

HEALTH AND ECOLOGICAL PROGRAMMES
AROUND THE CHERNOBYL EXCLUSION ZONE

PILOT INCINERATOR

FOR BURNING OF RADIOACTIVELY
CONTAMINATED WOOD
(U6.01e/11)



This project is funded
by the European Union



Beneficiary: State
Agency for the
management of the
Exclusion Zone



Recipient: State
specialized enterprise
«Central Enterprise for
Radioactive Waste
Management»



УКРАЇНОМІПРІЛАД

The project is
implemented by
the Ukrainian Atom
Instruments & Systems
Corp.

ABOUT THE PROJECT

Start of the works: December 17, 2012.

End of the works: May 29, 2015.

Project cost: 1 250 000 Euro.

Donor: The European Union, represented by the European Commission.

Beneficiary: State Agency for the management of the Exclusion Zone.

Recipient: State specialized enterprise «Central Enterprise for Radioactive Waste Management».

Contractor: Ukrainian Atom Instruments & Systems Corp.

PURPOSE

The Pilot Incinerator is designed for environmentally safe incineration of radioactively contaminated wood in the Chernobyl Exclusion Zone and for heat generation.

SPECIAL FEATURES

The project has tested and implemented up to date technologies for wood incineration, management of contaminated ash and removal of contaminated combustion products from the flue gases.

The Pilot Incinerator is equipped with a system for dust-free ash removal from the boiler and a system for dust-free conditioning of the contaminated ash. The Facility is additionally equipped with a bag filter for fine cleaning of the flue gases.

The energy generated as a result of the dry wood incineration will be supplied to the local heating systems of the Chernobyl Exclusion Zone.

This Facility is first in Ukraine. It is a pilot project, and further, higher capacity boilers will be built based upon its results.

MAIN PARAMETERS

- Rated consumption of wood chips during the Pilot Incinerator operation – 600 kg/hour,
- Thermal capacity – 1.75 MW,
- Efficiency – min. 81%,
- Dust concentration in the flue gas after the cleaning system – max. 5 mg/m³ (versus standard 150 mg/m³).

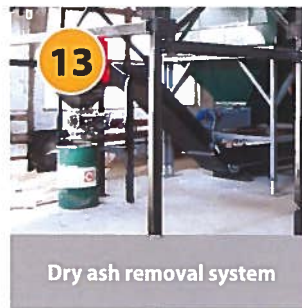
The base model of the KVm(a)-2,0-01 boiler is used as a basis for the Pilot Incinerator.



