).

Sanitary and epidemiological assessment of the technological process of pesticide destruction based on EIA and chemical and analytical support data has shown that modular installation for high temperature adiabatic pesticides incineration produced by FEROTech is efficient for pesticides incineration, does not pose threat to human health and environment and can be recommended for pesticides incineration with further monitoring and analysis of its operation.

2.6. Informing the public in accordance with the regulations of the legislation of the Russian Federation (on point 2.1. of the Terms of Reference)

As a result of public hearings held in Moscow region Staraya Kupavna town (DK Akrikhin) on 1 October 2010, International Environmental Impact Assessment Center provided the necessary information on the project to stakeholders; answered their questions in accordance with the procedure established by the existing normative basis; exercised rights and considered legal interests of citizens in relation to taking decision on implementation of planned economic activity.

In accordance with the Russian legislation, public received trustworthy information on environmental and social aspects of the planned activity; took part in discussions of the Project; contributed by substantiated proposals on the planned activity.

Activities to prepare, organize and hold public hearings were conducted in Staraya Kupavna town, a municipal entity, (Order to Conduct Public Hearings from 16.08.2010 No 211/1, Minutes of the Public Hearings that were held on 01.10.2010 in Staraya Kupavna town, Order to Adopt the Results of the Public Hearings from 04.10.2010 No. 249 and Conclusions No 18 from 04.10.2010).

Information about the Project was published in newspapers "Business Environment of Moscow Region" No. 24 from 25.08.2010 and No. 26 from 06.10.2010.

2.7. Submitting the materials for the State Environmental Assessment (on point 2.2. of the Terms of Reference)

In accordance with the requirements of the Federal law of 1995 *On Environmental Assessment* and provisions of Administrative Regulations to organize and conduct state environmental assessment approved by Order of the Ministry of Natural Resources No. 283 from 22.02.2007, International Environmental Impact Assessment Center prepared and submitted to the Federal Service for Natural Resources Management Control a set of documents for conducting the procedure of state environmental assessment. (The Appendix to section 2.7 of basic report)

On the remarks received from the State ecological examinations modified materials are additionally presented by the letter of ISCEIA February, 20th. (The Appendix to section 2.7 of basic report)

2.8. Development of technical specifications (TS)/standard (GOST) for pesticide destruction technologies in compliance with the Federal Classificatory Catalogue of Wastes. The project of Technical Specifications on the mobile modular complex equipment for implementation of technological procedures of incineration of the obsolete and prohibited pesticides (on point 2.3. of the Terms of Reference)

In accordance with the contractual arrangements, technical specifications (TS)/standard (GOST) were elaborated for pesticides destruction technologies in compliance with the Federal Classificatory Catalogue of Wastes. In accordance with the elaborated technical specifications:

The object of study is modular mobile integrated equipment to implement technological processes of obsolete and prohibited liquid (LCPWmk) and solid (SCPWmk) pesticides incineration.

The goal of the work is to develop a project of technical conditions for mobile modular integrated equipment (LCPWmk and SCPWmk) to implement technological processes of obsolete and prohibited liquid and solid pesticides incineration.

In the process of work technical documents were considered on equipment and technological process provided by the developer, the University of Florence, and marketed by FEROftech Company. Technical documents on the equipment specify that the equipment was approbated and complies with the requirements that exist in the country of its development.

The result of the study is a draft operating procedure for the mobile modular integrated equipment to implement technological processes of obsolete and prohibited liquid (LCPWmk) and solid (SCPWmk) pesticides incineration.

The project of Technical Specifications on the mobile modular complex equipment for implementation of technological procedures of incineration of the obsolete and prohibited pesticides

Technical conditions are formalized in compliance with GOST 2.114-95 requirements and apply to production and supply of mobile technological equipment sets of mobile configuration designed for thermal destruction in a rotating furnace of obsolete and prohibited pesticides non-compliant with GOST P 51247-99 requirements and other normative and technical documents as well as of high-toxic wastes application of which in the Russian Federation is prohibited.

