Modernization of Krasnoyarsk Cement Plant

Non Technical Summary

October 2011

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1 Introduction

Krasnoyarsk Cement Plant, owned by OJSC Holding Company Sibirskiy Cement since 2006, is undertaking a modernisation program aimed at meeting Siberia's future cement demand and achieving compliance with European and International environmental standards.

Wet process kiln technology is no longer considered as BAT for cement manufacturing, due to its inherent energy intensity and due to the high cement kiln dust generation requiring large abatement systems. Therefore the modernisation process will be focused on implementing a new dry process line, designed in order to increase the efficiency in cement production and mitigate the environmental impacts of the process.

Also, the Company is planning to build a covered conveyor line from the Torgashinsky Limestone Deposit to Krasnoyarsk Cement Plant, which will reduce traffic caused by trucks on the local road network and mitigate impacts on the local community.

This Non Technical Summary presents the key elements of the project in order to allow all stakeholders involved to understand the planned investments and their impacts both on the Company's operations and the neighbouring community.

2 Krasnoyarsk Cement Plant

Krasnoyarsk Cement Plant is located in the City of Krasnoyarsk, the administrative centre of the Krasnoyarsk Krai (the second largest federal subject in the Russian Federation).

Figure 1 – Kransnoyarsk Cement Plant location

Krasnoyarsk Cement Plant is a major cement manufacturer in the Krasnoyarsk Krai, covering 90% of the region's cement demand.

The Plant produces high-strength and special-purpose cement grades: general/special-purpose Portland cements PCR-M 400 D20, PC-M 500 DO, PC-M 500 AC, PC-M 400 DO GES, and sulphate-resistant Portland cement SSPC-M 400 DO. Krasnoyarsk Cement Plant is the Siberia's only producer of hydraulic cement used for power plant construction.

Currently, 3 wet-process rotary kilns (kilns n. 3, 4 and 5) are in operation, with an output capacity of 1,100,000 t of cement per year.

Raw materials for cement manufacturing are supplied from the Torgashinsky Cement Limestone Deposit and Kuznetsovskoe Clay Deposit located in the vicinity of the Plant, whereas coal is supplied from the Chernogorsky Coal Deposit and Kuznetsky Coal Field in the Kemerovo Oblast.

The Plant was commissioned in 1944. From 1965 to 1991, it used to produce over a million tonnes of cement every year; afterwards the economic decline in the 1990s led the Plant operations to a halt between 2001 and 2003.

In 2006 the Plant joined the Sibirskiy Cement Holding.

Since then, a comprehensive modernization programme has been developed in order to include technical upgrade measures, new equipment installation, technology enhancements, and environmental performance improvements, including:

- Installation of electrostatic filters for three kilns and clinker cooler;
- Installation of bag filters on cement silos;
- Purchase of new cement loaders;;
- Installation of new conveyors for the clinker transfer system;
- Modernization of cement mills No. 4 and 5.

2.1 Environmental performance of the existing plant

The core of the cement plant is the pyro-processing equipment used for the production of clinker.

Main air emissions are nitrogen oxides (NOx), sulphur dioxide (SO_2) and particulate matter.

Electrostatic Precipitators (EP) for kiln exhaust gas are in use on all 3 kilns, whereas no NOx abatement systems are in place.

The clinker burning process is a high-temperature process resulting in decarbonation of the limestone raw material, the sintering of the resulting lime and its chemical reaction with silica and aluminum and ferric oxides, producing the hydraulic cement minerals. Fuel combustion process results in the formation of nitrogen oxides (NOx). The amount formed is directly related to the main flame temperature (typically 1850–2000 °C). Nitrogen monoxide (NO) accounts for about 95 %, and nitrogen dioxide (NO2) for about 5 % of the total NOx. As most of the NO is converted to NO_2 in the atmosphere, emissions are generally reported as NO_2 per cubic metre of exhaust gas at standard reference conditions.

