10. SUMMARY AND FINAL CONCLUSIONS

The aim of this report is to define the impact of the undertaking consisting in installation of a suspension roaster in the “Głogów I” Copper Smelter on the environment. The study has been prepared based on the updated programme and spatial concept regarding installation of the suspension roaster in the “Głogów I” Copper Smelter. **The planned process devices and industrial facilities in the form of buildings, including: suspension roaster and electric furnace, waste-heat boiler, power building, etc. will be localised at the entire premises of the “Głogów I” Copper Plant, namely in the area constituting the property of the State Treasury.** *The perpetual usufructuary of these premises is KGHM Polska Miedź S.A. in Lubin.* Pursuant to the applicable legal regulations the planned suspension roaster together with the accompanying facilities should be classified as an undertaking which may have a significant impact on the environment and which requires the development of an environmental impact report and must obtain a decision on environmental considerations.

The planned undertaking includes:

> installation of a new suspension roaster with a copper production capacity of 250,000 Mg/year in the place of the three shaft furnaces in the Głogów I Copper Smelter,
> recovery of physical heat discharged from the suspension roaster in the waste-heat boiler,
> construction of a new rectangular electric furnace with the capacity of 2x25 MVA with a system of 6 electrodes arranged in the shape of two triangles; the furnace will be used for periodical full decopperisation of the slag coming from the suspension roaster,
> alternative solution for slag extraction from an electrical furnace:
    - slag pouring / extraction on pouring floors,
    - slag granulation and dewatering with the use of an INBA system,
> retrofit of the five existing converters for the purposes of the new technology consisting in electric furnace alloy conversion and reduction of converter slag from the second alloy air-refining period, installation of a new dedusting plant with gas cooling systems (separate for each converter) in full vaporisation chambers,

- > installation of the process line used for granulation of the reduced converter slag II before its transfer, as a charge, to the Doerschl reverberatory-rotary furnaces,
- > retrofit of the existing Anode Furnaces Section by installation of scales for weighing anodes on transport carts, installation of a gas mixer and transfer of gas filters and exhausts to the place of a disassembled sand dryer, and installation of the dust collection system using pneumatic transport,
- > transfer of the existing anode gas dedusting plant, including the chimney, to a different localisation in connection with the collision of the existing localisation with the planned node of slag collection from the electric furnace,
- > providing additional equipment for the Charge Preparation Section, i.e. copper concentrate steam dryer, new concentrate transport galleries to the steam dryer and auxiliary materials for the electric furnace and converters, installation of local suction devices in transfer nodes equipped with dedusting systems on bag filters,
- > retrofit of one of the existing concentrate dryers and its adaptation for the purposes of drying all the auxiliary materials (coke, lime stone and sand), and installation of a new dedusting plant in the auxiliary materials drying node,
- > providing additional equipment for the Lead Section, i.e. nodes of lead slag processing and ground slag transport to the suspension roaster,
- > installation of high-performance purifying systems for process gases generated in the processes and ventilation gases coming from local suction devices, i.e. the bag dedusting system and the wet desulphurisation system,
- > equipment for new production units with an appropriate energy and electrical energy infrastructure and microprocessor control system for the processes,
- > extension of the fuel base in the Głogów I Copper Smelter and adaptation of its technical condition to the currently applicable requirements.

A programme and spatial concept for the Głogów **I** Copper Smelter was developed in October 2007. This concept was used as the basis for preparing the environmental impact report regarding the undertaking consisting in the replacement of the three existing shaft furnaces with one suspension roaster. The undertaking has obtained the following:

- Decision on land development conditions for the investment under the name of: “Modernization of pyrometallurgy in KGHM PM SA – Suspension roaster in the “Głogów I” Copper Smelter” issued by the City Development Department, City Planning and Architecture Section of the Town of Głogów, attached to the letter of 11 June 2008 ref. No WRM.DPiA.7331-I/7/08 (the Decision constitutes Appendix

1 to this report),

- Decision on environmental considerations approval for implementation of the undertaking under the name of: “Modernization of pyrometallurgy in KGHM PM SA – Suspension roaster in the “Głogów I” Copper Smelter” issued by the Mayor of Głogów, attached to the letter of 14 November 2008 ref. No WŚ.7624-26/08 (the Decision constitutes Appendix 2 to this report).