Major construction as well as technical and operational indicators. As a result of analyzing the existing options, a mobile installation of modular type was selected. The installation was developed by the University of Florence and is marketed by FEROTech Company.

Technical conditions apply to toxic wastes incineration installation that is equipped with special supplementary modules to incinerate solid and liquid obsolete and prohibited pesticides.

If other chemicals need to be destroyed, including halogen-containing wastes (PCBs), basic installation that is the core of the technical solution to which technical conditions apply can be supplemented by special modules. This significantly increases efficiency and, at the end, ensures reduction of total costs.

Degree of introduction. Draft operating procedure, once approved with the producer of mobile modular integrated equipment (LCPWmk and SCPWmk), can be fine-tuned and, if necessary, approved by a competent authority.

Efficiency of technical conditions is determined by the possibility of incinerating obsolete and prohibited solid and liquid pesticides in the mobile modular integrated equipment (LCPWmk and SCPWmk) excluding negative environmental impact and negative impact on the operators of the technological modes.

Technical Specifications (TS) elaborated are an integral part of the procedure to authorize the technology and equipment in the Russian Federation. They are also a

basis to conduct due diligence procedure to ensure compliance with the existing national standards and requirements (certification) as well as an element of technical documents applied when operating pesticide destruction installations.

The Technical Specifications project is completely given in the section 2.8. of the main report

2.9. Establishing compliance of technology and equipment with norms and requirements effective in the Russian Federation, including developed TS or GOST (on point 2.4. of the Terms of Reference

Certification authority "*Ekologichnaya energetika*" [*Clean Energy*] of an independent non-commercial organization *Certification Centre "Kachestvo"* [*Quality*] (accredited by the Central Certification Authority of the Mandatory Environmental Certification System) conducted pre- and certification audit (inspection) of technological documents provided by FEROTech Company to confirm compliance of the equipment and technology with the requirements of Directive on Wastes Incineration – EU H-Waste Directive 2000/76/EC; of the elaborated TS and operating procedure on the mobile modular installation to incinerate obsolete and prohibited pesticides; and of the results of the environmental impact assessment.

As a result of the inspection, compliance of the mobile modular installation to incinerate obsolete and prohibited pesticides with the Russian environmental protection requirements, an environmental compliance certificate was issued.

Environmental compliance certificate No. 00001593, issued on 30.09.2010, has legal effect across the territory of the Russian Federation, is introduced into the Mandatory Environmental Certification System Registry. Moreover, ISO 9001 certificates were obtained for the installation of FEROTech Company from international certification authorities accredited in IGNet.

The above-stated certificates (3) are given in section 2.9 (under p. ToR 2.5) the basic report.

2.10. Completing a full set of documents allowing to import, transport and utilize pesticide destruction technologies and equipment in the territory of the Russian Federation in accordance with the Russian legislation (on point 2.5. of the Terms of Reference)

For completing the primary goal of the Project – creation of system of pesticide destruction of in the Russian Federation it was necessary to provide the contractor with the necessary legal, technical and methodical documentation, sufficient for legal and safe accomplishment of works.

During project execution the full set of documents consisting of Operating Procedure, results of chemical-analytic researches of operating installation, Environmental Impact Assessment, results of sanitary-and-epidemiologic researches, Technical Specifications (TS) of work accomplishment ; the resolution, the report and the conclusion of results of public hearings, letter on submitting the documents for the state environmental expertise has been completed. It is necessary to notice that reception of licenses for the right of work accomplishment by direct contractors implies submitting of the documentation developed within the framework of this Project.

Thus, the received complete set of documents allows not only to provide legal import to the Russian Federation and application of mobile installations, but also production of works on pesticide destruction by the licensed to this kind of works specialized organization.