Calculated air emissions levels (in mg/Nm^3) for the existing plant for years 2008 and 2009 are shown in the table below, compared with the reference limits of EU IPPC (Integrate Pollution Prevention Control) Directive.

Calculated Emissions	Units	2008	2009	IPPC Emission Limit Value
Particulate Matter (PM)	mg/Nm^3 clinker	423	174	30
NO_x	mg/Nm^3 clinker	536	593	500
SO_2	mg/Nm^3 clinker	142	171	50
CO	mg/Nm^3 clinker	739	924	500
VOC	mg/Nm3 clinker	43	57	10
n.5 Cooler Particulate (PM)	mg/Nm3 clinker	648	698	30

Table 1 - Calculated air emissions levels 2008 and 2009

Huge efforts have been made to reduce particulate emissions from the kilns, however emission are still above international standards.

2.2 Local Ambient Air Quality Monitoring

The Company monitors air quality on a monthly basis in three locations along the boundaries of the Sanitary Protection Zone (SPZ), measuring the concentrations of the following compounds: nitrogen oxides, sulphur dioxide, carbon oxide and particulate matter.

Pollutant	Concentration Range[1], μg/m^3	Emission Guidelines, μg/m^3	
		MAC_{mi}[1] (RF)	EU limit
Particulate matter: total PM_{10} content	170-1600 Not monitored	500 300	Not regulated 50 (24 hours)
NO_2	<20-122	200	200 (1 hour)
SO_2	<50 (below detection limit)	500	500 (10 minutes)
CO	240-16600	5000	30000 (1 hour)

Table 2 - Concentration ranges of key pollutants measured on the SPZ Boundary (monthly measurements at 3 locations, April-September 2010)

Monitoring results (measured instantaneous concentrations of above mentioned pollutants) show that prescribed MACmi limits are sometimes exceeded for particulate matter and, on some occasions, for carbon monoxide.

These recorded values can partially be attributed to cumulative impact of emissions generated by all enterprises located in the adjacent area.

The ongoing environmental investment projects will help the Company to improve its performance and reduce its impacts on ambient air in the SPZ in the surrounding area.

[1] Averaging period is 20 minutes

3 The Modernisation Project

The modernization program for Krasnoyarsk Cement Plant is centred on the construction of a new dry process line (kiln n. 6), which will allow the Plant to produce up to 2 million tonnes of cement per year.

As part of the modernization programme the movement of raw material via road haulage will be addressed by the construction of an overland covered conveyor to deliver crushed limestone from the Torgashinsky Limestone Deposit to the Plant. In the conveyor technology to be used the limestone will be loaded at the quarry station following which it will be mechanically closed by rolling the conveyor into a cylinder or tube for the duration of the transport distance where discharge will reverse the loading process.

Such projects will substantially decrease environmental pollution levels, improve quality output and energy efficiency and allow the Plant to gradually achieve compliance with international standards of Best Available Techniques (BAT).

3.1 Kiln n. 6 project

Wet process kiln technology is no longer considered as BAT for cement manufacturing, due to its inherent energy intensity and due to the high cement kiln dust generation requiring large abatement systems working in aggressive environments.

Therefore, progress towards BAT starts with the conversion from wet cement manufacturing to dry cement manufacturing.

Krasnoyarsk Cement Plant has therefore initiated a project to construct a new, 3840 tonnes per day, modern precalciner dry process kiln (line n. 6).

The supply has been awarded to the German cement plant specialist supplier KHD, who are also supplying new quarry crushing equipment and elements of the stone storage system. Construction will be carried out by local contractors.