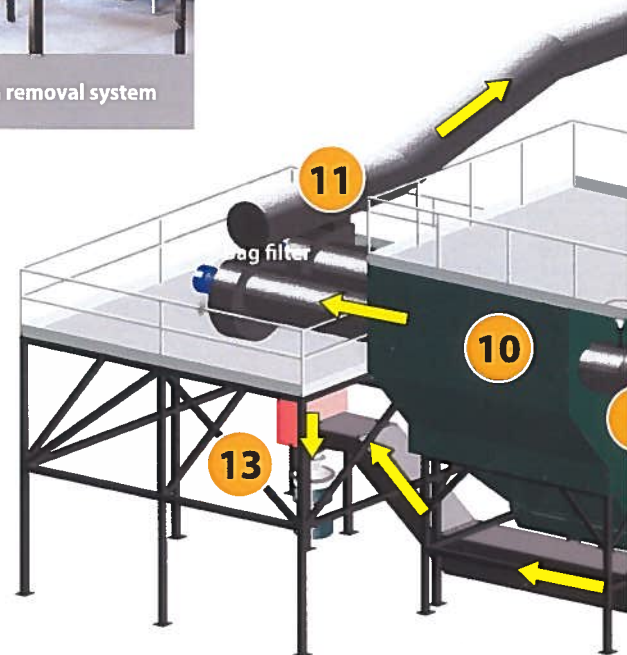
Chimney



Gas monitoring system



Dry ash removal system



Emergency power system



System of remote surveillance

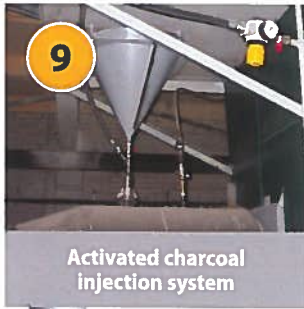


System of control and management

PROCESS FLOW CHART



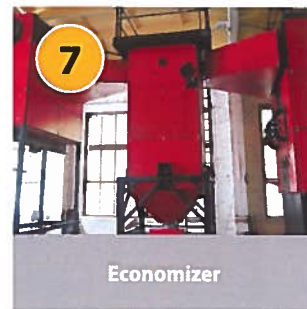
Bag filter



Activated charcoal injection system



Multicyclone



Economizer



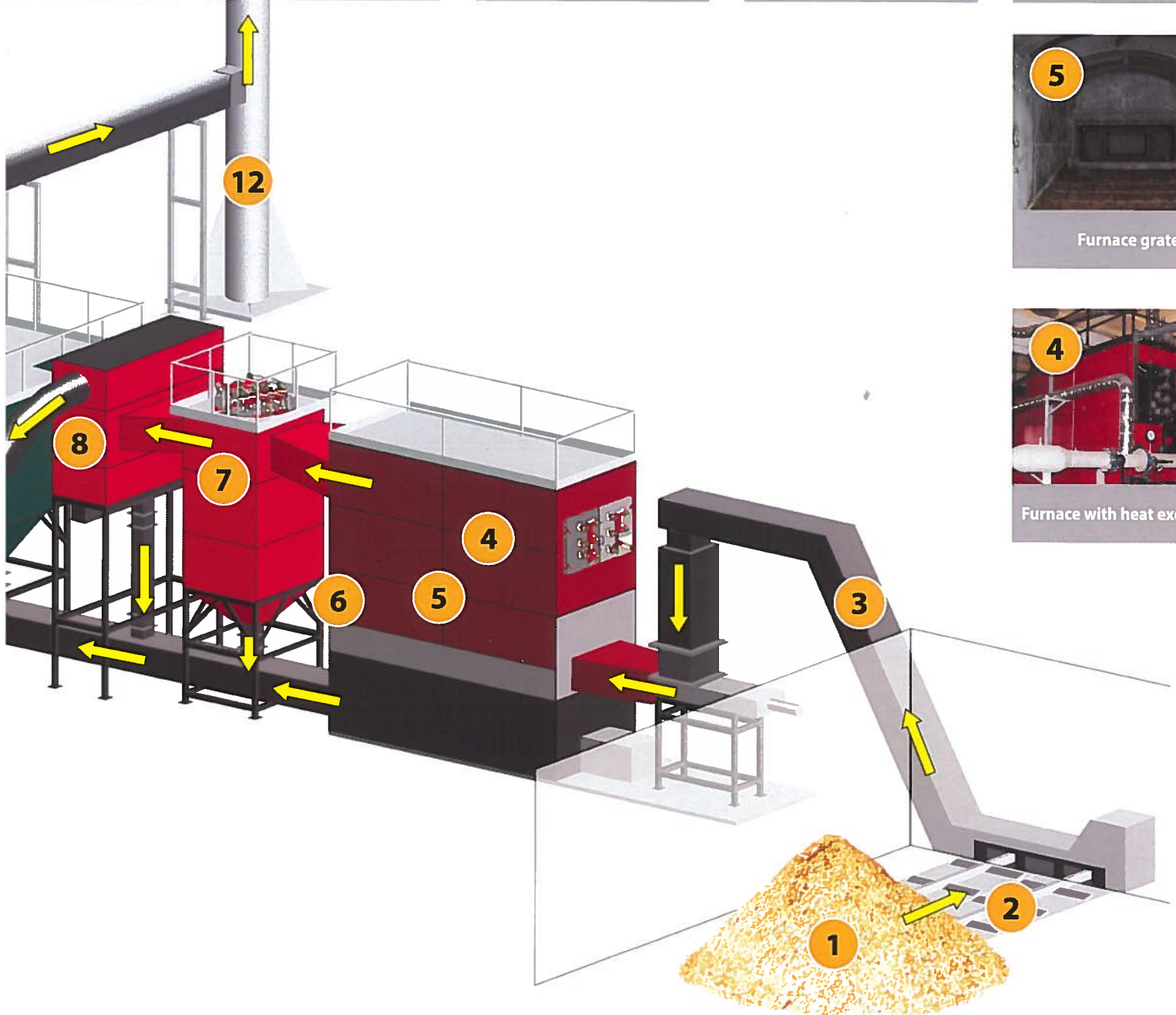
Liquid fuel supply system



Furnace grate



Furnace with heat exchanger



Storage of wood chips



"Moving bed" wood chips feeding system



Scraper conveyor

TECHNOLOGY OF ENVIRONMENTALLY SAFE INCINERATION OF CONTAMINATED WOOD

Forest wood is supplied from the Chernobyl Exclusion Zone which includes large areas of dead and contaminated forest subject to disposal, and large wooded areas which must be separated by wide fire protection lanes.

The wood, bark and branches subject to disposal are turned into chips in a wood crusher (chipping machine), and the chips are then stored in a warehouse (*picture 1*). The total humidity of the wood chips suitable for the Pilot Incinerator shall not exceed 60%.

The «moving bed» feeding system (*picture 2*) brings the wood chips from the warehouse to the scraper conveyor (*picture 3*), then a plunger type feeder delivers the chips to the travelling grate furnace (*picture 5*).

The incineration technology is based on layered combustion using a lattice structure travelling grate, takes place as «staged combustion» and is used to achieve maximum combustion efficiency with minimum amount of pollutants. The combustion process takes place in the boiler furnace made of heat-resistant concrete. The boiler has water cooling. Liquid fuel is used to heat the boiler, operate the afterburner chamber and maintain the boiler nominal operating conditions. The liquid fuel supply system (*picture 6*) ensures the best level of the wood combustion; automatic control of the afterburning temperature is in compliance with Directive 2000/76/EU.