Conclusion

Because of the serious concern of the governments and the nature protection public organization of some countries about the state of affairs in the Russian Federation with storage and use of such dangerous chemical substances as pesticides, the task has been set and work has been organized on creation in the Russian Federation modern system of destruction of pesticides using the innovative technologies and the modern technical and technological means which meet the international and Russian nature protection requirements.

Existing experience in the organization of system of pesticide treatment allows to draw a conclusion that without a creation of system of the obsolete and prohibited pesticide treatment, including an organization-legal institutional basis, a modern hardware complex on destruction of various kinds of pesticides, and also the developed regional network of collection, transportation, safe storage and destruction of pesticides to solve a task of liquidation of stocks of the obsolete and prohibited pesticides in the Russian Federation it is not obviously possible.

In this view the Managing Project Committee JUNEP-GEF at session in Reykjavík has approved on February, 4-5th, 2010 the project proposal on creation of system of destruction of the obsolete and prohibited pesticides in the Russian Federation and has made decision to develop work in this direction.

Main objective of this pilot project was the creation of institutional possibilities of realization national plans and the international projects on destruction SOZ (on pesticide example) on territory of the Russian Federation and a technique of stage-by-stage legalization of innovative technology on destruction SOZ. Successful accomplishment of such task takes on special significance on the threshold of ratification of the Stockholm Convention by the Russian Federation.

Having analyzed a number of existing technologies and technical solutions, instrumental in the destruction of pesticides, we have singled out the high-temperature adiabatic heat-treatment technology that is carried out in a package-type mobile unit, designed by the University of Florence and marketed by an Italian company FEROTech. The selected technical solution is based on a standard installation of modular type for toxic wastes incineration additionally equipped with a special module for incineration of obsolete and prohibited solid as well as liquid pesticides and other halogen-containing toxic wastes.

According to the results of the assessment and public hearings conducted in EU, technology of pesticide waste incineration under high temperatures has been recognized the Best Available Technology (BAT)

For creation the necessary legal and methodical basis the project has set a task to work out a number of necessary documents (TS, operating procedure on pesticide destruction installation) and to conduct compulsory procedures (public hearings, sanitary-and-epidemiologic and chemical-analytical inspections, Environmental Impact Assessment).

In the description of operating procedure and according to the requirements of the best available technologies Russian legislative, normative as well as normative and legal requirements were determined, analyzed and assessed.

The environmental impact assessment (EIA) of the selected technology and equipment for pesticides destruction has been conducted in accordance with the requirements of the Federal law of the Russian Federation *On Environmental Protection and Provision on Assessing Environmental Impact of Economic and Other Activity in the Russian Federation*.

Impact assessment on specific environmental components was conducted by a calculation method in accordance with the methodologies adopted in the Russian Federation or by using materials on analogue installations.

On the basis of the conducted researches of existing mobile installations for incineration of dangerous waste and the environmental impact assessment of technology and equipment of installation for pesticide incineration the following

has been formed: the contents and structure of the project of operating procedure for "technology-equipment" complex with regard to mobile modular integrated equipment in accordance with BAT requirements corresponding obsolete and prohibited pesticides incineration in accordance with the normative requirements of the Russian Federation.

The project of technological specifications(TS) on mobile modular integrated equipment to implement technological processes of obsolete and prohibited pesticides incineration has been worked out.

Technological specifications are set in accordance with the normative requirements of the Russian Federation and extend on production and delivery of the mobile complex technological equipment of the modular type intended for thermal pesticide destruction in the rotating furnace.

Technical Specifications (TS) after the coordination with the developer are a part of the procedure the technology and equipment legalization in the Russian Federation and are also a basis to conduct due diligence procedure to ensure compliance with the existing national standards and requirements (certification) as well as an element of technical documents applied when operating pesticide destruction installations.

Thus, **in the framework of the Project, for the first time an organizational pesticides management and destruction system was created that employs innovative technologies compliant with the international and Russian environmental protection requirements**, which is a mandatory condition for destruction SOZ\pesticides.

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