The new process line will include:

- A limestone crusher, with a capacity of 650 ton per hour, with a fabric filter bag house for dedusting;
- A new 2655 m long tube conveyor (Beumer Company) to transport crushed material to the Plant;
- A new raw mill shop, with 2 Tandem grinding plants, each one comprising an impact hammer mill and a ball recrushing mill, each system having a capacity of 150 tons per hour;
- Two new, low energy, conical base meal homogenization silos equipped with the internal inverse cone device;
- A new pyroprocessing plant, consisting of:
  - A rotary kiln, with 4.5 metres diameter and 50 meters length and a warranted output performance of 3840 tons per day;
  - A four stage a single string high efficiency preheater;
  - A expanded riser duct type precalciner of Piroclon type, incorporating two fuel firing positions allowing for “staged” combustion and hence providing lower NO_X emissions;
  - A high efficiency clinker cooler of Pirostepc type, with 3 independently driven grate sections within the cooler to allow for effective control of the heat recuperation, 75 m^2 of

cooling area on the grate and air supply divided into 10 chambers (for aeration) to ensure maximization of combustion air pre-heating;
  - A firing system using solid fossil fuels, the systems are designed to pulverize the coal fuel for firing in the safest most inert atmosphere available. Kilning control system is equipped with the CO_2 sensor, as well as with the sensor for determining residual dust content in air. To reduce the possibility of ignition of nozzle fuel, inertisation of the ground coal silos is accomplished by means of CO_2 (CO_2 is also injected to prevent other potential risks).);
  - Electrostatic precipitators (EPs) for the de-dusting of kiln exhaust waste gas as well as for the clinker cooler waste gas. Clean gas dust content is warranted to be lower than 30 mg/Nm^3.
- A new clinker storage facility , consisting of a single 46,000 tonnes concrete clinker silo;
- Two cement ball mills with a closed-loop grinding cycle and two cagesДве цементные шаровые мельницы замкнутого цикла помола с двумя сепараторами;
- Two blocks of cement silos (8 units) with a total capacity of 32,000 tonnes
- A new packing plant, already built and commissioned (and currently fed from the existing cement mills and silos).

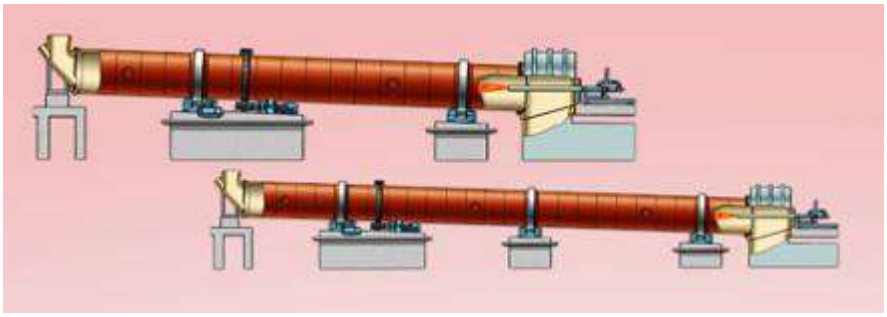


Figure 2 –KHD PYRORAPID® rotary kiln

The New kiln project was conceived in the 1990's and its completion delayed due to a number of political and commercial pressures the supplier has agreed to update its design of Kiln n. 6 to align its performance with BAT standards.

In particular, air emissions from the new kiln will be in line with BAT requirements and international standards:

- Dust content below 30 mg/Nm^3;
- NOx content below 500 mg/Nm^3.

Electrostatic precipitators (EP) will be used for the de-dusting of kiln waste gas as well as that of the clinker cooler waste gas.

SNCR (Selective Non-Catalytic Reduction, intended to inject ammonia or urea into the high temperature zone of the preheater) will be used for NOx abatement in order to ensure the system will attain the 500 mg/Nm^3 standard.

3.2 New limestone conveyor

Another project planned as part of the modernization programme includes the construction of a covered conveyor line from the Torgashinsky Limestone Deposit to Krasnoyarsk Cement Plant.

Limestone is currently delivered from the quarry to the Plant using trucks. The conveyor will cover approximately 2465 m to the limestone neutralizing storage, and 465 m to the production site.

Pipe conveyors are an evolution of traditional belt conveyors: these machines consist of loading points, drive and tail heads identical to that of standard belt conveyors, but have a different conveying section, with a particular shape.

