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Construction of waste segregation complex in Murmansk

Final Report

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Brief summary

The project aims at establishment a new domestic solid waste segregation and compactor plant on the base of ORKO-Invest LLC (ООО "ОРКО-*И*нвест") as well as subsequent realization of recoverable recourses.

There are 2 alternative scenarios: the total cost of project implementation pursuant to the first scenario is RUR 211 M, pursuant to the second scenario – RUR 300M.

The financing agencies that showed interest in this type of project are: NDEP; NEFCO; and IFC.

The identified benefits of the project implementation for ORKO-Invest are making profit of the sale of recycled materials.
Payback period of the project is six and a half years.

List of abbreviations

APC - Approximately Permissible Concentration
ABC — Acrylonitrile butadiene styrene
CBER - Council of the Barents Euro-Arctic Region
CPM – Cardboard and Printing Mill
CPP - Cogeneration Power Plant
EVD – The Agency for International Business and Cooperation: a branch of the Ministry of Economic Affairs of the Netherlands
FL – Federal Law
FSI – Federal State Institution
GOST – State Standard
GR – Rubber Goods
HMU – Housing maintenance and utilities
HPP - High-pressure Polyethylene
IEP - Investment Environmental Project
IFC – International Finance Corporation
IP – Incineration Plant
IPPC – Integrated Pollution Prevention Control
IRR – Internal Rate of Return
IZA – Ambient Pollution Index
KAZ - Kandalakshsky Aluminum Plant
LLC – Limited Liability Company
LPP - Low-pressure Polyethylene
MNR – Ministry of Natural Recourses
MPC – Maximum Permissible Concentration
MUGMS - Murmansk Department of Hydrometeorology and Monitoring of Environment
NDEP - Northern Dimension Environmental Partnership
NEFCO - Nordic Environment Finance Corporation (Rus. Экологическая Финансовая Корпорация Северных Стран)
NP – Maximum recurrence of exceeding of MPC
NPV – Net Present Value
OECD - Organization for Economic Cooperation and Development
OAO – Open Joint Stock Company
PA - Polyamide
PBT — Polybutylene terephthalate
PC - Polycarbonate
PCM - Paper and Cardboard Mill
PPE - Personal Protective Equipment
PPM - Pulp and Paper Mill
PPP - public-private partnership
PPR - Polypropylene
PS - Polystyrol
PTP - Polyethyleneterephthalate
PVC - Polyvinyl Chloride
PW - Polyethilene Wax
SanPin - Sanitary Regulations and Standards
SAUL - Siberian-Urals Aluminum Company
SDW - Solid Domestic Waste
SHS - Sanitary-hygienic Standard
SI - Pollutant Standard Index
SNIP – Construction Norms and Regulations
SPZ – Sanitary Protection Zone
SR – Sanitary Regulations
Taxpayer ID – Taxpayer Identification Number
UGMS - Department of Hydrometeorology and Monitoring of Environment

USRLE - Unified State Register of Legal Entities
WSC - Waste Segregation Complex
ZAO – Closed Joint Stock Company
ZATO - Closed Administrative-Territorial Entity

1 GENERAL PROVISIONS

1.1 Background

The project aims at establishment a new domestic solid waste segregation and compactor plant on the base of ORKO-Invest LLC (ООО "ОРКО-Инвест") as well as subsequent realization of recoverable recourses.

Segregation and recycling is the most simple, cheap and economically and ecologically efficient method at any subsequent waste treatment technology, which allow reducing the volume of wastes by 30-85% and profitably return them to the economic cycle as raw material, simultaneously preparing the remaining waste to the subsequent technological process.

Segregation and compaction of SDW is the first fundamental stage providing the highest efficiency of waste management. The mentioned technology does not conflict with any other existing in the sphere of waste management; rather it increases the efficiency of other ones.

Waste segregation involves extraction from the combination of all wastes of valuable particles, which are applicable for recycling with subsequent 5-10-fold compaction and baling to standard packages.
Such an approach allows minimizing haulage, simplifying waste storage, reducing the number of waste dumps and landfills and providing return of recoverable resources to commodity turnover.

This makes it possible to drastically reduce environmental load on the region and improve sanitary condition, and consequently solve the solid waste problem and set up an organized industrial waste treatment infrastructure comprehensively and in the long run.
Solid waste segregation is the only way to use them a second time as a raw material source with minimum environmental losses and relatively inconsiderable expenses.

Successful experience in application of solid waste recycling technology in Murmansk is so far insignificant. Complex handling of this problem has not been made by any enterprise. However the researches showed that nearly 80% of the total flow of waste makes the materials subject to recycling. For example, paper, cardboard and textiles make about 36% of waste mass, plastic – 23%, glass – 7%, metal – 4%, leather and rubber – 3% and wood – 2%.

It is necessary to note that there is a real market for recoverable resources segregated from the waste. These products include: classified and baled waste paper, textiles, polyethylene and other plastics, ferrous and nonferrous metals, glass waste and leather and rubber waste. Primary treatment product buyers are Russian industrial enterprises and organizations purchasing extracted valuable particles as a raw material for subsequent recycling and production release. Prices and demand for all types of recoverable resources within Russian Federation has an intense growth trend. Besides, recoverable resources are readily purchased by foreign countries (Ukraine, Belorussia, Baltic countries, Turkey, Iran, China etc.).

Based of the gained income it’s becoming possible to introduce treatment technologies sorted by types of industrial and consumer waste into commercial product by setting up of regional consumer network in the form of small and mid-size enterprises producing the ecologically clean product from the segregated recoverable resources, or by expanding own manufacturing capacities with units for recycling of recoverable resources to commercial product.

Thus, the present project considers possibility of complex approach to the SDW utilization problem. SDW segregation and compaction system provides the highest economic efficiency and turns SDW utilization into highly profitable and fast-payback business. For ORKO-Invest projected production fits well into general development line of the company, does not contradict its mission and goals, facilitates formation of positive image and should provide long-term strategic development.

1.2 Economic effects of IEP implementation

Segregated waste particles are the recoverable resource for subsequent use and therefore they represent commercial value.
It is planned to sell segregated SDW particles to the recoverable resource receiving enterprises and processing enterprises.
Benefits of the project implementation for ORKO-Invest is making profit of the sale of recoverable resource.
Other parties, like HMU and population are also interested in project implementation. As the project provides for introduction of selective waste disposal, for which an extra container for separate selection of commercially valuable waste will be installed and will be taken away by Orko-Invest free of charge, the total cost of waste disposition services will be reduced for HMU, and therefore a charge for waste disposition services for the population should be smaller.

1.3 Possibility to reproduce IEP

The similar projects has already been implemented within Russia, but this project is planned to be implemented in Murmansk region for the first time, though necessity in setting up of new waste treatment enterprises, in particular, waste segregation enterprises arose long time ago. That is why, both within the region and on the federal level, the idea of setting up of similar enterprises is quite vital.

1.4 Participants and flow chart of IEP implementation

Preliminary project parties will be as follows:

- Orko-Invest LLC (ООО "Орко-Инвест") – project initiator and operator
- Waste Segregation Complex (WSC) construction contractors
- Equipment supply and installation contractors
- Financial organizations
- Government bodies: Committee on Ecology and Management of Natural Resources of Murmansk region, Administration of Murmansk region

2 CHARACTERISTIC OF INITIATOR FACILITY AND ITS FINANCIAL STATUS

2.1 Details и brief characteristic of initiator facility

- Orko-Invest LLC (ООО "Орко-Инвест");
- Location: North-Western Federal District of the RF, Murmansk Region, Murmansk;
- Legal address: 114 Kolskiy Ave., Murmansk 183008, Phone: (8152) 25-42-01, website is not available.
- Orko-Invest includes the following departments: waste disposal department, contracts and claims department, accounting department, transport service (motor vehicle convoy, workshop, janitorial service department) and SDW landfill maintenance department;
- Manager of the enterprise – Tananykin Stepan Aleksandrovich – director of Orko-Invest;
- The enterprise was set up in 2004. From December 1, 2005 ORKO-Invest joins the existing municipal waste disposal system and according to the municipal contract with Committee on Development of Municipal Economy ORKO-Invest carries out technical and sanitary maintenance of the authorized waste dump in Drovyanoe settlement.

2.2 Legal status of facility

Orko-Invest is a limited liability company. Certificate of State Registration of legal entities – 51№000780973 (December 20, 2004)
Certificate of Registration with Tax Authority - 51№001561434 (December 20, 2004).
Extract from USRLE (Unified State Register of Legal Entities) - №5417 (September 3, 2009).
Orko-Invest has a License for handling of hazardous waste (Collection, use, treatment, transportation and emplacement), № ОТ-26-000155(51) dated January 30, 2007.

It's important to note that for the SDW project implementation the enterprise will have to expand range of services covered by this license and include waste recycling.
Orko-Invest directly interacts with government regulation bodies, in particular, on the issues of waste removal tariff adjustment and maintaining of selective disposal of some types of waste.
It's important to note that director and first deputy director of Orko-Invest are simultaneously the deputies of Deputy Council of Murmansk.
Orko-Invest carried out works under municipal contracts, namely, unauthorized dumps elimination in Murmansk.

2.3 Current state of production and sales of products, prospects of facility development

2.3.1 Current status

Orko-Invest is the biggest service supplier for disposal of SDW from population and organizations (95% of municipal SDW volumes).

Main sources of industrial and consumer waste generation in Murmansk region are the enterprises and organizations, including military units of the Ministry of Defence of Russia and population of the region.

There are 22 dumps and 1 landfill authorized by the self-governing authorities and 20 unauthorized (accidental) dumps.
Solid domestic waste generating from population life activity, as well as enterprises and organizations of Murmansk region, enter into the thermal treatment plant Zavod TO TBO OJSC (ОАО «Завод ТО ТБО») (operating since 1986) for treatment and for emplacement – to the "Poligon TBO" (SDW Landfill) dump, located in Drovyanoe settlement (operating since 1971). SDW are incinerated at waste incineration plant without preliminary segregation and separation of recoverable resources material. Design capacity of the plant is 130,000 tons/year. Generated heat is transferred to the steam drum GOUTEP TEKOS (ГОУТЭП «ТЭКОС»).

The existing domestic waste dumps were mainly set up long ago without taking into account ecological, sanitary and fire regulations and have an adverse effect on the environment.
The existing SDW collection system does not provide extraction of recoverable resources and, what is the most important, hazardous industrial waste, generating in domestic conditions (mercury-containing items, toxic metals, current sources, oil products, paintwork material, polyvinyl chloride and other hazardous substances). Such types of waste upon their storage in the landfills and upon incineration result in environment pollution by hazardous toxicants.
Industrial waste management system, including SDW of industrial enterprises is illustrated in figure 2-1.

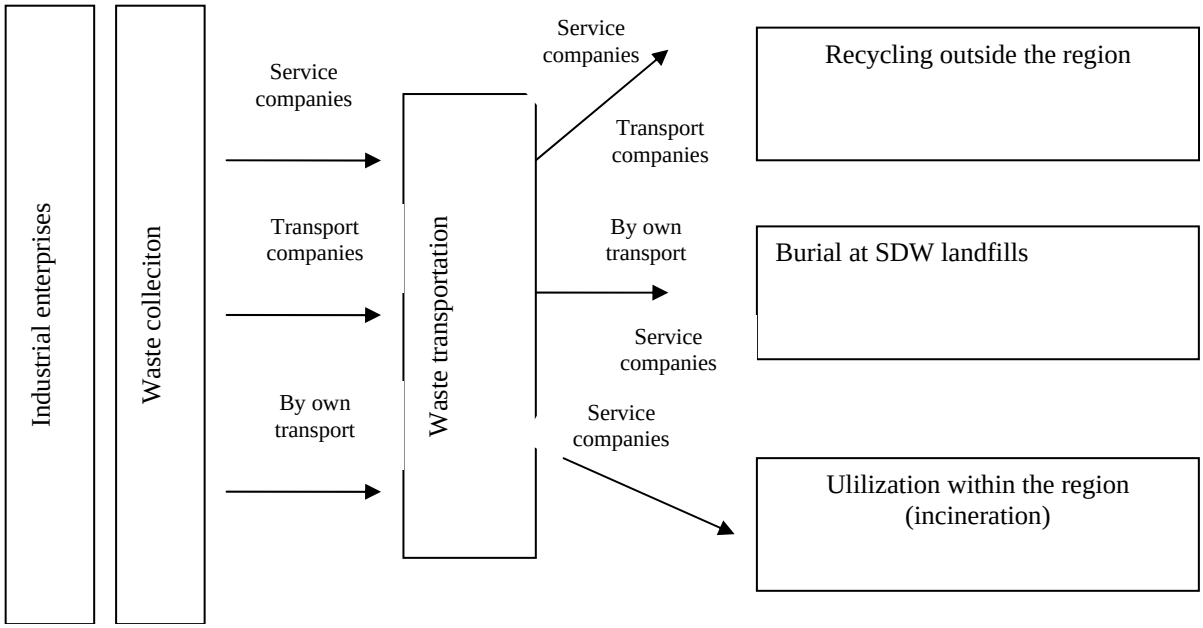

Figure 2-1 Industrial enterprise waste treatment system

The construction of industrial waste landfill was completed on the territory of Severonikel plant in Monchegorsk in 2007, and at present the facility is not accepted for operation. This is the only waste disposal facility in the region equipped with impervious screen using polymer film.

Toxic waste

Mercury-containing waste is accepted and treated by the following licensed organizations:
- Ecotrans LLC (ООО «Экотранс»), Murmansk region, Kola district, Molochniy settlement.
- ZAO “Ekord” (ЗАО «Экорд»), Kirovsk, Titan settlement, Industrial site.