The flue gases from the wood chips incineration in the furnace are ducted to the afterburner chamber where convection heat exchange occurs and heat carrier is heated with the waste gases from the boiler. The efficiency of the double-sided heat exchanger is enhanced by an economiser (an additional heat exchanger) (*picture 7*) where water to be supplied to the consumers in the Chernobyl Exclusion Zone is heated.

The flue gases are cleaned in the high efficiency multicyclone (*picture 8*) followed by activated charcoal injection after which the gases pass through the bag filter.

The use of the activated charcoal (*picture 9*) improves substantially the bag filter (*picture 10*) effectiveness in retention of such elements as mercury, strontium and caesium. Due to this cleaning system, the dust concentration in stack emissions does not exceed 5 mg/m³ that is significantly below the permissible levels of contamination specified in the current standards of the European Union and Ukraine. The flue gases cleaned of harmful components and dust are then released through the stack (*picture 12*).

The automatic ash handling system removes the fuel combustion products (ash, cinder) with the scraper mechanism and places them into 200 L containers (*picture 13*). The design of the system prevents any release of dust and ash spillage outside the container and the system itself, or in the absence of the container.

The computer-based monitoring and control system provides for the facility control, automation and monitoring of the control, warning, adjustment processes necessary for protection and tripping off.

The radiation monitoring system is designed for:

- continuous monitoring of radiation contamination levels of the wood chips fed to the boiler furnace;
- radiation monitoring of the fuel gas and calculation of radioactive aerosol releases through the stack;
- radiation monitoring of the ash for the classification of the storage type;
- continuous monitoring of the absorbed dose of gamma radiation and control of beta radiation contamination of the biomass boiler, equipment, rooms and environment;
- alarm (both light and sound) in case of excess contamination levels of the wood chips, dose rate levels in the ash collector, facilities and environment.