Figure 3 – Pipe conveyor section

After the loading point, the belt is folded around the material and assumes a tubular shape along the whole length of both upper and return strand.

Figure 4 – Pipe conveyor

Thanks to the complete enclosure of the belt, which prevents all types of material leakage, pipe conveyors can make curves both horizontally and vertically – up to 28^0, running along winding paths and going round obstacles and existing structures.

The belt of the pipe conveyor is folded into a dust-tight enclosure, which prevents material leakage and protects from external contaminations. The complete enclosure of the return strand guarantees a perfect cleaning along the whole length of the path and allows material transport in both directions.

Delivery by conveyor will reduce the traffic load on the local road network, as well as dust emissions in the Plant's area, since crushing will be carried out in a new crushing unit located close to the quarry, before being transported via conveyor to the Plant.

The construction and operation of this conveyor line will result in the following benefits:

- Reduced fuel consumption (25 - 30%) and associated emissions from large haulers currently used to deliver limestone material from the quarry site;
- Reduced limestone dust emissions generation, associated with limestone crushing process;
- Reduced traffic load (and consequent noise, vibration, air pollution and traffic congestion) on the local road network due to the avoided trucks' usage.

Generally, the construction of the pipe conveyor belt will result in improved air quality and traffic conditions within the Plant's impact area.

4 Possible scenarios for the future of Krasnoyarsk Cement Plant

Krasnoyarsk Cement Plant is evaluating possible scenarios for its future, aiming to maintain and enhance production capacity as well as improving environmental performance while of course providing value for its customers in providing consistent quality products at competitive prices.

After the successful commissioning of dry line n. 6, as a result of the increased production capacity outdated wet line n. 3 will be decommissioned

Based upon market conditions, Krasnoyarsk Cement Plant will determine subsequent steps for its future development such as:

- Modernizing remaining wet lines n. 4 and n. 5 to allow continuing their operations and improve their environmental performance;
- Closing down wet lines n. 4 and n. 5 and installing a second dry line (line n. 7).

Krasnoyarsk Cement Plant will take all necessary actions to ensure the remaining wet kilns achieve a high level of environmental performance and that they are in compliance with a high standard for particulate air emissions. The plant will target an emission level below 50 mg/Nm^3 .

All new units will be designed as far as practical to respect the terms of BAT to ensure a high degree of compliance with modern international standards.

Different scenarios for future operations of the Plant have been analyzed:

Option zero	Closure of all wet kilns (only dry kiln 6 in operation)
Option one	Refurbishment of wet kilns 4 and 5 (kilns 4, 5 and 6 in operation)
Option two	Closure of all wet kilns and construction of a second dry kiln (kilns 6 and 7 in operation)
Option three	continued use of kiln 5 without major refurbishment (kilns 5 and 6 in operation)

Expected total dust emissions (in tons per year) associated to the different scenarios are shown in the figure below, compared to actual emissions over the last 4 years.