Housing and maintenance utilities sector insignificantly covers the mercury-containing waste collection and utilization system.

There is a beryllium-containing waste deposit (burial site) deactivated in 90-ies in Kandalaksha. The deposit stores beryllium-containing waste of 1 class of hazard in quantity of 816.2 tones, which are owned by Kandalashsky Aluminium Plant and a legal successor is SUAL OJSC KAZ SUAL ОАО «СУАЛ» «КАЗ-СУАЛ») branch.

Selenium arsenic sludge of 1 class of hazard is generated in sulphuric acid production processes at the nonferrous industry enterprises. Today over 63.4 tons of sludge is accumulated in the storage until the utilization problem is solved.

Oil products waste management

Most oil products are burnt at boiler houses and CPP. Insignificant part of processed oil waste is used by the enterprises themselves as lubricants for units and assemblies where it is possible to use low-quality oil products (for example, reducing gears).

At present there is no capacity or enterprises in Murmansk region for deep oil product waste processing and obtaining of marketable oil products.

At the waste oil product acceptance and reprocessing enterprise Krondeks LLC (ООО «Кронdекс») oil products are purified of mechanical impurities and water in a separator and thereafter handed over to be burnt at boiler houses as boiler fuel.

Processed oils are accepted in accordance with a license by Avtokolonna 1118 OJSC (ОАО «Автоколонна 1118»), GOUTEP (State Regional Unitary Heat and Power Enterprise) TEKOS (ГОУТЭП «ТЭКОС»), Murmansk CPP (Cogeneration Power Plant) OJSC (ОАО «Мурманская ТЭЦ»), Ivanov IP (individual entrepreneur) (ИП Иванов) from Apatity.

In the region there is no network for processed oil product acceptance (for example, a municipal one) from small companies, individual persons and motorists.

Oil-contaminated waste treatment

In the territory of the region acceptance and utilization of oily waters (including bilge waters) are carried out by oil transfer complex First Murmansk Terminal LLC (ООО «Первый Мурманский терминал»), MASKO CJSC (ЗАО «МАСКО»).

The technologies and equipment used to purify oily waters of oil products are out of date and no more provide waste water purification from oil products to the standard degree.

There is an actual problem of utilization of solid waste containing the following oil products: oil slimes of oil tank cleaning, mazut-contaminated sand etc. In the region there are no enterprises accepting such waste types for utilization.

Exhausted battery management

Polar-Servis LLC (ООО «Полар-сервис»), Metall OJSC (ОАО «Металл») and Biznes-servis («Бизнес-сервис») of Murmansk (without battery acid) have battery collection license and perform this activity.

Batteries are waste of 3 class of hazard and they are subject to be delivered to organizations licensed for hazardous waste acceptance.

Exhausted automobile tire management

The problem of automobile tire and rubber goods (RG) waste recycling is quite topical.

Automobile tire and rubber goods are accepted and recycled in the region by Nord-Intel LLC (ООО «Норд-интел»).

Considerable quantities of waste are delivered by the enterprises directly to the treatment plant Chekhovskiy reclamation plant LLC (ООО «Чеховский регенераторный завод»), the town of Chekhov of Moscow region.

Difficulty in tire utilization arises from high cost of recycling services and necessity in waste transportation to the plant located outside the region.

2.3.2 Characteristic of current production

Orko-Invest concluded 1980 contracts with enterprises, including 1790 SDW disposal contracts and 190 SDW burial contracts.

The clients of Orko-Invest are industrial enterprises of the city, HMU services, public institutions and population.

Production capacities and human resources

The enterprise owns the special waste disposal equipment (27 units), special landfill maintenance equipment (5 units), waste collection containers and office equipment. Construction equipment (7 units).

The enterprise has 125 staff members.

2.3.3 Marketing and sales system of the manufactured products

The company takes care of the quality of services provided, settles claims, carries out market researches for its own future development and for the industry as a whole. In particular, at the moment the company carries out active marketing researches on the problems of realization of waste segregated particles having a commercial value.

2.3.4 Characteristic of the ecological monitoring system (service) of facility

There is no own environmental monitoring service at the enterprise. All the activities related to environmental monitoring are carried out by contractors. For example, Orko-Invest concluded a contract with FSI TSLATI (Centre of Laboratory Analyses and Technical Measurement) in Murmansk region (ФГУ «ЦЛАТИ по Мурманской области») for carrying out of monitoring in the dump area of Drovyanoy settlement.

According to the industrial ecological monitoring programme approved by the government bodies, the monitoring for ambient air, soil and surface waters was organized on the dump area.

A regular collection of samples and their laboratory analysis for specific components are carried out under the contract.

2.3.5 Human resources policy

There is no written HR policy available at the enterprise but it doesn't mean nonperformance of staff management activities.
Labor relations between enterprise and staff are based on the Labor Code of the Russian Federation, work of staff is regulated by policies and procedures adopted at the enterprise (employment policies and procedures).
Staff management activities are mainly aimed at maintaining of work motivation, staff stability and continuity and development – training and advanced training.
Enterprise employees occasionally participate in topical conferences, 6 employees received a training course on "Hazardous waste management" and obtained respective certificates.

2.3.6 Investment program and prospects of facility development

In 2008 Orko-Invest purchased 22 units of specialized equipment for the total amount of 44 million rubles and 150 Euro containers for the amount if 2.0 million rubles.

To maintain the leased waste removal equipment in operating conditions, the company purchased assemblies and units for the total amount of 9.3 million rubles.
Orko-Invest leases land plots 1700 square meters in area in the Frunze Street and 15,000 square meters in area in Zelenyi Mys (Зеленый Мыс), which are suitable for development of transfer (transshipping) station with segregating line to realize one of the advanced (2 stage) waste disposal model, which will allow reducing transport expenses and providing intermediate inspection.

In 2009 Orko-Invest takes part in implementation of municipal target programme "Optimization of industrial and consumer waste management system".

Having a monopoly in the area of waste disposal services in Murmansk, Orko-Invest plans to develop its business not only in segregation but in recycling market in the future as well.

At the next stage after implementation of the waste segregation project Orko-Invest plans to change-over to commercial products – granular polymer raw material:
a semi-product, subsequently used for production of consumer goods from polymers: polymeric and polymeric sand building materials.

2.4 Characteristic of financial state of facility

This information can be obtained from the NPA Arctic Project Office or from the Executing Agency.

3 DESCRIPTION OF INVESTMENT ENVIRONMENTAL PROJECT

3.1 Description of IEP

The project provides for construction of waste segregation complex in Murmansk. At the moment 2 options of complex construction are considered:

1st option – single WSC with capacity of 50,000 tons per year;
2nd option – two WSCs each with capacity of 35,000 tons per year.

The project provides for application of manual segregation of waste, coming to conveyor and use of electromagner for picking of waste metal particles. The extracted waste particles and tails are subjected to compaction and bailing.

Technology and operating procedures are described in the following paragraph.

3.2 Processes that make the basis of IEP

1 stage Weighting and radiation control
Weighting and radiation control of waste collector.

2 stage Unloading
Waste is transported to the receiving department of production building and unloaded to the hoppers. From the hoppers the special loading machines transfer waste to the horizontal belt conveyors.

3 stage Selection of bulky and construction waste
In the receiving department the selection of bulky waste (washing machines, refrigerators, furniture, batteries, household appliances, foamed plastic, ferrous and nonferrous metal etc.) is carried out. Construction waste, tree branches and bulky waste comes into shop for reduction in size and fragmentation.

4 stage Separation of inert particles
By incline conveyor the waste enters into vibrating table, where they are separated from inert particles, sand, rocks etc. and by conveyor enters into compactor for further compaction.

5 stage Conveyor segregation
Remaining waste from vibrating tables enters into belt conveyor to the classifier equipped from both sides with points for hand sorting of recoverable recourses. On the sorting conveyor valuable particles (recoverable recourses) are picked in sequential order with subsequent compaction: cardboard, paper, newspaper and plastic. By magnetic separators installed above the horizontal conveyor in the classifier, SDW is separated from metal, which are subsequently compacted.

Compaction of recoverable recourses and “tails” is carried out by highly reliable equipment.

Hand sorting points are placed in a closed heated gallery fed with conditioned air. Sterilization lamps are installed above the sorting table (sorting conveyor).

6 stage Compaction and transportation to burial landfill
Remaining waste (“tails”) which is not subject to recycling, enters by conveyor into compactors for baling with automatic wire tying of bales, and then transported to the landfill for burial.

7 stage Burial of “tails” in the landfill
Waste (“tales”) from WCP is transferred to the landfill baled, taken out from the truck and laid on the landfill body by automatic bale-lift loader. Compacted waste in bales of 1 cubic meter in size are laid in the landfill layer by layer in 3-4 lines, then covered with sod.

Fiigure 3-1 Overall view of WSC

3.2.1 Characteristic and demand in raw materials and resources involved in production, specific consumption of raw materials and resources

Raw materials source for the planned production is solid domestic waste (SDW), i.e. the waste generating at the domestic and public buildings, trading, entertaining, sporting and other enterprises (including waste from the current repairs of apartments), domestic heater waste, sweepings, fallen leaves, collected from the courtyard area and bulky waste.

SDW are generated from 2 sources:
- residential buildings;
- administrative building, institutions and public enterprises (caterinig, educational, entertainment, hotel, kindergarten etc.)

Thus, the main supplier of waste (raw material) for the planned line is the population of municipal housing stock of Murmansk, Kola region and Severomorsk, as well as industrial, trade, domestic and other enterprises of all forms of ownership, organization and incorporation – consumer waste (SDW) and non-hazardous industrial waste producers

Efficiency of business proposed within the framework of the project also involves availability of stable raw material and consumer market. Complex enterprise has the advantages in terms of raw materials availability.

Transport and geographical analysis of the population displacement system of Murmansk region formed so far allows highlighting the following city groups united by peculiarities of geographical position and transport connection:

a) Nickel – Zapolyarniy – Pechenga with population about 50 thousand people.;
b) Murmansk – Severomorsk – Kola with population about 450 thousand people.;

c) Olenegorsk – Monchegorsk – Kirovsk – Apatity – Polyarnie Zori – Kandalaksha with adjacent Kovdor and Revda with total population about 300 thousand people.

The fist group of settlements despite of their compact arrangement, does not possess sufficient population size to set up stationary waste recycling enterprise. At the same time two other groups have quite sufficient population size in this regard, which justifies development of recycling in the second group and setting up of stationary waste recycling plant in the third group.

Industrial waste market is also not fully demanded market, which can be efficiently used in this business after introduction of recycling technology. Taking into account the abovementioned and availability of existing accumulated landfills, where quite substantial quantity of SDW is deposited, the problem of raw materials market upon reasonably selected recycling volume will by no means affect the efficiency of considered business.

3.2.2 Level of energy intensity of production

The exact level of energy consumption is not known yet at this stage. But based on average international figures, the following values will be used in this analysis: 10 kWh/ton of wastes. For 70,000 tonnes, this will amount to 700,000 kWh per year.

Post treatment:
- Baler : 10 kWh/ton
- Shredder : 1 kWh/ton
- Crusher: 8 kWh/ton

Therefore, for WSC of 70,000 tons of capacity the energy intensity will be 2,030,000 kW.

3.2.3 Compliance with international standards

The planned facility will be designed in accordance with the Best Available Technology (BAT) as described in the Integrated Pollution Prevention and Control, Reference Document on Best Available Techniques for the Waste Treatments Industries, written in 2006.

3.2.4 Level of approval of technology (tested in pilot plant environment, performed full-scale tests and etc.)

Waste segregation technology is not innovative and is already applied in waste segregation plants of the regions of Russia. 16 similar complexes with total capacity of 1.5 million tons of waste per year operate in Moscow region.
Similar projects were implemented in the other regions as well, e.g. in Kazan, Tambov and Perm region, Sochi, Lipetsk, Ryazan and Belgorod.

For this particular project the equipment has not been tested in experimental-industrial conditions.

3.3 Characteristic of the area, resources and infrastructure used for investment project implementation

3.3.1 Payout of the area of IEP implementation

The 1st option of production location (in the building of the former Severstalproyekt plant)

Figure 3-2 The map indicating the location of the WSC according to the first option of project realization

According to the first and preferable option the waste segregation complex shall be situated in the building of the former Severstalproyekt (Северсталь проект) enterprise in the north-eastern part of Murmansk. The complex capacity shall be 50,000 tons a year.
To the north and to the south of the planned enterprise there are industrial enterprise buildings, to the east – warehouses, to the west – a motorway (Metallistov passage (проезд Металлистов)).
All the required communication lines to the building where it is planned to organize waste segregation exist: power supply, roads, heating and sewage system.

The 2nd option of production location implies construction of two waste segregation complexes:
The second option of project realization suggests construction of two new complexes each of 35,000 tons a year capacity in Pervomaysky and Leninsky city districts.

3.4 Technical, ecological and consumable properties of product

The end product of the production shall be secondary raw materials obtained in result of segregation of plastic, cardboard, and non-ferrous metal waste. Demand for these raw materials is formed by enterprises engaged in recycling of these waste types.

Within the framework of the project release of primary SDW treatment production is supposed that is intended for further realization by industrial enterprises and organizations using secondary raw materials for further treatment and consumable goods release.

The definition of secondary raw material is regulated by GOST (State Standard of the Russian Federation) 25916-83 "Secondary material resources. Terms and definitions". According to this GOST secondary raw materials are understood to be “secondary material resources that at present can be repeatedly used in the national economy”, in which case secondary material resources are defined as “industrial and consumption waste that emerges in the national economic”.