The major differences between process solutions which may influence the scale of impact of the planned undertaking on the environment, resulting from the current concept in relation to the solutions assumed in the concept from 2007 are as follows:

- it is currently planned that two processes of air refining of the liquid alloy CuPbFe will be performed in the converters. The product of the first air-refining period will be converter copper and converter slag I returned to the electric furnace, whereas the second air-refining period will generate the alloy returned to the first air-refining period and converter slag II with a large content of lead directed to the Lead Section to be processed in Doerschl furnaces,
- converter slag II is to be granulated before transporting the slag to the Lead Section for further processing in Doerschl reverberatory-rotary furnaces,
- designs for two separate systems for wet desulphurisation of process gases from the converters and gases discharged from the electric furnace / suspension roaster tapping have been developed,
- auxiliary materials and sand will be dried in one drum drier fired with natural gas,
- it is planned to install hot and cold blast fans for the suspension roaster and air blast fans for the burners in a separate, acoustically isolated fan station,
- a new localisation of the lead slag pre-processing line has been assumed,
- an alternative solution for processing slag coming from an electrical furnace has been designed; it includes:
  - slag pouring and extraction on a pouring floor,
  - slag granulation and dewatering in a granulation unit with the use of the INBA system,
- the localisation of process gas dedusting from anode furnaces has been changed,
- installation of a series of local suction devices on transportation line chutes for the concentrate and auxiliary materials has been planned.

The new concept is also based on new metallurgical balances developed for the Głogów Copper Smelter by the Institute of Non-Ferrous Metals in Gliwice (different quantities and compositions of the applied charge materials, which results in different

quantities of gases extracted from the gas dedusting plant and different contents of metals in the dust emitted to the environment and in waste in the form of dust and slag).

Copper smelting in a suspension roaster is regarded as common “standard” method of producing copper from primary raw materials which complies with the BAT requirements. When implemented on an industrial scale the method enables achieving good economical effects and, by applying its process solutions, limits the negative impact of the copper production on the environment.

The planned facilities and systems will be provided with the following protective measures limiting the influence of the planned undertaking on the environment:

- systems of efficient reduction of pollutant emissions to the environment,
- process gas afterburn chambers reducing emissions of substances containing organic carbon and carbon oxide,
- heat recovery by installation of a waste-heat boiler,
- dedusting of process gases from the suspension roaster in the electrostatic filter to the final concentration of 50 mg/Nm^3 and transferring the dedusted gases rich in SO_2 to the modernised sulphuric acid plant using a double contact process (conversion ratio >99.85%) with inter-stage absorption and mist eliminator,
- high-efficient fabric filters reducing concentration of dusts emitted to the environment to a maximum concentration of 3 mg/Nm^3 for the following process nodes:
  - steam concentrate dryer,
  - drum dryer for auxiliary materials,
  - local extractors on concentrate transportation line chutes,
  - chute nodes for the transportation line of charge additions for the electric furnace and converters,
  - suspension roaster charge tanks,
  - gases extracted from blister copper tapping and slag from the suspension roaster, and alloy tapping from the electric furnace,
  - process gases from the electric furnace and gases extracted from slag tapping coming from the electric furnace and ladle cart housings,
  - electric furnace charge tanks,
  - process gases from converters,

- converter charge tanks,
- lead slag crushing and separation nodes.

- wet flue gas desulphurisation system reducing emissions of SO2 to the concentration of 200 mg/Nm^3 for process gases coming from the converters and from local suction devices, i.e. tapping outlets from the suspension roaster and electric furnace,
- gas and gas-oxygen burners with a low emission of nitrogen oxides - 100-150 mg/Nm^3,
- use of heating oil with a low sulphur content (below 1%) for firing the suspension roaster,
- returning the generated waste to the production process and its recovery or transfer outside the Copper Smelter for recovery or neutralisation,
- closed water cycles for cooling the suspension roaster and electric furnace, and for granulation of the slag produced in the electric furnace and converters – minimisation of water consumption and waste generation,
- installation of forced draught fans for the suspension roaster concentrate burner, forced draught fans for oil and oil-oxygen burners, forced draught fans for dust sulphatation in the waste-heat boiler in the separate acoustically insulated fan station building,
- equipping the planned systems and fans with thermal and acoustic insulation, soundproof housings and acoustic screens, and reduction of the emitted noise to the level of 85 dB,
- modernisation of the existing turboblower station by replacement of the existing blowers with new ones as well as acoustic insulation of the facility walls and transport pipeline,
- hardening and concreting the area designed for the localisation of the planned facilities and installation of concrete pans under the furnaces, fuel tanks and transformers,
- reduction of the emission of the non-organised dusts in the area of pouring slag from the electric furnace by spraying the slag with water from water cannons.