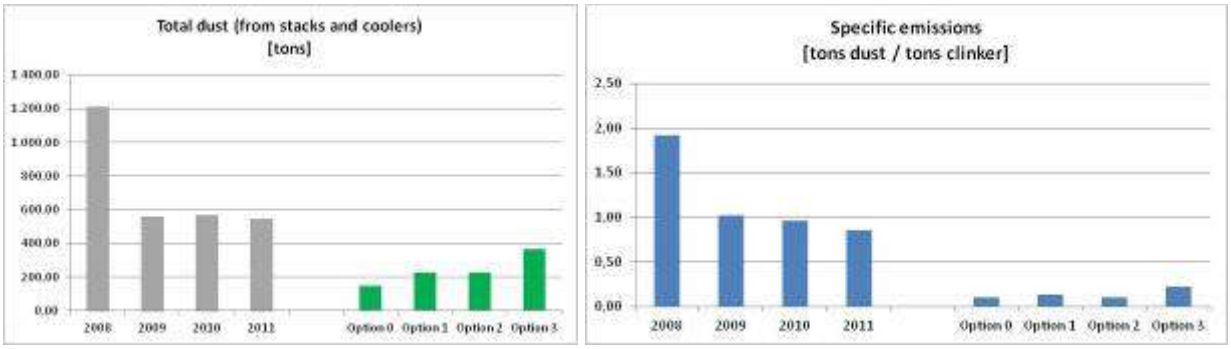


Figure 5 – Total and specific dust emissions according to different scenarios

Options zero, one and two will bring an improvement in overall dust emissions from the plant.

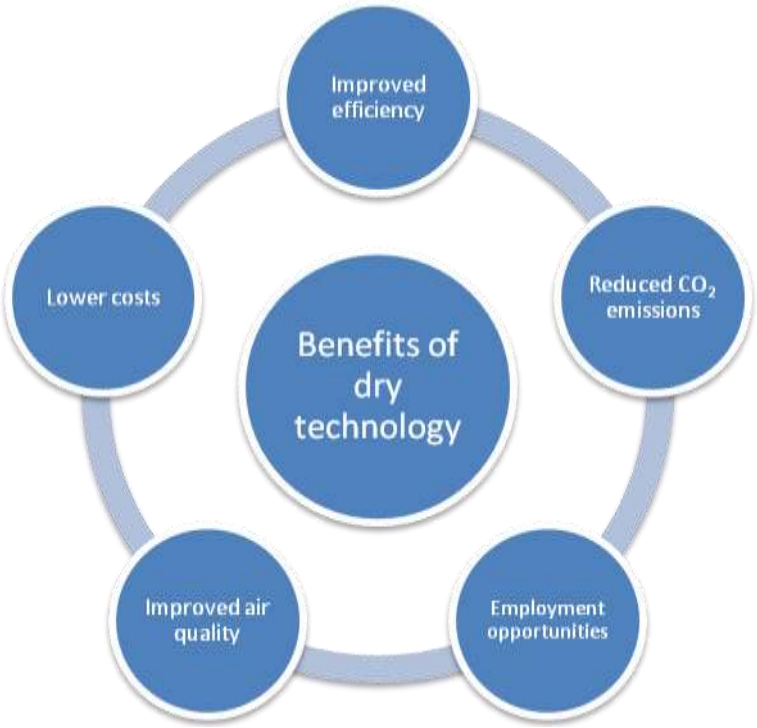
Taking into consideration specific emissions (tonnes of dust for tons of clinker produced) the situations will also improve dramatically for these scenarios.

5 Benefits of Modernisation Programme

Besides guaranteeing significant quality improvements and energy savings, the modernisation project and the replacement of old inefficient units with a state-of-the-art new unit will substantially decrease environmental impacts from the Plant operations.

Wet lines, no longer considered as BAT due to lower efficiency and higher emissions, will gradually be replaced by new dry lines, using modern technology.

The modernization program will bring benefits to the Kransoyarsk Cement Plant from an environmental, economic and social point of view.



The main advantages of the dry cement manufacture process are among others:

- Lower fuel consumption compared to wet process.
- Higher production efficiency.
- Lower maintenance and repair costs.
- Relatively smaller space (footprint) requirement, resulting in lower construction costs as compared to a wet process line of similar capacity.
- Improvement of air quality due to the reduction of emissions of air pollutants such as NO_x and dust.
- Reduced specific CO_2 emissions (tons of CO_2 released/tons of clinker produced).
- More consistent product Quality.
- Possibility to use less energy-rich fuel allowing for opportunities to use fossil fuel substitutes.

5.1 Environmental impacts

Main impacts from the construction and operation of the new dry line have been assessed in the project documents.

The main direct impacts will be on air emissions. Kiln 6 will be equipped with emissions treatment and continuous emission monitoring to ensure compliance with all applicable standards.

Key Performance Indicators (KPIs) for the new dry kiln, compared to the existing wet lines, are shown in the table below.