End products include:
1) Waste segregated according to the type that is ready for secondary recycling (various types of waste paper, polyethylene and other plastic waste, non-ferrous scrap);
2) Segregated waste improper for secondary recycling or pressing and intended to be buried at landfills;
3) In prospect in case of increase of production capacities secondary recycling equipment for raw materials formed in the process of waste segregation may produce consumable goods such as granulated polymer raw material (an intermediate product used in production of consumer goods of polymers); polymer and polymer-sand construction materials; rubber powder (an intermediate material for rubber-enriched plastic products such as road slabs, pavement slabs, flexible roof etc.); mazut, gasoline fraction, carbon black, synoil and other products of recycling of worn-out tyres and other industrial rubber waste; the heat- and sound-proof construction material Ekovata ("Эковата"); heat-proof decorative cellular glass and cellular decoration; soil for lawns and roadside territories.

Product quality
All products manufactured within the project framework shall conform to GOST requirements demanded from various secondary raw material types as well as to SanPin requirements (before being delivered to the complex raw materials undergo obligatory radiological control).

End product advantage is a higher quality content of secondary raw material obtained in the process of segregation i.e. the lack of foreign garbage improper for recycling.
Technological and technical solutions implemented in the project are at present most progressive for work with “Russian” garbage. It is important to note that application of the considered main ideas and work methods provides the possibility to get positive results in production and economic indexes at some Russian waste segregation plants.

Range of products manufactured of secondary raw material or with the use of secondary raw material is rather wide and mounts to more than 1,000 items. Main directions of secondary raw material use can be seen in Table 3-1.

Table 3-1 Main directions of secondary raw material use

No.	Waste type	Use direction or names of products manufactured with the use of waste
1	Waste paper	In paper and cardboard production Soft roofing material production (felt roofing) Padflats Heat-proof material (Ekovata) Fiber veneer Finish tile (moisture-proof waste paper)
2	Polymer waste	Production of chip, shredding, granules to be used as secondary raw materials Industrial-use item production (plastic film, furniture fittings, molded items such as baseboard, angle bar; polymer pipe boxes etc.) Consumer goods production
3	Non-ferrous scrap	Metal items production

3.5 Process risks

Process risks associated with the project are mainly associated with a raw material deficit because of a decrease in delivered volumes of waste. It is also important to note economical risks that imply possible difficulties in development of the recycled material market, which is new for the area.

4 ENVIRONMENTAL IMPACT ASSESSMENT

4.1 Description of current state of environment at the area of IEP implementation

The Project will be implemented in Murmansk Region. The Murmansk Region is one of the largest and most developed regions of the European North of Russia. The region is located in the Kola Peninsula. Most of its territory lies within the Arctic Circle. With the area of 145 thousand sq. km, the region represents a unique combination of abundant natural landscape, cultural and historic environment and developed economy. Advantageous geographic locations, significant natural resource potential, ice-free sea port, and proximity of the borders with the EU countries are the key factors of social and economic regional development.

The Murmansk Region has significant advantages compared to other Russian regions. This happens mostly because of its geopolitical and geographic location. The Murmansk Region is the northern gate of Russia; it links Russia with the European countries and handles huge cargo flow from our country and back.

Various natural resources exist in the region. More than 60 major fields of various minerals have been discovered in the Kola Peninsula area. Currently, nearly thirty types of fossils are produced; the most precious minerals are phosphor ore, titanium iron, aluminum, copper, nickel, zirconium, and other rare metals. The reserves of mica, ceramic raw material and raw materials for construction, facing stone, semi-precious and ornamental stones are extensive.

Figure 4-1 Murmansk Region map

Superb oil and gas reservoirs have been discovered in the Barents Sea in the last ten years. Shtokman gas and condensate field, with the reserves of 3.0 trillion cubic meters (tcm) of gas, is one of them. Development of such a unique field will satisfy the gas needs of the entire North-West of Russia for many years.

The economy of the Murmansk Region is targeted to the natural resources. The region delivers 100% of the Russian production of apatite concentrate and 12% of iron ore concentrate, 14% of refined copper, 43% of nickel, 14% of the fish production.

Natural and climate conditions in Murmansk Region, as well as complex physical and geographic situation often cause natural disasters, the most typical of them are:

- storm winds with the speed of 30 m/s and more;
- heavy snow storms (with wind speed up to 20 m/s during 12-15 hours);
- snowfalls (with average daily amount of 40 mm);
- frost (with the ambient temperature less then 40 C during more then 3 days);
- heavy ice-covered ground (wire icing of more then 20 mm);
- avalanching in mountains;
- forest fires.

Almost all Murmansk region is located in an unfavorable climate zone, which causes certain issues in operation of industrial and transport organizations.

Heavy wind storms, snow storms, snowfalls are typical for the coastal area of Cola Peninsula all year.
This zone comprises all restricted admission territories, such as: Polyarny, Snezhnegorsk, Skalisty, Ostrovnoy, Zaozersk, Zapolyarny, as well as cities of Severomorks and Murmansk.

Air

The main cause of air pollution is industrial emissions of hazardous substances. Steel making factories and non-ferrous production plants contribute to air emissions at the rate of 60%.The main stationary sources of the emission in the Cola Peninsula are industrial enteprizes as: JSC "GMK "Pechenganikel" (Nikel and Zaplyarny), JSC "Severonikel Factory" (Monchegorsk), mining and concentration complex "OLKON" (Olenegorsk), JSC “Kandalakshsky Aluminum Plant” (Kandalaksh), JSC "Apatit" (Apatyty), power generation plants, boiler houses. Significant input in air pollution of city areas is done by automotive and railroad transport.

In atmosphare air emission of industrial enterprises are exposed by a complex of meteorological factors, which influence the existing level of the pollution. The dispersion of pollutants in Cola Peninsula mainly depends on active cyclonic activity with moderate or heavy winds. North-West of RF European part is categorized as favorable area for air pollution dispersion.

At anti-cyclonic season with weak winds and lowed inversions with gauzes in cities and industrial centers of Murmansk region increased level of pollution concentrations can be observed. High pollution (with maximum single concentrations of pollutants above 10 MPC) of the city air has not been observed. The most single concentrations of sulfur dioxide have been recorded in Nikel (3.5 MPC), nitrogen dioxide - in Murmansk (2 MPC) and carbon oxide in Monchegorsk (2.2 MPC).

The established standard for air quality assessment is MPC – maximum permissible concentration. Based on this standard other characteristics can be calculated: SI – standard Index – the maximum detected concentration of any pollutant in the city, divided by MPC.
NP - Maximum frequency of MPC increase %;
IZA - Ambient pollution index.

- The pollution level is considered to be increased if IZA is 5-6, $SI < 5$, $NP < 20\%$;
- The pollution level is considered to be high if $7 \le IZA \le 13{,}5$, $SI < 10$, $20\% < NP < 50\%$;
- The pollution level is considered to be very high if $IZA \ge 14$, $SI > 10$, $NP > 50\%$.

Based on the atmosphere pollution observation data the assessment of air pollution level in the settlements and towns of Murmansk Region was performed (Table 4-1).

This assessment allowed to determine the towns of Murmansk region, where mean year concentration of pollutants is ≥ MPC, the largest single pollution indices are introduced – PSI and the maximum frequency of exceedence of MPC by any substance in the town (tables 4-1).

Table 4-1, Indices of ambient air pollution in the area of Murmansk UGMS activities in 2008 (Source of information – Report on environment safety and rational use of natural resources of Murmansk region in 2008).

City	IZA (5)	Contaminants	SI	NP	Pollution level
Apatity	1,1	Suspended substances Sulfur dioxide Carbon oxide Nitrogen dioxide Benzopyrene	1,4 <0,1 1,2 0,4 1,1	2,0 - 1,6 - -	Low
Zapolyarniy	2,2	Suspended substances Sulfur dioxide Carbon oxide Nitrogen dioxide Formalin	0,8 3,2 0,4 0,4 0,7	- 10,0 - - -	Low
Kandalaksha	2,0	Suspended substances Carbon oxide Poorly soluble nonorganic fluorides Hydrogen fluoride Benzopyrene	1,6 0,7 0,5 1,5 2,1	7,4 - - 2,6 -	Low
Kirovsk	-	Suspended substances Sulfur dioxide Carbon oxide Nitrogen dioxide	0,8 0,1 0,8 0,4	- - - -	Low
Cola	3,0	Suspended substances Sulfur dioxide Carbon oxide Benzopyrene Formalin	0,6 0,4 1,4 0,7 0,5	- - 1,3 - -	Low
Monchegorsk	5,0	Suspended substances Sulfur dioxide Carbon oxide Benzopyrene Formalin	1,0 1,6 1,8 3,5 0,8	- 1,6 1,2 - -	High
Murmansk	4,0	Suspended substances Sulfur dioxide Carbon oxide Phenol Formalin	0,6 1,6 1,3 1,9 1,0	0 4,2 1,3 4,9 -	Low
Nikel	4,0	Suspended substances	1,0	-	Low

		Sulfur dioxide Carbon oxide Formalin Benzopyrene	3,7 0,7 0,7 0,6	18,8 - - -	
Olenegorsk	-	Suspended substances Sulfur dioxide Carbon oxide Nitrogen dioxide	1,2 <0,1 0,8 0,7	1,4 - - -	Low

Taking into consideration these standard characteristics the air quality of air pollution was performed in Murmansk region. The cities where average pollutants concentration ≥1 PMC were defined.

Table 4-2 Indices of ambient air pollution of the towns of Murmansk region in 2008 (Source of information – Report on environment safety and rational use of natural resources of Murmansk region in 2008).

City	Ambient pollution index (IZA)	Standard index (SI)	Maximum frequency of MPC increase % (NP)	Average annual ≥1MPC
Zapolyarniy	2,2	3,2	10,0	1,0 MPC (sulfur dioxide) 1,0 MPC (formalin)
Cola	3,0	1,4	1,3	1,3 MPC
Monchegorsk	5,0	1,6	1,6	3,0 MPC (formalin) 1,2 MPC (benzopyrene)
Murmansk	4,0	1,9	4,9	1,7 MPC (formalin)
Nikel	3,0	3,7	18,8	1,1 MPC (sulfur dioxide) 1,7 MPC (formalin)
Olenegorsk	-	1,2	1,4	1,2 MPC (suspended substances)

In 2008 based on the observation data the content of pollutants in the ambient air, expressed in terms of API, is low. There were some occasional pollution detection on certain pollutants mainly in the 30-40 km zone of the main industries.
Murmansk is on the second place after Monchegorsk on IZA. Other SI and NP are also high but still lower than in some other towns of Murmansk area.

Waste

Generation of hazardous wastes of 1-4 hazard class decreased by 36.9% in 2008 in comparison with 2007 and made 288,400 tons.
Use and processing of hazardous wastes decreased in comparison with the previous year and made 199,900 tons (69,300 from waste generation).
Quantity of waste burials increased by 14.6% in comparison with 2007 and made 197,700 tons.
Actual quantity of generation, use, processing and allocation of consumer and production wastes in Murmansk region in 2008.

Table 4-3 Actual quantity of generation, use, processing and allocation of consumer and production wastes in Murmansk region in 2008 (Source of information – Report on environment safety and rational use of natural resources of Murmansk region in 2008)

Types of waste	Generation, tons	Use, processing, tons	Burial, tons
1 класс	63,3	98,2	0,000
2 класс	91,3	31,1	0,000
3 класс	85793,2	61625,7	2433,3
4 класс	202448,8	138209,9	194297,0
5 класс	203352400,6	51183969,9	152128494,4
Всего отходов	203640797,2	51383934,8	152325224,7

About 90,000 tons of waste per year is incinerated at the incineration plant of Murmansk. There are no landfills equipped according to the up-to-date environmental requirements in Murmansk region. There 19 so-called “authorized” landfills, 5 of them have 2 year remaining life; area occupied by the landfills is about 150 ha. There are over 40 unauthorized waste emplacement sites.
There are about 300 thousands tons of solid municipal wastes being generated in Murmansk annually. Secondary materials usage is poorly represented and focused mainly in Murmansk and Apatity.

Oil products waste management

According to the data provided by regional enterprises 2,693 tons of processed oil products and their mixtures emerged in 2008: processed engine, motor, diesel, industrial, transformer, compressor, turbine oils etc., as well as oil-contaminated emulsions, diesel fuel rests, floating oil separator films. Of this amount 1,845 tons (68.5%) were used or decontaminated. Most oil products are burnt at boiler houses and CPP. Insignificant part of processed oil waste is used by the enterprises themselves as lubricants for units and assemblies where it is possible to use low-quality oil products (for example, reducing gears).

At present there is no capacity or enterprises in Murmansk region for deep oil product waste processing and obtaining of marketable oil products.

At the waste oil product acceptance and reprocessing enterprise Krondeks LLC (OOO «Кронdекс») oil products are purified of mechanical impurities and water in a separator and thereafter handed over to be burnt at boiler houses as boiler fuel.

Processed oils are accepted in accordance with a license by Avtokolonna 1118 OJSC (OAO «Автоколонна 1118»), GOUTEP (State Regional Unitary Heat and Power Enterprise) TEKOS (ГОУТЭП «ТЭКОС»), Murmansk CPP (Cogeneration Power Plant) OJSC (OAO «Мурманская ТЭЦ»), Ivanov IP (individual entrepreneur) (ИП Иванов) from Apatity.

In the region there is no network for processed oil product acceptance (for example, a municipal one) from small companies, individual persons and motorists.

Surface waters

There are more than 127 thousand hydro objects on the Kola Peninsula including 20,6 thousand stream flows, 107 thousand water reservoirs including lakes of Imandra, Umbozero, Lovozero, reservoirs at Tuloma, Voronya, Teriberka rivers. The region is very rich with water resources.
Regular monitoring of water reservoirs quality is carried out by Murmansk UGMS with frequency of 6-12 times per year at 55 regional rivers, lakes, springs and reservoirs.