Taking into account the land topography, the technical and engineering data of the updated undertaking, including the entire related infrastructure, the results of calculations and applicable regulations, the following conclusions can be drawn with regard to the environmental impact of the project:

Air

Upon implementation of the undertaking presented in this study the emissions of the substances introduced to the environment by emitters of the Głogów I Copper Smelter will be significantly reduced: for dust – by approx. 53%, including the content of the following metals: Cu by 67%, As – 63%, Cd – 86%, Pb – 1.5%, SO_2 – 57%, nitrogen oxides with respect to NO_2 by approx. 55%, CO – 40%, H_2SO_4 – 4%, H_2S and CS_2 – 95%. Upon implementation of the planned undertaking emissions of hydrogen sulphide and carbon disulfide will be present only in the FGDS, because Doerschl furnaces will further process the sludge from the wet dedusting of shaft furnaces, stored at the storage yard and in other storage sites, and the process gases generated in these furnaces will be desulphurised in the FGDS together with flue gas produced during energy combustion of fuels, just like in the present situation. Modernisation of the copper production process and usage of the aforementioned protective measures will considerably reduce the impact of the plant on the surrounding environment. *Lower emissions of the substances discharged to the environment will be reflected in limitation of the impact of the system on the environment by reducing the concentrations of substances in the air. In the target situation, outside the premises to which the Copper Smelter has a legal title, all the calculated parameters of immission of all the analysed substances are lower than the admissible values.*

In comparison to the previous report regarding the undertaking in question it may be noted that the quantity of substances emitted to the environment will be reduced (the present project solutions assume higher operational performance of gas treatment systems and take into account a method for discharging the excessive quantity of lead from the copper production cycle by reducing converter slag II), which will entail reduction of the impact zone of the permissible immission parameters. *The phenomenon can be observed especially during analysis of the impact of the admissible lead precipitation isoline on the environment. In the current version the range of the lead precipitation isoline equal to 0.1 g/m*^{2} x year is lower than the one determined earlier, and the area limited by this isoline is completely confined within the industrial borders of the Głogów Copper Smelter.

Waste management

Replacement of shaft furnaces with a suspension roaster enables eliminating the

following types of waste produced in the Copper Smelter:

- slag from shaft furnaces,
- sludge from wet dedusting of gases coming from shaft furnaces.

As a result of the removal of the shaft furnaces, the FGDS will generate less waste from the process of boiler flue gas desulphurisation, and the entire waste will be utilised in the suspension roaster process performed in the Głogów II Copper Smelter. So far a considerable part of the waste from flue gas desulphurisation has been transported and stored in the landfill in Biechów.

The by-products of the suspension roaster, i.e. dusts from gas treatment, slag from the suspension roaster and slag from converters, will be returned to the copper and lead production processes carried out in the Głogów Copper Smelter.

The waste generated in the process of producing fire-refined copper based on the suspension roaster technology, requiring storage or management outside the premises of the Copper Smelter will be:

- Fe-As alloy (waste code 10 04 99) separated in the lead slag crushing and separation node in the quantity of approx. 8,760 Mg/year,
- slag from the electric furnace (waste code 10 06 01) in the quantity of approx. 706,960 Mg/year, part of dusts from the electric furnace (waste code 10 06 03*) in the quantity of 7,400 Mg/year.

The separated Fe-As alloy (waste code 10 04 99) will be transported and stored at the sublevel Fe-As alloy ore storage yard in sediment tank no. IVA. The storage yard is an open IVA tank mounted on piles with expansion joints. The bottom of the tank and side walls are water-proof and constructed of ferroconcrete slabs. The external side walls are covered with earth, the tank is drained. Leachate from the storage yard will be directed to the industrial wastewater treatment plant.