Parameter	Units	Existing Wet kilns 3, 4, 5	NEW Dry kiln 6
Output per 24 hrs	Tpd	1960	**3.840**
Output annualised	Tpa	572.320	**1.219.400**
Fossil Fuel Efficiency	kcal/kg clinker	1503	**778**
Fossil Fuel specific usage	kg/t clinker	227	**140**
CO_2 Emissions per tonne clinker	$kgCO_2$/t clinker	1127	**841**
CO_2 Emissions per tonne cement	$kgCO_2$/t cement	1010	**754**
Kiln Particulates	mg/Nm^3	500-700	**< 30**
NOx Emission	mg/Nm^3	~600	**<500**
Power usage to Clinker stage	kWh/t clinker	130	**67**
Power usage for Cement Grinding	kWh/t cement	40	**39**

Table 3 – KPIs for wet and dry kilns

The new dry line will bring significant improvements in terms of efficiency (reduced fuel and power consumption) and pollution prevention (reduced air emissions).

Expected NO_X and dust emissions from the new dry kiln compared to the emissions from the existing wet kilns are shown in the graphs below.

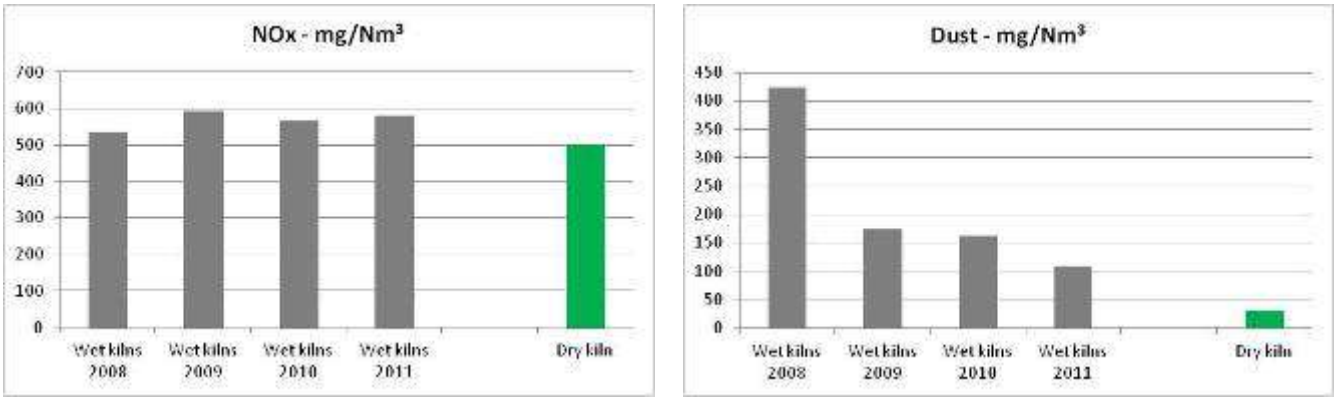


Figure 6 – Expected NO_X and dust emissions

According to existing legislation, cement manufacturing industries are required to have a 500 m Sanitary Protection Zone (SPZ). The Plant's mandatory SPZ includes residential housing and food processing industries. In May 2009, 1.165 people lived in the Plant's SPZ.

According to the air quality estimates produced for the scenario featuring a new dry process line and a tubular belt conveyor system, the following SPZ sizes were proposed in the design documentation:

- 490 m east of the Plant site boundary;
- 150 m south east of the Plant site boundary;
- 90 m south of the Plant site boundary;
- 15 m south-west of the Plant site boundary;
- 500 m west, north-west, north and north-east of the Plant site boundary.

The design documentation includes specific measures designed to significantly reduce pollutant emissions and noise impact levels. Providing that they are fully and properly implemented, these measures will ensure that relevant MAC limits and noise impact guidelines are met.

The modernization of the Plant will allow shortening its SPZ so that its boundaries and those of residential areas won't directly adjoin. The SPZ Project has been approved by all relevant authorities and all permits have been received.