It is very specific for the natural waters to include metal ions such as cupper, iron and manganese. High concentrations of metals when no water discharge form industrial enterprises takes place can be observed in low-water season when feeding is primarily done by ground waters.

However industrial activity at Kola North leads to pollution of water reservoirs by sewage waters as well as by dust emissions coming to water with rainfall. High and extremely high water pollution levels by metals, sulfates, ditiophosphate, nitrogen and phosphorus compounds, organic substances are limited and can be observed in small water objects. Rivers Nadui (Monchegorsk) and Kolos-yoki (Nikel) are classified as chronically polluted water objects due to they are exposed to direct water discharge from non-ferrous metallurgy companies without sufficient treatment.

<u>Murmansk</u>
The most polluted water object in Murmansk is the Varnichny stream (ручей Варничный). It flows through the central part of Murmansk gathering road discharges as well as discharge waters from Murmansk CPP (Cogeneration Power Plant) OJSC and other city enterprises. The stream is contaminated with ammonia nitrogen and unstable organic elements.

The quality of the water in the Rosta river (Роста) is affected by discharges from Murmansk cereal concern OJSC (OAO «Мурманский комбинат хлебопродуктов»), Plant for solid domestic waste thermal treatment OJSC (OAO «Завод ТО ТБО»), Murmansk CPP (Cogeneration Power Plant) OJSC (OAO «Мурманская ТЭЦ») and other city enterprises. Stable contamination of the river with petroleum hydrocarbons is observed, their average annual concentration is 8 MPC.
In lake Ledovoye (Ледовое) main pollutants are metal compounds such as copper, manganese, ferrum, zinc, nickel, as well as petroleum hydrocarbons, nitrite nitrogen, ammonia nitrogen and organic elements. Average annual concentration of oil products is 4 MPC.

Soil

The main factors causing soil pollution are industrial and domestic waste as well as emissions from the industrial enterprises (aerogenic pollution).

Settlements of Murmansk region occupy 0.4% of the territory of region, agricultural lands – 0.2%; 8,950 ha are occupied for plough-lands for forage grasses production in comparison with 17,411 ha in 1990.

In accordance with the effective normative-legal acts: Federal Low "About sanitary-epidemiological safety of population" dated 30.03.1999 No. 52-FL with addenda and amendments, art. 21; SanPiN 2.1.7.1287-03 "Sanitary-epidemiological requirements as to soil quality"; GN 2.1.7.2041-06 "Maximum permissible concentration (MPC) of chemical substances in soil"; GN 2.1.7.2042-06 "Guiding permissible concentration (GPC) of chemical substances in soil" – the control of observance of requirements of sanitary legislation as to soils, maintenance of territories of urban and country supplements, accomplishment of measures on prevention of soil pollution.

In year of 2008, the soil examinations were carried out on all administrative territories, including Severomorsk ZATO. As compared with 2007, specific weight of samples exceeded sanitary standard of the heavy metals' content in soil has been reduced.
The districts of region have been ranked taking into account K_{sum} – a summary index of soil pollution (Table 4-3). In accordance with the accomplished ranking, the territory of the Severomorsk ZATO takes the second place as to soil pollution grade.

Table 4-3 Ranking of region territories basing on soil pollution index (K_{sum})

Territory	Summary index of soil pollution Ksum
Kovdorskiy district	0,14
ZATO Polyarniy	1,23
Terskiy district	1,37
Apatity town	2,24
Kandalaksha town	2,27
Olenegorsk town	2,7
Kirovsk town	3,0
ZATO Skalistiy	3,02
Lovozerkiy district	3,62
ZATO Zaozersk	5,1
Monchegorsk town	6,0
the city of Murmansk	7,72
Kola District	10,32
ZATO Severomorsk	32,8
Pechengskiy district	45,92

The highest index of soil pollution has been registered in the industrial enterprises impact zone (Pechenega area, ZATO Severomorsk). In Murmansk the index of soil pollution mounts to 7.72; this is lower than the average rate in the region.

Demographic situation and population health

Demographic situation and population health in Murmansk region as well as in Russia in whole becomes worse and is determined by low birthrate and life expectancy, high death and sickness rate. For the year 2007 Region population decreased for 5902 people and by the 01.01.2008 it accounted 850 929 people (fig 4-2).

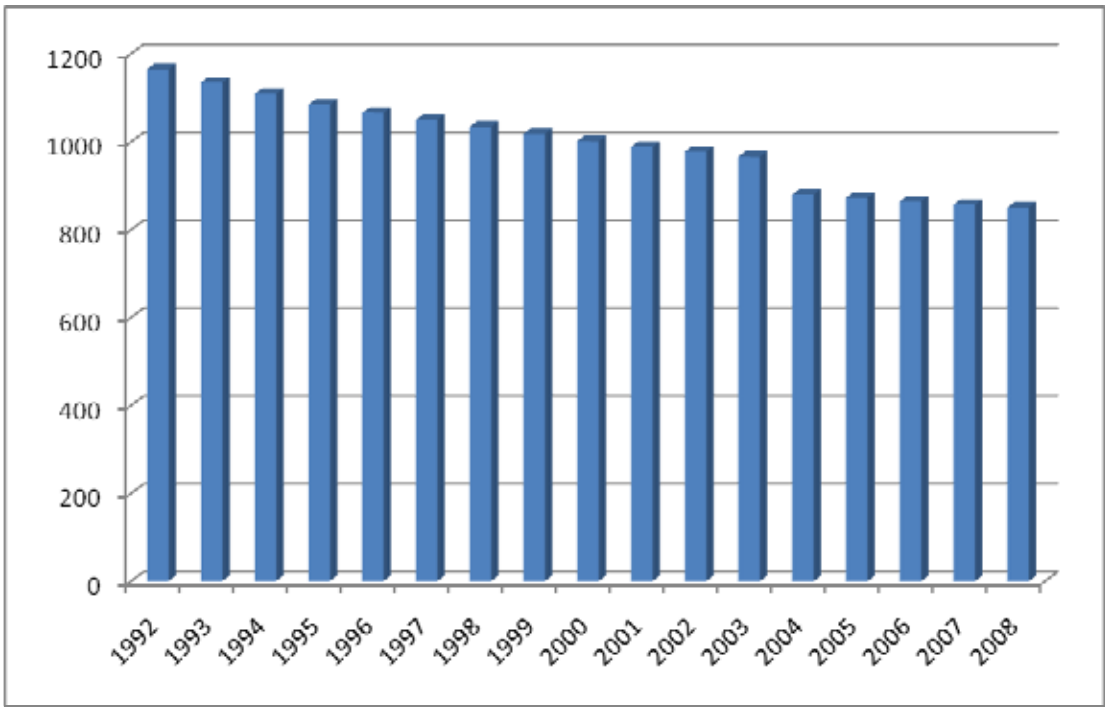

Figure 4-2 Population at the beginning of the year, in thousands

Children above 14 make 122,534 people (14.4%), persons over working age – 126,788 people (14.9%). There is a regressive type of age distribution formed and maintained in the region. Middle age of population in the region is 36.1 years.
Generally the Murmansk region has the same demographic modernization problems as other regions of the North-West Federal District:

- Decrease in population due to the high death rate and low birthrate;
- Ageing of population due to low birthrate and rising death rates at working age;
- High death rate at working age and subsequent large gap in male and female life expectancy, as well as decrease of general index of life expectancy

High death rate of population in Murmansk Region is connected with untimely death rate of blood circulation illnesses, high men death rate of accidents, traumas and poisonings, as well as high death rate of new growth.
Basic reasons of population health level and demographic situation decrease still remain: social stratification and poverty, increase of unemployed people amount, unbalanced structure and quality of food, adverse working conditions of employees, negative ecological and natural climatic conditions.

According to data of Directorate of state population placement service in Murmansk region as of March 03, 2009 total unemployment accounted 14963 people (as of February 01, it was 13178 people). Level of the registered unemployment (to economically active population) amounted 3%.

Quantity of employees supposed to be fired in accordance with staff reduction, liquidation according to data of enterprises themselves amount 1998 people.

Quantity of employees being on unpaid vocation as of March 03 amounts 128 people. Those who are idle because of employer's fault – 305. As far as vacancies concern Severomorsk

ZATO is in the third place in Murmansk region: in Murmansk (2944), Kola district (526), Severomorsk (368), Kandalaksha (240), Pechengskiy district (171).

4.2 Requirements of environmental legislation

A short list of regulatory document in the field of industrial and consumption waste management:

- Federal law dated January 10, 2002 No. 7-FZ «On environment protection»
- Federal law dated June 24, 1998 No. 89-FZ "On industrial and consumption waste";
- Order of RF MNR (Ministry of Natural Resources) dated December 18, 2002 No. 868 "On organization of professional training for the right to work with dangerous waste";
- Order of RF MNR (Ministry of Natural Resources) dated December 2, 2002 No. 483-p "On approval of Methodological recommendations on organization of activity licensing of dangerous waste treatment in the territory of the Russian Federation";
- Order of Rostekhnadzor (Russian Federal Service for Ecological, Technical and Atomic Supervision) dated October 19, 2007 No. 703 «On approval of Methodological instructions on project development of norms of waste emergence and restrictions for their distribution»;
- Order of RF MNR (Ministry of Natural Resources) dated December 2, 2002 No. 786 «On approval of the federal classification waste catalogue»;
- GOST (State Standard) 30773-2001 Cost-effective use of resources. Waste treatment. Technological cycle stages. Main provisions;
- GOST (State Standard) 1639-93 Non-ferrous metal scrap and alloy waste. General technical conditions (including Amendment No. 1);
- Sanitary regulations on gathering, storage, transportation and primary processing of secondary raw material. Sanitary rules (SR) dated January, 22, 1982 No. 2524-82 are accepted by the Order of the USSR Chief State Medical Officer of January 22, 1982 No. 2524-82;
- Enactment of the Government of the Russian Federation of July 17, 2003 No. 442 “On transboundary waste transportation”.

Regional and municipal regulatory documents

- Enactment of the Governor of Murmansk region dated April 21, 2000 No. 165-PZ "On the order of gathering and utilization of metal mercury, processed bulbs containing mercury, mercury-filled devices and maintenance of demercurization works";
- Enactment of the Government of Murmansk region dated February 22, 2008 г. No. 74-пп/3 "On concept of optimization of consumption waste management in Murmansk region";
- Decision of the Deputy board of Murmansk of October 3, 2007 No. 40-488 "On approval of the Regulation on order of industrial and consumption waste treatment in the territory of municipal district of Murmansk".

International regulatory acts

- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal of March 22, 1989;
- International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78).

4.3 Description of considered alternatives

Zero option

Preservation of the existing waste treatment in the region will lead to further garbage accumulation, increase of ecological stress and further aggravation of sanitary situation. That is why the zero project option cannot be applied in this case.

First option

It is planned to organize industrial processes in the building of the former Severstalproyekt plant (The capacity of waste segregation line in this case shall be 50,000 tons a year)

Second option

According to the second option, two new complexes are to be built of 35,000 tons a year capacity each.

The first option is preferable from the environmental point of view. At the same time development of both project realization options is being carried out in view of material expenses and waste transportation distance.

4.4 Characteristic of sources and types of environmental impact

To define levels of effect of project realization it is necessary to single out main project stages such as pre-project preparation, construction and operation. Project stages imply activities varying according to scale, effect and exposure degree; therefore effect degree differs at each stage.

The following staged have been singled out for this project:

- Pre-project preparation
  - Investigations
- Construction
  - Construction of new buildings (in case of the second option) and communication line admission
  - Installation of equipment in the corresponding building
- Operation
  - Waste segregation complex operation in normal conditions

On the basis of the information gathered as of the time of estimation possible impact on the environment and population has been drawn up (see Table 4-5).

Table 4-5 Possible impacts on environment and population arisen from project's implementation

Planned works: / Impact on:	Project preparation	Option 1: Installation Of equipments in existing building	Option 2: Construction Of new buildings, installation Of equipments	Operation
Environment:				
Soils				
Surface water				
Subsoil water				
Air				
Wildlife				
Flora				
Fauna				
Social and economic environment				
Forced resettlement				
Transport				
Economic development				
Employment				
Health and safety of population				
Health and safety of staff				
Nature and culture heritage				

Impact level
Heavy (negative)
Medium (negative)
Weak (negative)
Neutral
Positive effect

Expected positive impact

Environmental impact

The WSC project has strategic significance for Murmansk region; its realization will be the initial step towards sustainable waste management of the region.

This approach minimizes transport mileage, simplifies garbage storage system, cuts the number of dumps and landfills, helps to return valuable secondary raw materials into goods turnover.

Construction of WSC makes it possible to significantly decrease ecological stress on the region and to improve the sanitary situation, and hence solve the SDW problem as a whole and in the long run, create an arranged industrial infrastructure for industrial waste processing and recycling.

Separation of plastic waste from the whole waste mass intended for burning at a waste incineration plant will in general lead to decrease of dioxide discharge that get into the atmosphere during plastic incineration and which are cancerogenic. This means that the sanitary situation and health of the population in general will improve.

It is SDW segregation that allows using them for a second time as a secondary raw material source with minimum environmental losses and comparatively low economic expenses.

The technological process of SDW segregation and pressing is at present the most environmentally safe method of utilization and burying of domestic waste.

Social impact

Positive social impact of project realization includes an increase in population employment in this field. Construction of a complex for waste segregation enables creation of additional working places and employment of 30 people.

The project assumes a gradual introduction of preliminary segregation of garbage by the city residents and gathering of commercial waste in separate containers. The housing maintenance and utility service and the city population will gain a direct profit due to this project, the housing maintenance and utility service will pay less for garbage removal.