The Pilot Incinerator has a diesel emergency power supply system (*picture 14*) which can maintain the operation of the emergency power unit for at least 10 hours. This system is triggered automatically in case of failure of the normal power supply source.

The Pilot Incinerator has a system of remote visual monitoring (*picture 15*) of the technological process for the observation and monitoring of the process main stages on the screens (*picture 16*) installed on the control desk.

ECOLOGY OF THE CHERNOBYL EXCLUSION ZONE

The 1986 accident at the Chernobyl Nuclear Power Plant resulted in substantial radioactive contamination of the surrounding areas. These areas are now part of the Chernobyl Exclusion Zone (CEZ). The most contaminated areas in the CEZ are covered with profuse vegetation.



The uncontrolled growth of vegetation, fallen trees and lack of appropriate post-accident forest preservation activities have created favourable conditions for large-scale spontaneous forest fires on the CEZ territory. Smoke plumes from such fires may transport radioactive matters over substantial distances both within Ukraine and outside.

To reduce this risk, the contaminated dry wood should be destroyed and disposed of safely. Given the substantial size of such forest, controlled incineration appears to be the only possible way of the disposal.

The current radiation contamination levels of the dry wood in the CEZ prevent the application of simple classic incineration methods without any technologies for safe management of the radioactively contaminated ash and flue gases.

Safe management of the contaminated dry wood is exactly the purpose of the *Pilot Incinerator* funded by the European Union.



The European Union initiatives

The European Union is made up of 28 Member States who have decided to gradually link together their know-how, resources and destinies. Together, during a period of enlargement of 50 years, they have built a zone of stability, democracy and sustainable development whilst maintaining cultural diversity, tolerance and individual freedoms. The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders.

Following the Chernobyl accident, the European Union launched a Nuclear Safety programme under TACIS (Technical Assistance to the Commonwealth of Independent States) which, between 1991 and 2006, allocated some €1.3 billion to nuclear safety and security projects, with over €560 millions of technical assistance projects implemented in Ukraine. From 2007 to 2013 the EU expanded its nuclear safety assistance and cooperation to third countries under the Instrument for Nuclear Safety Cooperation (INSC) which had a total budget allocation of €524 million. In 2014, the strategy for a second phase of the INSC (2014 – 2020) was agreed in Brussels, committing an extra €225 million for nuclear safety projects. Ukraine will continue to be a major recipient of this assistance.

In total, the European Union has been funding worth some €480 million of industrial projects in Chernobyl. In addition to contributions to international funds (the Chernobyl Shelter Fund and the Nuclear Safety Account) managed by the European Bank for Reconstruction and Development (ERBD), the European Union has been funding as well projects to study, assess and mitigate the consequences of the Chernobyl accident and for the processing and storage of radioactive waste at the site.

In 2011, the European Union initiated projects to address the social and regional consequences of the Chernobyl accident. The incinerator pilot project is part of those.

The European Union has committed to date more than €600 million so far to Chernobyl projects, as follows:

- Industrial projects: €480 million – of which €400 million channelled through international funds and €80 million implemented by the European Commission.
- Power generation support: some €65 million.
- Social projects: some €15 million.
- Research projects: some €100 million.

For further information about cooperation between the EU and Ukraine on Nuclear Safety, please contact Joint Support Office for the Management of the Instrument for Nuclear Safety Cooperation (INSC) in Ukraine:

Office 420, 49a Volodymyrska str., 01001 Kyiv, Ukraine, Tel: +38 044 569 5606, Fax: +38 044 569 5607,
E-mail: office@jso.kiev.ua, Web: www.jso.kiev.ua

PROCESS FLOW CHART