The Project Documentation that included List of environmental measures received a positive resolution from the State Review.

However, in the industrial area, where the Plant's main is located, 30 other companies are based as well. These companies also negatively affect population living in the area affected by the industrial zone (e.g., air pollution, noise). In this connection, works on establishing a single SPZ for this industrial zone are being carried out under the auspices of the City.

The figure below shows the Plant, the Quarry, the proposed layout of the conveyor and the associated SPZ.

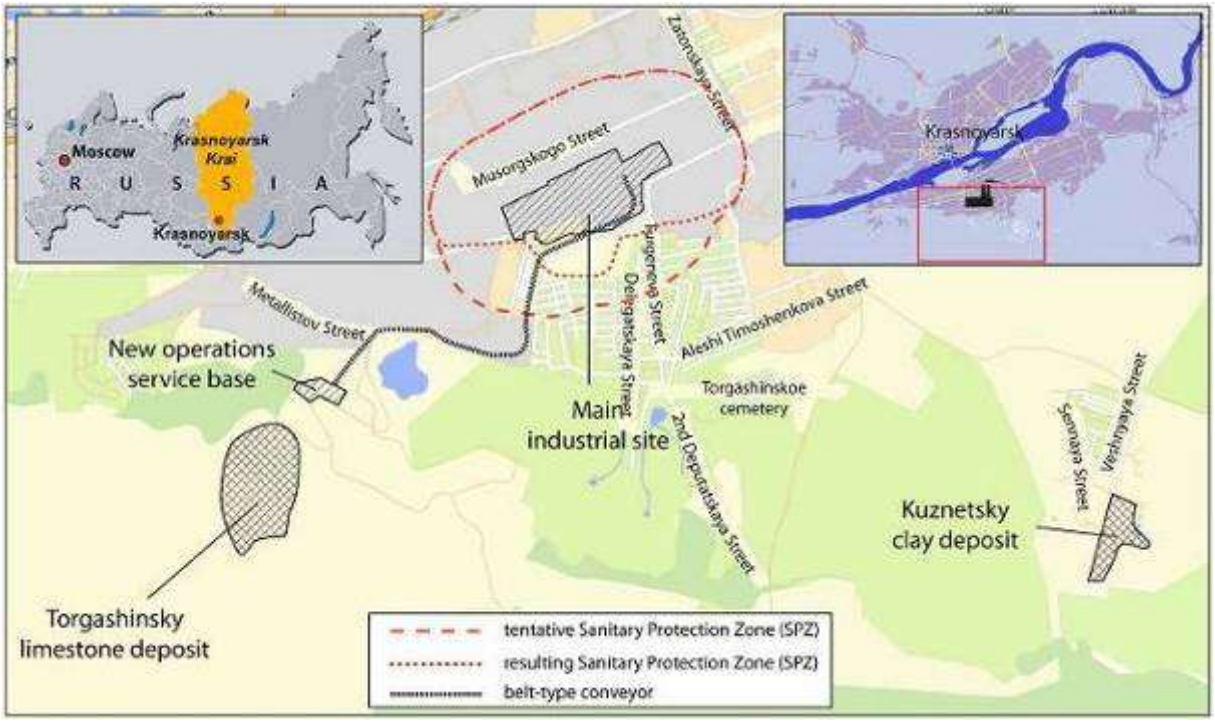


Figure 7 – Mandatory and expected SPZ

5.2 Social impacts

Currently construction activity is booming in Krasnoyarsk with about 2,000 various construction projects being underway. Housing construction projects dominate the City's construction sector; in fact it is to underline that in spite of the financial crisis, Krasnoyarsk Plant has remained a national leader in terms of new housing commissioned per capita for the last three years. In 2009, 469,000 m^2 of housing space were commissioned in the City.