It is also important that waste segregation and recycling, a new branch of industry in the region, will be developed.Thus the enterprise ORKO-Invest and the whole region will have the possibility to develop new markets and get profit.

Introduction of this technological process of SDW segregation and pressing leads to significant economic and environmental effects that imply the following:

- Increase of operation term of the landfill in 3-4 times and decrease of its square in 5-6 times;
- Decrease of biological and chemical activity of briquetted waste and hence decrease of emission of gases and liquid discharges and exclusion of spontaneous ignition possibility;
- Elimination of distribution of light waste with the wind;
- Low moisture content of briquetted waste and high briquette density that allows no precipitation from the atmosphere and contributes to slow-down of anaerobic processes; this helps to decrease biogas formation in unit time and contamination of ground waters;
- A significant simplification of landfill operation process;
- Decrease by 70-75% of the amount of soil for coverage of waste and landfill remediation;
- Cut in transportation costs for waste transportation in 6-8 times because of their high density (for briquette transportation normal lorries with platforms instead of special cars are used);
- Possibility of extraction and further use of secondary raw material;
- During landfill operation there shall be no more need in compactors for waste compression, the need in other special equipment goes down, only automatic loaders and manipulators are required;
- The work zone of car unloading is reduced;
- Work with SDW gets more technological, environment safe and aesthetic that has a certain social significance;
- Favourable breeding conditions are created for rodents, birds, and stray pets.

In the course of project realization negative impact on the environment and population is also inevitable. For the summarized description of the negative impact on the environment and population see the table below:

Table 4-5 Description of impact on the environment and population from project realization

Production processes	Impact on:	Description
Construction		
Option 1 – equipment installation in the existing building		
Transportation of new equipment	Air Traffic flows	Most likely new equipment transportation will be done in lorries operating on diesel fuel. Diesel engines are characterized by high soot discharge emerging as a result of fuel overloading. Soot is enriched with cancerogenic hydrocarbons and minor elements; their discharge into the atmosphere shall not be permitted. Due to the fact that processed gases get into the lower atmosphere layer and the process of their dispersal varies much from the process of dispersal of high stationary sources dangerous elements are practically situated in human breathing area. During transportation of new equipment stress on the existing transport flow will increase. However, it is important to note that the impact at the construction stage has a temporal and local character
New equipment installation	Staff health and safety	In the course of new equipment installation casualties are possible among the staff engaged in installation work.
Refit of the inner space	Staff health and safety	In the course of repair work connected with refit of the existing room casualties are possible among the staff engaged in repair work.
Territory planning, asphalt work	Soils Flora Staff health and safety	Works connected with territory amenities may cause insignificant influence on soils (for example, removal of the upper soil layer (0-5 sm)), as well as on the flora.
Option 2 – new building construction and equipment installation		
Construction work	Soils Subsoil water Air Flora Staff health and safety Traffic flows Forced resettlement	The strongest impact during the construction stage is expected in case the second option is chosen (construction of two new complexes). Construction work will directly influence soils and subsoil water (foundation pit digging, soil layer removal, removal of vegetation); air (discharges from the construction equipment); staff health and safety job-related accidents); social sphere (possible resettlement of the local inhabitants from the sanitary protection zone of the future enterprises) .
New equipment transportation	Air Traffic flows	Most likely new equipment transportation will be done in lorries operating on diesel fuel. Diesel engines are characterized by high soot discharge

<table>
<tr><th>Production processes</th><th>Impact on:</th><th>Description</th></tr>
<tr><td></td><td></td><td>emerging as a result of fuel overloading. Soot is enriched with cancerogenic hydrocarbons and minor elements; their discharge into the atmosphere shall not be permitted. Due to the fact that processed gases get into the lower atmosphere layer and the process of their dispersal varies much from the process of dispersal of high stationary sources dangerous elements are practically situated in human breathing area.
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<tr><td>Refit of the inner space</td><td>Staff health and safety</td><td>In the course of repair work connected with refit of the existing room casualties are possible among the staff engaged in repair work.</td></tr>
<tr><td colspan="3">Operation</td></tr>
<tr><td>Waste transportation</td><td>Air
Traffic flows
Staff and population health and safety</td><td>Discharges into the atmosphere will be caused by garbage collectors delivering waste to be classified, tailings to the landfill or garbage incineration plant that is also a part of this project. Garbage collectors are lorries that operate on diesel fuel.
Diesel engines are characterized by high soot discharge emerging as a result of fuel overloading. Soot is enriched with cancerogenic hydrocarbons and minor elements; their discharge into the atmosphere shall not be permitted. Due to the fact that processed gases get into the lower atmosphere layer and the process of their dispersal varies much from the process of dispersal of high stationary sources dangerous elements are practically situated in human breathing area.
During transportation of new equipment stress on the existing traffic flow will increase.

Discharge (% in terms of volume) of elements during diesel engine operation

<table><tr><th>Pollutant</th><th>% in terms of volume</th></tr><tr><td>Carbonic oxide</td><td>0.01-0.5</td></tr><tr><td>Nitrogen oxide</td><td>0.002-0.5</td></tr><tr><td>Hydrocarbons</td><td>0.009-0.5</td></tr><tr><td>Benzpyrene</td><td>Up to 10 mkg/m3</td></tr></table>
Indirect air impact can also imply discharges into</td></tr>
</table>

Production processes	Impact on:	Description
		the atmosphere of incineration of non-utilizable waste part at the waste incineration plant. During waste transportation by garbage collectors noise impact on the environment is inevitable. Waste transportation will impose more stress on the existing city traffic flows and increase the risk of road accidents that will have negative influence on the population health and security.
Loading/unloading of waste/secondary raw material	Staff health	Impact on the staff caused by evaporation of toxic elements
Segregation	Staff health and safety Working area air	Impact on the staff caused by evaporation of toxic elements
Removal of tailings to the landfill	Air Soil Subsoil water	In the course of waste segregation a part of the waste cannot be used hereafter and shall be buried at a landfill or burnt at the dump that has an indirect negative impact concerning in the first place the air, soils and subsoil water Here toxic waste (class of hazard 1-3) shall be considered that is formed in the course of WSC operation such as mercury bulbs, accumulators, and processed oils. This waste requires special treatment methods at special enterprises and has no commercial value (excluding processed oil that is accepted for reprocessing).
Water supply/sewage system	Surface waters (through the central sewage system)	In the course of technological process of waste segregation industrial sewage waters emerge that will later be discharged into the industrial sewage system. Sewage treatment at the complex equipment is designed. Apart from this domestic and service facilities using the central water supply system will be organized. Domestic and service sewage disposal will be as well organized through the sewage system.

The preferable option from the point of view of environmental impact is the first option since it implies the least environmental negative impact (as can be concluded from Table 4-5).

4.5 Measures for prevention of unfavourable environmental impacts of IEP implementation

Measures for prevention of negative environmental impact from project realization are represented in Table 4-6.

Table 4-6 Measures for prevention of negative environmental impact from project realization

Production processes	Impact	Risk	Impact prevention measures
Construction			
Option 1 – equipment installation in the existing building			
New equipment transportation	Pollutant discharges from transport/ increase of stress on city traffic flows	Low	Fitting lorries with special gas-cleaning filters. Since this impact has a temporal and local character and concerns subcontracting organizations no special measures shall be taken by the project operator. The operator's role has a controlling character.
New equipment installation	Job-related accidents	Low	In the course of the work all workers shall observe occupational safety requirements at the object in accordance with SanPin12-04-2002
Refit of the inner space	Job-related accidents	Low	In the course of the work all workers shall observe occupational safety requirements at the object in accordance with SanPin12-04-2002
Territory planning, asphalt work	• Fertile soil layer removal, • Flora degradation • Job-related accidents	Medium	Territory amenities: amenity planting, artificial landscape creation. Occupational safety requirement observance.
Option 2 – construction of new buildings and equipment installation			
Construction works: Foundation pit digging, territory planning, various work types of construction equipment	Natural landscape and flora disturbance/ fertile soil layer removal	Medium	Territory amenities: amenity planting, artificial landscape creation.
	Pollutant discharge in the atmosphere from construction equipment	Medium	Pollutant discharge from construction equipment has a temporal and local character so no special measures on impact prevention shall be taken.
	Soil contamination (by oil products and construction materials)	Medium	Oil product spill prevention measures: transport tanking will be carried out at a special asphalted territory; all possible oil product spills will be removed from the soil surface. Contaminated soil will

Production processes	Impact	Risk	Impact prevention measures
Construction			
			be stored in air-tight containers.
	Waste formation	Medium	Waste forming in the course of construction will be accumulated at a specially allocated place. Dangerous waste (class of hazard 1-3) will be stored in conditions safe for the environment: mercury bulbs – in a closed metal container, processed oils and chemicals – in an air-tight container with a tray etc. All waste will be removed from the object territory in time.
	Job-related accidents	Medium	In the course of the work all workers shall observe occupational safety requirements at the object in accordance with SanPin12-04-2002.
	Forced resettlement	Low	A sanitary protection area will be organized for this type of enterprise the size of which shall be 500 m according to SanPin 2.2.1/2.1.1.1200-03. Object location shall be carried out with account to the sanitary protection area otherwise population shall be resettled from this area.
	Increase in city traffic flow intensity	Low	-
New equipment transportation	Pollutant discharges from transport/increase of stress on city traffic flows	Low	Fitting lorries with special gas-cleaning filters. Since this impact has a temporal and local character and concerns subcontracting organizations no special measures shall be taken by the project operator.
New equipment installation	Job-related injuries	Low	In the course of work all workers shall observe occupational safety requirements at the object in accordance with SanPin12-04-2002.
Refit if the inner space	Job-related injuries	Low	In the course of the work all workers shall observe occupational safety requirements at the object in accordance with SanPin12-04-2002.

Production processes	Impact	Risk	Impact prevention measures
Construction			
	Operation		
Waste transportation	Pollutant discharges from transport/ increase of stress on city traffic flows	Low	Fitting lorries with special gas-cleaning filters.
Loading/unloading of waste/secondary raw material	Job-related accidents	Low	In the course of work all workers shall observe occupational safety requirements (use of Personal Protective Equipment(PPE)).
Segregation	Job-related accidents Toxic evaporations from the waste	Medium	In the course of work all workers shall observe occupational safety requirements (use of Personal Protective Equipment(PPE)). The room housing the classifying conveyor will be mounted with gas-cleaning equipment with sufficient ventilation.
Pressing and briquetting	Job-related accidents	Medium	In the course of work all workers shall observe occupational safety requirements (including use of PPE).
Removal of tailings to the landfill	Waste ("tailing") formation	Low	All waste forming in the course of production will be stored in conditions safe for the environment and removed from the territory of the enterprise in time.
Water supply/sewage system	Discharge of industrial and domestic and service sewage waters	Low	Industrial sewage water treatment will be undertaken by the plant equipment. Domestic and service sewage water will be discharged into the central sewage system and is not supposed to be preliminary treated in accordance with Russian requirements.
-	Rainfall discharge	Low	Gathering of rainfall discharge will be carried out with the help of a collector. No treatment is stipulated.

4.6 Justification of necessity to perform additional engineering surveys

There is no need to carry out an engineering survey for project realization according to the first option since the production project will be adjusted in an existing building with all communication lines available. Project documentation will be required for project realization.

It makes sense to conduct an additional marketing inspection with the emphasis on processing enterprises presence in the region.

In case the second option is chosen it will be necessary to conduct engineering and environmental survey and develop project documentation on its basis.

4.7 Draft of the List of environmental conditions

In course of designing, construction and operation of the object, the ecological requirements to the object should be taken in consideration, whose short list is presented below:

- Observance of key requirements on allocation of the object (for example, absence of objects residential area as well enterprises of food and pharmaceutical industries in the sanitary buffer zone of the design STP)
- Observance of key requirements regarding operations in water protection zone.
- Minimization of emission from stationary and mobile sources (compliance with permissible limits)
- Minimization of noise impact (compliance of noise level with permissible limits)
- Organization of industrial, domestic and storm water drainages providing for minimization of surface, subsoil water and relief pollution (compliance of pollutants' concentration with permissible limits)
- Waste disposal with regard to the safe conditions for environment (compliance of disposed volume with permissible limits and approved conditions of disposal).
- Minimization of waste / maximum recycling
- Norm-setting of impact on sewage treatment facilities (discharges, emission, waste and noise)
- Payable impact on sewage treatment facilities (discharges, emission, waste and noise)
- Safe handling chemicals
- Providing the safe labor conditions (observance of safety measures, providing the proper labor conditions, including work area air control)

5 IMPLEMENTATION PROGRAM OF INVESTMENT ENVIRONMENTAL PROJECT

5.1 Specifications for major and auxiliary equipment procured within the frame of IEP

The following main equipment is to be installed at the WSC: a belt conveyor, a briquetting press, a crusher and a cutter. Technical specifications of this equipment (as exemplified by equipment produced by the company Stanko Agregat (Станко Агрегат) can be seen below.

Belt conveyer

The conveyer has a system of electric drive motor frequency regulation that enables regulation of the conveyer speed and is mounted with an emergency stop system. Climate work conditions: boreal climate 4, category 3 GOST (State Standard of the Russian Federation) 15150-69.

Table 5-1 Main technical characteristics of the belt conveyer

Technical characteristics	Index
Productivity, t/hour	36
Belt width, mm	1,200
Drive power, kV	5.6
Transportation speed, m/min	6-24
Cylinder diameter, mm	376

Briquetting press

Table 5-2 Main technical characteristics of the briquetting press

Technical characteristics	Index
Pile size, mm: width	800
height	1000
length	1000 –: 1500
Pile weight, t	Up to 0.95
Final density of the pressed material in the pile, t/m3	0.9
Binding (automatic)	4 rows
Binding wire diameter, mm	3.0...3.5
Productivity, t/hour at the original material density 0.2 t/m3	20
Compression force, t	120
Unit compression pressure, kg/sm	15
Working pressure in the hydraulic system, MPa	25
Annual oil consumption for reducing gear oiling, l	16
Regulation on oil change in the reducing gears	once in 6 months
Annual lubricant consumption TSIATIM-201 (ЦИАТИМ-201) GOST (State Standard of the Russian Federation) 6267-74, kg	2

Regulation on lubricant change in bearings	once in 3 months
Gross installed capacity of electrical power consumers, kV	83.09
Maximum power demand in operation mode, kV	64
Weight, kg	29,500
Dimensions: length	16,000
Width	6,500
Height	3,500

Crusher

Rotary crusher is designed for breaking big cardboard and paper sheets. The crusher is included into the waste segregation complex. It is a welded construction with a mounted loading hopper where waste is fed into, a processing chamber, a rotor, a fixed knife unit and fencing.

The rotor is turned by an electric motor through a V-belt drive. Cardboard or paper get into the inner space of the crusher through the loading hopper. They pass through the fixed knife unit and the turning rotor, where big cardboard and paper pieces are broken, and then they get onto the conveyer that runs below the crusher. Climate work conditions: boreal climate 4, category 3 GOST (State Standard of the Russian Federation) 15150-69.

Table 5-3 Main technical characteristics of the crusher

Technical characteristics	Index
Crusher productivity, t/hour	4
Rotary speed, RPM	682
Power of electric motor drive, kV	15
Rotary speed of the motor shaft, RPM	975
Dimensions, mm: length	2,000
Width	1,900
Height	1,700
Entrance gate section, m	0.7*1.4
Loading chamber volume, m3	1.2
Annual lubricant consumption TSIATIM-201 (ЦИАТИМ – 201) GOST 6267-74 (TSIATIM-203 (ЦИАТИМ – 203) GOST 8773-73), g	Up to 30
Regulations on lubricant change in the bearings	Once a year
Weight, kg	2,100

Cutter

The cutter is designed for breaking production waste of plastic masses obtained by injection moulding as well as for breaking holders of the above mentioned material for their repeated use as raw material.

The cutter is a machine of rotary type; its main units are a processing chamber with two fixed knives and a rotor turning inside it, 500 mm long with three legs.

The rotation is transported to the rotor through a belt drive. Plastic mass is fed into the box through a side hole closed with three doors.

Big plastic pieces are broken in the fixed knife unit and turning rotor and through the calibration grate get into containers (of the Customer) situated below the cutter.

Table 5-4 Main technical characteristics of the cutter

Technical characteristics	Index
Productivity, kg/hour	80
Rotary speed, RPM	557
Rotor diameter, mm	300
Power of the electrical motor drive, kV	15
Dimensions, mm: length	1,000
width	870
height	1,530
Size of processed thermoplastic waste with wall thickness not more than 5 mm, mm	480 x 200 x 160
Diameter of the calibration grate holes, mm	12 or 22
Annual lubricant consumption TSIATIM-202 (ЦИАТИМ – 202) GOST 11110-75, g	Up to 50
Weight, kg	716

5.2 Program of project production

5.2.1 Raw material and logistics support of production (raw materials, transportation network, major vendors of stock and materials)

Raw material basis for project realization is comprised of waste that will be used for secondary raw material production.
SDW can be obtained from two sources:
– residential buildings;
– administrative buildings, institutions and public enterprises.
Thus the main suppliers of waste (raw material) for the projected line are the population of the municipal residential areas of Murmansk, Kola region and Severomorsk, as well as industrial, commercial, domestic and other enterprises of all property category, organizations and institutions that produce consumption waste (SDW) and industrial waste.

Waste Paper
Waste papers are used as a secondary material in producing paper (correspondence paper, printing paper and toilet paper), packing board and roofing, insulating and other construction materials. The use of waste paper considerably reduces the use of timber (a ton of waste paper can replace 4 cubic meters of wood) and, consequently, deforestation.

Waste Paper Classification

In Russia and the CIS, waste paper and waste cardboard is procured and purchased pursuant to GOST 10700-97. It classifies the following groups and grades of waste paper (briefly):

- **GROUP "A"** – high quality waste paper.
  - grade MS-1A – white paper production waste (except newspaper).
  - grade MS-2A – production waste for all types of white paper in the form of trimmings with ruling and a black-and-white or colored stripe.
  - grade MS-3A – sulfate brown pulp paper production waste.
  - grade MS-4A – used non-moisture-proof paper bags.
- **GROUP "B"** – medium quality waste paper.
  - grade MS-5B – corrugated board and its components production and consumption waste.
  - grade MS-6B – printed board production and consumption waste.
  - grade MS-7B – used books, magazines, brochures, catalogs, note pads and other printing and paper products made of white paper with no binders, covers or backs.
- **GROUP "V"** – low quality waste paper.
  - grade MS-8V – newspaper production and consumption waste.
  - grade MS-9V – paper cartridges, paper spools, paper inserts.
  - grade MS-10V – cast paper products.
  - grade MS-11V – coated and saturated paper and cardboard production and consumption waste.
  - grade MS-12V – black and brown paper and cardboard production and consumption waste, waste of carbon paper, etc.
  - grade MS-13V – cardboard, white and colored (except black and brown) paper production and consumption waste.

Plastic

Classification of plastic waste

Reworked plastic is:

- PET — Polyethyleneterephthalate
- PVC — Polyvinylchloride
- PP — Polypropylene
- HDPE — High-density polyethylene
- HPP — High-pressure polyethylene
- PW — Polyethylene wax
- PA — Polyamide
- ABS — Acrylonitrile butadiene styrene
- PS — Polystyrene
- PC — Polycarbonate
- PBT — Polybutylene terephthalate

According to the estimates by National Research Center for Resource and Waste Management (NICPURO), in the overall polymeric waste structure
- polyethylene waste is 34%,
- PET - 20.4%,
- laminated paper - 17%,
- PVC – 13.6 %,
- Polystyrene – 7.6 %
- Polypropylene – 7.4 %

The polyethylene waste is best collected and recycled (20%); 10% of PVC waste is recycled. Recycling of the polystyrene waste constitutes 12%, polypropylene – 17%, PET – 12%. The laminated paper waste is practically non-collectible and non-recyclable.

Metal scrap

Non-ferrous scrap classification:

- Copper scrap: metal processing waste and other waste.
- Copper alloy scrap: copper alloy waste (brass, bronze, tombac)
- Aluminum scrap: various aluminum and aluminum alloy scrap.
- Magnesium scrap: plane scrap.
- Titanium scrap: plane and ship scrap of titanium alloys.
- Lead scrap: accumulator and cable scrap.
- Rare-metal scrap: complicated alloy scrap and high-quality production waste.
- Semiconductor scrap: electronic industry waste.

5.3 Project production marketing program

5.3.1 Project production marketing outlets

The project production is secondary raw material obtained after SDW segregation, particularly plastic, waste paper, non-ferrous metals (aluminum).

Metal scrap

Average price for aluminum in Russia is 20 rubles per kilogram.

Processing Companies

In Russia, the main metal scrap processing companies are:

- *Profit* JSC (Urals), as part of mining company *MMK* JSC, *Vtorchermet* JSC (entire North-West of Russia) - since 2007.
- *Vtorchermet* JSC, as part of Russian mining company *Severstal* JSC),
- *Vtormetproekt*, *Vtortsvetmet* JSC (Moscow and Moscow Region);
- *Maxi-Scrap Siberia* LLC, *Obyedinenie Vtorchermet* JSC (Novosibirsk Region);

Scrap yards are spread in Murmansk region, among them are Sevzapgeoresurs LLC (ООО «Севзапгеоресурс»), the company EKO-Komfort («ЭКО-Комфорт»).

Consumers

The primary consumers of metal scrap are metals companies, the biggest of which are Severstal, Novolipetsk Metallurgy Works (NLMK), Magnitogorsk Metallurgy Works (MMK), Oskol Electric Metallurgy Works (OMK), Volzhsky Pipe Plant (VTZ), Taganrog Metallurgy Works (TMK), *Kransy Oktyabr* Metallurgy Works (Volgograd) and some others.

Russia is a major metal scrap exporter. The major market outlets are Turkey (one third of the entire export), then Spain, Greece, Italy – together 25 %, and then China and Korea – 16 %.

Waste Paper

About 80 waste paper collection plants work in Russia. See the list of those at http://www.rospress.ru/sbormak.html

The major Russian waste paper processors are *St-Petersubrg KPK* JSC (part of *Ilim Pulp Enterprise* forestry holding, up to 18% of the market), *Naberezhnye Chelny KBK* JSC (10.5 %), Aleksin KF (12.1 %), *Stupino KPK* LLC (10 %), *Kartontara* JSC (Maikop, 9 %). Each of them processes more than 100 thousand tons of waste paper yearly. Balakhna Cardboard

Mill, Perm Paper Mill, Svetogorsk Paper Mill, Ryazan Cardboard and Felt Plant, *Karavaevo* JSC can process 20-50 thousand tons/year. The capacities of other processors are 20 thousand tons/year and less.

Large paper mills also have waste paper processing plants or shops. For instance, a waste paper processing plant with the capacity of 80 tons of air-dry weight per day works at Kamennogorsk Offset Paper Plant (Leningrad Region, Russia, SZLK Group).

Consumers
The main waste paper consumers are paper mills (more than 50% of recycled products), package plants, construction materials plants, etc.
The primary waste paper suppliers dealing with paper and cardboard arere printing works, package manufacturers), trade enterprises, especially larger networks, and, to a lesser extent, waste paper collection (including domestic collection) companies.
The table below shows waste paper prices as of October 2009.

Table 5-5 Waste Paper Prices (Different Grades) as of October 2009

Type of paper	Price	Region
Sale		
МС-5Б/3	4,200 RUB/t	Nizhny Novgorod region
МС-5Б	3,900 RUB/t	Samara region
МС-5Б and МС-8В	3,000 RUB/t	Yaroslavl region
Buy		
Pressed cardboard, piles of 400-500kg	4,000 RUB/t	Chelyabinsk region
МС-5Б/3	4,200 RUB/t	Nizhny Novgorod region
МС-5Б	3,900 RUB/t	Samara region

Plastic

Primary plastic waste recycling plants:

- *TcheslavpolymerDon* LLC (Rostov Region) built in 2008
- *Christie International Ltd* JSC (St. Petersburg)
- Plastic recycling plant (Sverdlovsk Region): test startup was performed in early 2009
- LLC Polymer (Kaluga)
- AngarskPoly-M (Irkutsk Region)
- LLC “Vtorplast” (Vladimir Region)
- LLC “NPL Plastic” (Tver Region)
- LLC “PET Technology” (Moscow)

In Murmansk region polymer waste is accepted for processing in Apatity and Murmansk (Polimer K («Полимер К»)).

Plastic Waste Consumers

The primary demand for polymeric waste is generated by fresh material processers, i.e. manufacturers of plastic products, e.g. packages, bags, bottles, tare, plastic pipes, construction materials. Such companies recycle in-house waste and purchase industrial and domestic waste from third parties. Sometimes, they sell in-house waste. However, the yield is not high (rarely more than 50 tons/month).
The table below shows prices for plastic waste in different Regions.

Table 5-6 Plastic waste prices as of October 2009

Waste type	Price (RUB/kg)	Region
Cuts of window PVC, siding. Unmarketable goods	20	Kaluga region
УПМ, УПП, ПСМ, ПСС brand polystyrene waste	Up to 27	The city of Moscow
HDPE276(cans of natural colour)	15	The city of Moscow
Stretch and high pressure film in packs (without admixtures)	5-10	The city of Moscow
HDPE (of molding brands)	Up to 20	The city of Moscow
Cuts of window profile PVC, PVC panel waste, PVC pipes	30	The city of Moscow
PA waste including filled PA of any type	20	The city of Moscow
PVC : unmarketable goods, warehouse remains, waste: cable and shoes plasticized rubber of ПЛП-2, ПЛ-1,ПЛ-2,Ом-40,И-40, НГП brands	5-20	Nizhny Novgorod region
HPP and piled stretch	5-15	Novosibirsk region
Secondary granulated HDPE	Up to 40	Tver region
HDPE chips, black colour, of convoluted pipes	22	The Republic of Bashkortostan
Foil-clad polystyrol. УПМ belt cutting of white colour	21	Belgorod region
PVC (window profile)	30	Vladimir region
Classified, pressed, landfill	9	Krasnoyarsk Territory

PET bottles		
Used PP in the form of accumulator housing	8	Kursk region
HPP film. From 40 th/month	12	Kursk region

6 FINANCIAL EFFICIENCY OF INVESTMENT ENVIRONMENTAL PROJECT

The financial analysis concentrates on assessing the financial feasibility of the proposed investment. The analysis will be based on constant prices, meaning that the effects of inflations are excluded from the analysis, which makes it possible to compare the costs and revenues in different years.

To be able to assess the financial feasibility of the Sewage Water Treatment Plant, the investment and costs of waste water treatment involved in the new plant, will be compared to the additional revenues to be generated by calculating the Net Present Value of these numbers with a discount rate of 13% (source CIA World Fact Book).

Paragraph 6.1 will first elaborate on the required investments. The next session assesses the additional revenues, whereas the additional costs are presented in paragraph 6.3. In the final section these numbers are compared by calculating the Net Present Value.

Analysis of the financial feasibility of the project has been carried out on the basis of data presented by Orko-Invest considered as reliable as well as on the basis of information on similar projects.