The continuous construction boom has boosted the development of building material industry, including cement manufacture: this is the reason why also the "Krasnoyarsk City Socio-Economic Development Programme until 2020" includes a technical modernization project for Krasnoyarsk Cement Plant.

Construction and operation of the new dry line will allow satisfying the needs of the region; moreover it is expected that the construction and operation of new production line will create 190 additional jobs and in general the construction process will result in an inflow of labour to the region. Overall, the predicted social impacts of the project operation are positive for local people, the region and the economy.

The fact that the Plant is part of the major Southern Industrial Hub of the Sverdlovky District comprising over 30 industries has justified the decision of the Krasnoyarsk City Administration to design and establish a common SPZ for the entire industrial hub; all related preparations are currently underway.

As part of this process, the City Administration is planning to decide how to take care of the affected households who currently live in the residential areas located within the boundaries of the Southern Industrial Hub (the Cementnikov Settlement, Torgashino residential area, etc.).

5.3 Planned management and monitoring systems

Krasnoyarsk Cement Plant is currently developing and implementing an ISO 9001 Quality Management System designed to ensure proper quality of products supplied to its customers. The System is scheduled to be launched within December 2012.

The Company will also integrate environmental, social and health and safety management issued into the Quality Management System, in order to to control all processes and manage their impacts on the environment and risks for health and safety of workers or of the local community.

A monitoring program will be implemented to constantly control environmental impacts from the Plant's activities.

Kiln n. 6 will be endowed with a Continuous Emission Monitoring System (CEMS) for NOx and dust, to constantly monitor compliance with regulatory and BAT standards. Gradually CEMSs will be installed also on other new or upgraded units.

The Company will also continue to monitor air quality (NO_x, SO_2, CO and particulate matter) along the boundaries of the Sanitary Protection Zone (SPZ), to ensure public health is protected.

5.4 Planned stakeholder engagement

Krasnoyarsk Cement Plant has developed a Stakeholders Engagement Plan in order to enhance public information and stakeholders' engagement process, especially in relation to the ongoing modernisation project.

The following main events have already taken place as part of the public consultation process for the Technical Upgrade and Modernisation Project at the Krasnoyarsk Cement Plant:

- Meetings of the Plant specialists with the representatives of the Design Consultant to discuss the continuation of the Technical Upgrade and Modernisation Programme;
- Meeting of representatives of the Sverdlovsky District Administration and Krasnoyarsk Cement Plant with the residents of the Cementnikov Settlement and Torgashino Residential Area as part of the general community meeting;
- Public hearings convened as part of the approval process for the proposed draft amendment to the Krasnoyarsk City Land Use and Urban Development Rules concerning the territorial zoning modification involving the conversion of part of the existing Hazard Class III Industrial Facility Zone where the Plant site is located to the Hazard Class I-II Zone.
- Publications covering the new cement manufacturing line in various mass media (district, City and Krai newspapers; on the Plant's official website and other information portals).

All documents regarding the modernisation will be made available for public consultation on the Company's website and at the Plant offices in Krasnoyarsk.

Additional information regarding Sibirskiy Cement Company operations and the modernisation program at Krasnoyarsk Cement Plant is available at:

- The Department for Capital construction of Sibirsky Cement Company office, 15 building 1 Musorgsky street, Krasnoyarsk and by telephone (391) 2746461 from 8.00 to 17.00. Contacts: Korobkov Pavel Fedorovich, Zherdeva Julia Jurjevna; email: v.pivneva@sibcem.ru

  Mr Alexandr Cherepanov, Vice-president, Investment Development; cherepanov@sibcem.ru
- Sibirskiy Cement's website**:** http://www.sibcem.ru/
- The library n.a. Sergey V. Mikhalkov, 46 Schoros street, Krasnoyarsk.
- EBRD Resident Office for Siberian Federal Okrug, Business Center "Vesna" 3 "A", Vesni Str., 15th floor, Krasnoyarsk. Contact Nikolay Sorokin email: SorokinN@ebrd.com; and Krasnoyarsk@ebrd.com
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