6.1 Value and structure of investment to IEP

Project envisages segregation of three types of waste into secondary resources – paper/cardboard, plastic and non-ferrous metals.
Two options of project implementations are being considered now:

1) One facility in the existing building (capacity – 50,000 tons) and
2) 2 new complexes (capacity – 35,000 tons each).

It is assumed that the lines will be in production about 2,000 hours per annum, and that the capacities will be as follows:

- Existing building: 25 ton/hr

Or:

- New building, line 1: 17.5 ton/hr
- New building, line 2: 17.5 ton/hr

Table below demonstrates the volume of investments for both options.

Table 6-1. Volume of investments for both options of waste separation lines (measurement unit - thousand roubles)

№	UNIT	INVESTMENT OPTION 1	INVESTMENT OPTION 2
	Waste separation lines		
1	- Preparation (design, research)	17,000	19,000
2	- Civil works	76,000	108,000
3	- Plant Equipment	88,000	125,000
4	- Mobile equipment	15,000	22,000
5	Sub total waste separation	**196,000**	**174,000**
	Post treatment		
6	- Baler	4,500	8,000
7	- Wood shredder	1,000	3,000

8	- Crusher	9,500	15,000
	Sub total post treatment	**15,000**	**26,000**
	TOTAL INVESTMENT	**211,000**	**300,000**

Design and research works will be performed for about one year or one year and a half; construction – 3 years. The investment plan on the project is shown below.

Table 6-2 Time schedule for investment

№	stage	Years			
		2010	2011	2012	2013
1	Design and research works				
2	Construction				
Payment (thousand roubles)		**19,000**	**140,000**	**141,000**	

6.2 Expected income of the project implementation

The expected income of the project's implementation will be formed by sale of secondary raw materials received from three components of waste amounting to 28% of the total amount of SDW in Murmansk:

Paper / cardboard; approximately 24% of the total
Plastic: approximately 20% of the total
Non-ferrous metals, mainly aluminum: 2.7% of the total

The price for recycled plastic in Russia is 5-27 RUR per kilo. We will assume here an average price of 5 RUR/kilo assuming mostly low grade plastics.

The market price for paper/cardboard is 2 RUR/kg, and for aluminum 20 RUR/kg

In addition to these revenues, a gate fee for all waste of 340 RUR/m3, or 50 RUR per ton, is taken into account, which is assumed to remain constant during the project duration. An estimate of the revenues is shown in table below.

Table 6-3 Estimated additional revenues

Waste composition	Composition	material ton/year	Price RUR/ton	Total revenue RUR/year
Solid nunicipal waste	100%	70, 000	50	3, 500.000
Organics	23.6%			
Paper/cardboard	24.3%	17, 010	2, 000	34,020.000
PVC/plastics	15.6%	10, 920	5, 000	54,600.000
Glass	13.4%			
Ferro metals	1.1%			
Non ferro metals (mainly aluminium)	2.7%	1, 890	20, 000	37, 800.000
Textile/leather/rubber	4.4%			
Wood	0.5%			
Hazardous	0			
Others (sludge, wrecks etc)	14.4%			
Total	**100.0%**			**129,920.000**

6.3 Evaluation of expenses for production

Details about the operation and maintenance costs are not yet known in this stage of the project.
It is assumed that the operation and maintenance costs will amount to 3% of the capital investment per year. A typical breakdown of O&M costs is as follows:

- Labour : 40%
- Energy: 20%
- Maintenance: 20%
- Others (interest, consumables, overhead) : 20%

Based on this breakdown, the O&M costs are as follows:

Table 6-4 Estimated O&M costs waste segregation facility

Cost item	Composition	Total O&M costs (RUR/year)
Labour	40%	3,600.000
Energy	20%	1,800.000
Maintenance	20%	1,800.000
Others (interest, consumables, overhead)	20%	1,800.000
Total O&M Costs	**100,0%**	**9,000.000**

6.4 Indices of financial efficiency of IEP

The cash flow analysis based on the above estimates has been carried out taking into account the subsequent 10 years provided that the current prices will be retained at the same level so as to evaluate the financial feasibility of the project on construction of WSC (70,000 tons per year).

The following parameters are used in the analysis:

- Internal Rate of Return (IRR). This parameter calculates the profitability of a series of cashflows. It is the interest rate at which the costs of investments lead to benefits of the investment. An investment is considered acceptable if its IRR is greater than the minimum acceptable rate of return (often the cost of capital, e.g. the CIRR which is 2.85% (source: OECD) in the EU region);
- Net Present Value (NPV). A positive NPV means that the proposed investment is acceptable, given a certain discount rate (13% in this case);
- Payback period. This parameter calculates the period of time required to return the on investment to repay the sum of the original investment. The shorter the payback period, the more preferable the investment.

The cashflow analysis is summarised below.

Table 6-5 Cash flow analyses

[redacted]

Assumption	IRR	NPV	Payback period
Base case scenario	0.25%	235,560	6 years + 5.37 monthes

6.5 Analysis of the project financial efficiency indices sensitivity

In order to test the sensitivity of the project, we have carried out a cashflow analysis for various scenarios:

- Best case scenario: revenues increased with +10%, operational costs and construction costs decreased with -10%;
- A scenario in which the revenues are increased with +10%;
- A scenario in which the revenues are decreased with -10%;
- A scenario in which the operational costs are increased with +10%;
- A scenario in which the operational costs are decreased with -10%;
- A scenario in which the investment is increased with +10%;
- A scenario in which the investment is decreased with -10%.

The following table summarized the results of the analysis.

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Table 6-6 Сводный анализ результатов

Assumption	IRR	NPV	Payback period
Base case scenario	0.25%	235,560	6 лет + 5.37 месяцев
Best case scenario	0.31%	231,432	6 лет
Revenues +10%	0.28%	204,337	6 лет + 2.70 месяцев
Revenues -10%	0.22%	117,919	6 лет + 8.64 месяцев
Operational costs +10%	0.25%	158,135	6 лет + 5.54 месяцев
Operational costs -10%	0.26%	164,121	6 лет + 5.21 месяцев
Investment + 10%	0.23%	137,025	6 лет + 8.14 месяцев
Investment -10%	0.28%	185,231	6 лет + 2.60 месяцев

The analysis shows that the proposed project is feasible, given the positive NPV and payback period being smaller than the economic life of the facility.

6.6 IEP financing

It seems logical, given the amount of the investment, to opt for a co-financing mechanism whereby the Russian authorities provide for part of the required funds and one or more international financing institutes for the rest.
It is recommended for the initiator to apply to the state authorities to obtain part of the financing (20% - thousand RUR 42,000 – 1st option, or thousand RUR 60,000 – 2nd option) for project implementation.

In the frame of municipal target program “Waste management program optimization” Orko-Invest suppose to receive funding for development of design documentation, construction and commissioning of WSC (see the table below).

Volume of financing from local budgets for project funding (thousand rubles):

	Item	2009			2010			2011			2012			2013		
		Local budget		Attracted budget	Local budget	Regional budget	Attracted budget	Local Budget	Regional budget	Attracted budget	Local budget	Regional budget	Attracted budget	Local budget	Regional budget	Attracted budget
		plan	actual	actual												
#	Development of design documentation, construction and comissioning of WSC	0,0	0,0	0,0	3 000,0	0,0	0,0	10 000,0	12 000,0	80 000,0	10 000,0	9 000,0	80 000,0	10 000,0	9 000,0	80 000,0

Partial appropriation of funds for the project implementation is possible from the regional budget within the framework of the long-term targeted program “Wastes” for 2009-2013.
While conducting this study the proven information regarding the funding from the program focal point was absent.

Decision to develop this program was made by the Murmansk oblast Government Decree #74 dated from 22.02.2008 “On concept to optimize solid waste management in Murmansk region”. The state client and the coordinator of this program was represented by the Committee of nature management and environment of Murmansk region (at present - Committee on natural resources and environmental protection of Murmansk region, focal point – Svetlana Bulatova, tel: (8152) 21 00 32).
The objective of this program is reduction of environmental impact resulted from generation of domestic and process wastes.

Volume and funding sources of the program:

1. Regional budget, thousand rubles
   2009 – 16, 800
   2010 – 56, 600
   2011 – 93,150,0
   2012-2013 – 393,700
2. Budgets of municipal organizations, thousand rubles
   2009 – 33,360
   2010 – 62,895
   2011 – 118,295
   2012-2013 – 139,760
3. Attracted funds, thousand rubles
   2009 – 4,500
   2010 – 24,700
   2011 – 439,600
   2012-2013 – 1 223,100

It is recommended for Project initiator to continue negotiations with Russian stakeholders of municipal, regional and federal level.

In August 2009 Royal Haskoning team conducted a number of interviews with representatives of the following organizations – potential donors of this project:

- European Bank of Reconstruction and Development
- International Finance Corporation
- EVD (The Agency for International Business and Cooperation: a branch of the Ministry of Economic Affairs of the Netherlands)
- Council of the Barents Euro-Arctic Region (CBER)
- Northern Dimension Environmental Partnership (NDEP)
- NEFCO
- Committee of Nature Use and Environment of Murmansk region

The financing agencies that showed interest in this type of project are: NDEP; NEFCO; and IFC.
In the tables below is summarized the information on these organizations.

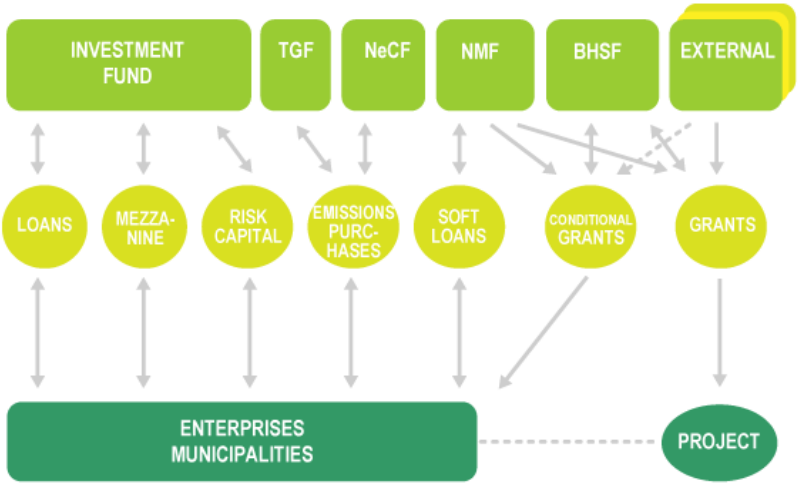
Table 6-7 Summary information on NDEP

Name of funding agency	Northern Dimension Environmental Partnership (NDEP)

Logo of organization	Northern Dimension Environmental Partnership
Name of contact person/ respondent	Jaakko Henttonen NDEP Manager
Contact details of respondent	EBRD, One Exchange Square London EC2A 2JN Tel. +44-2073387186 Fax +44-2073387486 Mobile +44-7802510609 Email: henttonj@ebrd.com
Programmatic priorities of funding agency	1. Waste water 2. Energy efficiency and heating 3. Solid waste
Types of funds administered by agency:	Grants
Type of assistance (grant, loan, ….):	Grants
Objectives:	The purpose of NDEP is to mobilise support for environmental and nuclear safety investments in the Northern Dimension Area by providing grants for concrete projects prepared by the IFIs. The grants are allocated from the NDEP Support Fund which pools significant contributions from partner governments.
Time frame of current round:	Continuous, though decisions of council on project proposals is either in November or December of each year.
Eligibility criteria/ conditions:	The following: 1. Impact on the environment; 2. Geographical location; 3. Co-financing required: they provide 10 – 20 % maximum of a project costs. So other funds to be provided by other agencies through e.g. loan.
Average amount of funding per approved project:	5 million Euro
Information materials on fund:	www.ndep.org and in Russian: http://www.ndep.org/RUS/index.asp For an overview of projects in pipeline: http://www.ndep.org/projects.asp?type=nh&cont=prjh&pageid=15&content=projectlist

Table 6-8 Summary information on NEFCO

Name of funding agency	Nordic Environment Finance Corporation (NEFCO)
Logo of organization	
Name of contact person/ respondent	Henrik G Forsström, Senior Adviser
Contact details of respondent	Henrik G Forsström Senior Adviser NEFCO P.O. Box 249, FIN-00171 HELSINKI, FINLAND Office: Fabianinkatu 34 Telephone: +358 10 618 0638 Mobile: +358 400 888 541 (Russia +7 952 240 5405) Fax: + 358 9 630 976 E-mail: henrik.forsstrom@nefco.fi http://www.nefco.org
Programmatic priorities of funding agency	1. Water and sewerage
	2. Cleaner technologies in industry
	3. Waste
	4. Renewable Energy & Energy Efficiency
	5. Consultancy & Environmental services
	Others: NEFCO targets all forms of environmentally hazardous emissions and discharges, such as greenhouse gases and toxic pollutant.
Types of funds administered by agency:	1. NEFCO Investment Fund
	2. Nordic Environmental Development Fund (NMF)
	3. Environmental Hotspots in the Barents Region (BHSF)
	4. NEFCO Carbon Funds (TGF & NeCF)
	5. Arctic Council Project Support Instrument (PSI)
	6. Project Specific Funds
	Information on each of these funds can readily be obtained through: *http://www.nefco.org/nefco/financing/*
	NEFCO's funding resources (derived from http://www.nefco.org/introduction/funding_resources):

	
Type of assistance (grant, loan, ….):	NEFCO offers loans, subordinated loans and soft credits to enterprises and municipalities, for projects which aim at reducing environmentally hazardous emissions and discharges, such as greenhouse gases and toxic pollutants, within NEFCO's area of operation (Russia, Ukraine and Belarus, and the Baltic countries). NEFCO administers several funds and facilities that in certain cases can provide grants or other funding (such as carbon financing for JI projects under the Kyoto Protocol) for development and implementation of projects of particular benefit to the environment. NEFCO works within a network of partners including other IFIs, international and national organisations (such as the Arctic Council, Barents Euro-Arctic Council and the NPA-Arctic), bilateral and multilateral donors (including the Nordic governments, the EU and the NDEP). NEFCO may also enter into partnerships with local enterprises which carry out environmental projects in countries where it operates. Each project financed by NEFCO must fulfil certain environmental criteria and the reductions in emissions and discharges must be quantifiable. Each project application is carefully analyzed by NEFCO's legal advisors, investment managers and environmental experts.
Objectives:	The basic mission of NEFCO is to promote cost-effective ways to reduce the environmental pollution emanating from regions adjacent to the Nordic countries.
Eligibility criteria/ conditions:	Each project to obtain funding from NEFCO must meet number of environmental criteria including reduction of emissions and discharges. Every project application is to be thoroughly reviewed by NEFCO lawyers, investment managers and experts on environment
Average amount of funding per approved project:	N/A - NEFCO works with small and medium-sized projects (sometimes through specialized facilities using intermediaries for smaller projects). NEFCO may provide up to 5 MEUR as an investment in a single project.
Information materials on fund:	Website www.nefco.org where information can be found and downloaded. Contact NEFCO's information department for paper copies and further information.

Contact person of found representative	Mr Amund Beitnes Investment Manager Telephone: +358 10 618 0658 Mobile: +358 50 311 3684 (Russia +7 921 165 9885) Fax: + 358 9 630 976 E-mail: amund.beitnes@nefco.fi
Tips:	NEFCO works within the framework of the Arctic Council and the Barents Euro-Arctic Council (BEAC). The Energy Efficiency Centers in NW Russia have long experience of working with NEFCO.

Table 6-9 Summary information on IFC

Name of funding agency	International Finance Corporation (IFC)
Logo of organization	
Name of contact person/ respondent	Pavel Kochanov
Contact details of respondent	36, bld.1, Bolshaya Molchanovka str., Moscow, 121069, Russia Tel: +7 (495) 411-7555 (ext.2014) Fax: +7 (495) 411-7563 www.ifc.org
Programmatic priorities of funding agency	1. Private sector development, e.g. industry, financial institutes, agriculture
	2. To a lesser extent: public sector support e.g. infrastructure and health
Types of funds administered by agency:	1. Loans
	2. Equity
	3. Intermediate forms between loans and equity
	4. Guarantees
	5. Purchasing of bonds
	Grants only for preparation of programs – technical assistance Long-term financing which is not available through local commercial banks. Conditions are market-rate.
Type of assistance (grant, loan, ….):	Loans, credits
Objectives:	- Promote private business development in private markets; - Invest is public sector development in order to set conditions for further private sector growth

Eligibility criteria/ conditions:	No formal criteria, but IFC conducts an appraisal of a project, looking at technical, environmental, social, and financial performance.
Average amount of funding per approved project:	Starting from 200 million Russian Rubles, so 7 – 8 million USD.

It should be noted that during communications were discussed the potential possibility of donors to provide financing for this project. Specific requirements towards the project as well as financing terms will be the subject to the future interactions between the project initiator and donors.

For detail review at later stages of project implementation the above organizations may request more information, e.g. detailed economic feasibility, and technical characteristics of the waste segregation complex.
It is recommended to initiator to consider possibility of public-private partnership (PPP).
Public-private partnership (PPP) is a variety of interactions between the government and business for solving of socially important tasks on mutually agreed terms.
The main scope of application of PPP is a construction of autobahns, and the rest is – projects in housing and public utilities.
PPP in housing and public utilities covers investment projects on construction (reconstruction, upgrade) of gas-, water-, heat- and energy supply, water discharge, counting and waste water treatment, waste processing and disposal. These projects are being implemented to the benefit of state and branch development with attracting of private funding which can be substantiated by the profits gained by private partner during the project operation and services payment.
There are some samples of PPP-projects in the area of waste management implemented in the RF.
As example there is a waste processing complex (capacity – 350 th. tons annually) planned to be constructed in Saint Petersburg. This is the first project in the area of waste processing in the North-Western Federal District of Russia which is being implemented with use of PPP-tools.
The project will match the model DCFOT (Design – Construction – Financing – Operation - Transfer) according to the Law of Saint Petersburg “On participation of Saint Petersburg in public-private partnership”.

As for the Murmansk WSC construction project the most effective tool of PPP is use of tariff regulation measures and subsidization of rate of interest out of funds of federal budget.

In particular, revision of waste disposal tariffs (to increase) by the Government of Murmansk region will course to a shorter payback period of the project.
In 2009, the waste disposal tariff in Murmansk in average for residents and industries amounted to 300 RUR/m^3 of wastes. In 2010 according to the forecast of Orko-Invest this tariff will be increased to 340 RUR/m^3 of wastes (put into calculations of financial effectiveness of the project).

Besides, subsidization of interest rate out of funds of regional budget can be effective tool to attract business into project.

7 CONCLUSIONS

7.1 Brief conclusions

The idea of the project consists in creation of a new production on the basis of ORKO-Invest the primary task of which will be introduction of the technology of segregation and complete pressure of solid domestic wastes as well as subsequent sale of secondary raw materials.

The raw material base for the planned production is solid domestic wastes (SDW), that is, wastes formed in residential and public facilities, trade, entertainment, sports and other enterprisers (including wastes from the current repair of apartments).

Project "Construction of waste segregation complex in Murmansk" is not complicated in terms of its technical feasibility.
Waste segregation technology is not innovative and is already applied in waste segregation plants of the regions of Russia. 16 similar complexes with total capacity of 1.5 million tons of waste per year operate in Moscow region.
Similar projects were implemented in the other regions as well, e.g. in Kazan, Tambov and Perm region, Sochi, Lipetsk, Ryazan and Belgorod.

Economic effect for Orko-Invest from the project implementation is deriving the profit from sale of secondary raw materials.

Other parties, like HMU and population are also interested in project implementation. As the project provides for introduction of selective waste disposal, for which an extra container for separate selection of commercially valuable waste will be installed and will be taken away by Orko-Invest LLC free of charge, the total cost of waste disposition services will be reduced for HMU, and therefore a charge for waste disposition services for the population should be smaller.

Environmental impact
The WSC project has strategic significance for Murmansk region; its realization will be the initial step towards sustainable waste management of the region.
This approach minimizes transport mileage, simplifies garbage storage system, cuts the number of dumps and landfills, helps to return valuable secondary raw materials into goods turnover.
Construction of WSC allows minimizing haulage, simplifying waste storage, reducing the number of waste dumps and landfills and providing return of recoverable resources to commodity turnover.
This makes it possible to drastically reduce environmental load on the region and improve sanitary condition, and consequently solve the solid waste problem and set up an organized industrial waste treatment infrastructure comprehensively and in the long run.

Separation of plastic waste from the whole waste mass intended for burning at a waste incineration plant will in general lead to decrease of dioxide discharge that get into the atmosphere during plastic incineration and which are cancerogenic. This means that the sanitary situation and health of the population in general will improve.

Social impact

Positive social impact of project realization includes an increase in population employment in this field. Construction of a complex for waste segregation enables creation of additional working places and employment of 30 people.

The project assumes a gradual introduction of preliminary segregation of garbage by the city residents and gathering of commercial waste in separate containers. The housing maintenance and utility service and the city population will gain a direct profit due to this project, the housing maintenance and utility service will pay less for garbage removal.

It is also important that waste segregation and recycling, a new branch of industry in the region, will be developed. Thus the enterprise ORKO-Invest and the whole region will have the possibility to develop new markets and get profit.

The very segregation of solid domestic wastes allows using them secondary as a source of raw materials with minimal ecological losses and relatively low economic expenses.

The proposed project is feasible, given the positive NPV and payback period being smaller than the economic life of the facility.

It seems logical, given the amount of the investment, to opt for a co-financing mechanism whereby the Russian authorities provide for part of the required funds and one or more international financing institutes for the rest.

At the moment of estimation the question in relation to the provision of financing by the Russian authorities was open.

Aappropriation of funds for the project implementation for project is supposed to be within the municipal program “Optimization of waste management” out of local, regional and attracted budget.

Partial appropriation of funds for the project implementation is also possible from the regional budget within the framework of the program “Wastes” for 2009-2013.

The financing agencies that showed interest in this type of project are: NDEP; NEFCO; and IFC.

7.2 Major risks and uncertainties in connection with IEP implementation

Process risks associated with the project are mainly associated with a raw material deficit because of a decrease in delivered volumes of waste. It is also important to note economical risks that imply possible difficulties in development of the recycled material market, which is new for the area.

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ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ЭКОЛОГИЧЕСКОМУ, ТЕХНОЛОГИЧЕСКОМУ И АТОМНОМУ НАДЗОРУ

ЛИЦЕНЗИЯ

№ ОТ-26-000155 (51) **от 30 января 2007 г.**

На осуществление деятельности

Деятельность по сбору, использованию, обезвреживанию, транспортировке, размещению опасных отходов
(конкретный вид лицензируемой деятельности)

[в соответствии с приложением к настоящей лицензии]

Настоящая лицензия предоставлена юридическому лицу

Общество с ограниченной ответственностью "ОРКО-инвест"
(полное наименование юридического лица с указанием организационно-правовой формы)

ООО "ОРКО-инвест"
(сокращенное наименование юридического лица)

(фирменное наименование юридического лица)

Основной государственный регистрационный номер записи о государственной регистрации юридического лица **1045100212277**

КОПИЯ ВЕРНА
ЗАМ. ДИРЕКТОРА ПО ФЭВ
ООО «ОРКО-ИНВЕСТ»
СОРОКИНА О.Б.

Серия А В № 011141

[State Coat of Arms]

ПРИЛОЖЕНИЕ Лист 1 из 1

к лицензии № ОТ-26-000155 (51) от 30.01.2007 г.
(без лицензии недействительно)

Классы опасности:
[чрезвычайно опасные; умеренно опасные; малоопасные; практически неопасные]

Свойства отходов:
[данные не установлены; токсичность; пожароопасность; опасные свойства отсутствуют]

Виды отходов:
[древесные отходы из натуральной чистой древесины несортированные; шпалы железнодорожные деревянные, пропитанные антисептическими средствами, отработанные и брак; древесные отходы с пропиткой и покрытиями несортированные; отходы рубероида; золошлаки от сжигания углей; стеклянный бой незагрязненный (исключая бой стекла электронно-лучевых трубок и люминесцентных ламп); грунт, образовавшийся при проведении землеройных работ, не загрязненный опасными веществами; бой бетонных изделий, отходы бетона в кусковой форме; шлак сварочный; тормозные колодки отработанные; ртутные лампы, люминесцентные ртутьсодержащие трубки отработанные и брак; шины пневматические отработанные; мусор от бытовых помещений организаций несортированный (исключая крупногабаритный); мусор от бытовых помещений организаций крупногабаритный; мусор строительный от разборки зданий; отходы (мусор) от уборки территории и помещений объектов оптово-розничной торговли продовольственными товарами; зола мазутная; сажа очистки котлов; лакокрасочные отходы, тара ЛКМ; смет с твердых покрытий; отходы теплоизоляции и обмуровки; шлаки (сжигание ТБО); полимерные отходы; шламы минеральные; растительные остатки; обтирочный материал, загрязненный маслами (содержание масел 15% и более); остатки и огарки стальных сварочных электродов; отходы из жилищ несортированные]

КОПИЯ ВЕРНА
ЗАМ. ДИРЕКТОРА ПО ФЭВ
ООО «ОРКО-ИНВЕСТ»
СОРОКИНА О.Б.

Руководитель Управления по технологическому и экологическому надзору Ростехнадзора по Мурманской области — **Ю.В.Фундератов**

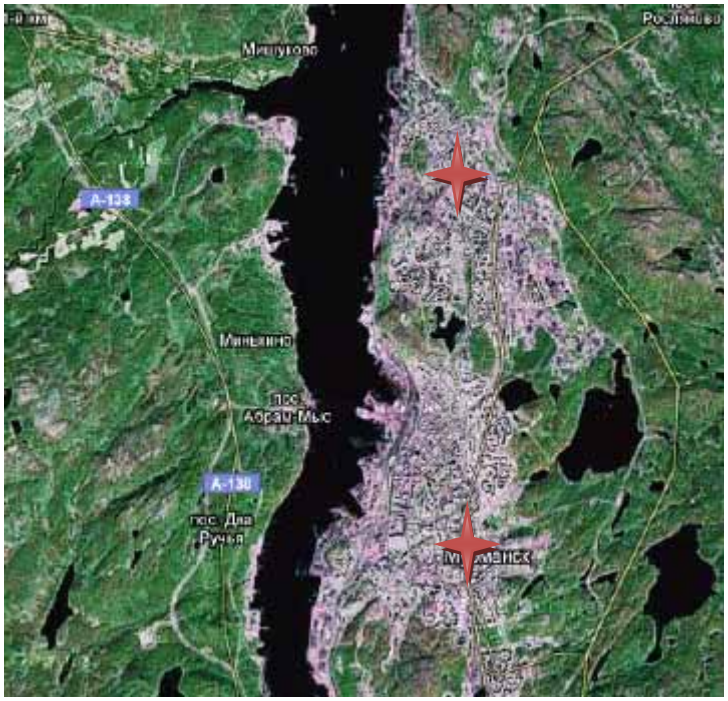
(должность уполномоченного лица) (подпись) (Ф.И.О. уполномоченного лица)

Серия А В № 007135

Appendix 2 Map of the planned location of WSC

1st option:

2nd option:



Appendix 3 Photo of incineration plant in Murmansk

Appendix 4 Map of SDW landfill in the settlement of Drovyanoy