Slag from the electric furnace with code 10 06 01 will be transported to the pouring floor. The site of slag pouring and extraction will consist of three pouring floors. Sides of the slag pits will be constructed as ferroconcrete retaining walls slightly bended outward at the top. The bottom of the slag pits will be made of natural ground covered with a layer of finely ground slag. It is planned to spray the slag poured to the pits with the use of water cannons.

At the beginning of each pouring floor there is a site for storing “cakes” and two

stands used to knock them out. Slopes of the stands will have ferroconcrete retaining walls bended outward at the top. The bottom of the storage yard will be made of natural ground covered with a layer of finely ground slag. When cooled it will be mechanically extracted and transported to the slag crushing and separation station.

In emergency situations the electric furnace slag may be subject to granulation in the INBA system. Waste from the electric furnace in the form of cooled and mechanically ground slag poured on the pouring floor or granulated slag produced in emergency situations will be collected from the storage sites by an external recipient as a raw material, for example, for the production of road aggregates.

Part of the electric furnace slag will be recovered in the Copper Smelter to be used a material for road hardening, and reclamation and filling post-mining voids.

Earth from excavations for the new industrial facilities, trestle bridges, roads and yards complying with the environmental standards will be used for land levelling or transported to the industrial waste landfill in Biechów.

Part of the dusts from the planned electric furnace (waste code 10 06 03) will be provided to external recipients to recover lead contained in it. The dusts will be stored in the premises of the Copper Smelter in closed tanks from where they will be successively collected by external recipients by road or by rail (rail tanks).*

In comparison to the previous report from the modernisation of pyrometallurgy in the “Głogów I” Copper Smelter, the method of managing the waste generated by the copper production system based on a suspension roaster is analogical.

The updated version takes into account only the alternative method of handling the electric furnace slag, i.e. it will be poured and extracted on pouring floors or optionally granulated in emergency situations. The current version also provides for granulation of the converter slag from the second stage of reduction. The slag after granulation will be transferred to the Lead Section and used there as charge for Doerschl reverberatory-rotary furnaces.

Protection against noise

The noise dispersion calculations and noise measurements performed for the present situation demonstrated that in the acoustically protected areas, i.e. in the inhabited areas with single- and multi-family residential development and farmlands the permissible levels of noise during the day and night are not exceeded both in the present situation and in the situation after modernisation of the copper production

process in the “Głogów I” Copper Smelter, i.e. after the replacement of the shaft furnaces with the suspension roaster.

Modernisation of the pyrometallurgical process in the “Głogów I” Copper Smelter will not lead to exceeding the applicable permissible noise levels in the adjacent acoustically protected areas, provided that the process gas exhaust and ventilation fans, and the planned process equipment are to be equipped with thermal and acoustic insulation, and soundproof housings and screens, as specified in Table 5 included in this study. The calculations demonstrated that the admissible noise isolines for day and night conditions, i.e. isolines depicting the noise level of 45 and 55 dB/A/ resulting from the exclusive impact of the new noise sources are completely closed within the industrial area of the Głogów I Copper Smelter.

The current version of the programme and spatial concept of pyrometallurgy modernisation in the “Głogów I” Copper Smelter assumes additional acoustic protective measures for the fans and process equipment so that the level of their acoustic impact at the source does not exceed 85 dB. In the current version, the force draught fans for the concentrate burner, force draught fans for oil burners and oil-oxygen burners, as well as air fans for dust sulphatation in the waste-heat boiler will be installed inside the acoustically insulated fan station building located in the direct vicinity of the suspension roaster. The existing converter turboblower station will be modernised and muffled by installation of new turboblowers and acoustic muffling devices (in the station walls and transport pipeline).

The applied protection measures will additionally translate into limitation of the acoustic impact of the planned facilities and process equipment on the environment.

Water and sewage management

The planned facilities: suspension roaster and electric furnace will be equipped with closed cooling water systems.

Process sewage generated in the new facilities (water from the closed cycle blowdown process, washing floors, wet desulphurisation of converter gases and gases generated above the tapping holes of the suspension roaster and electric furnace) and rainwater from the existing and planned halls, roads and yards will be discharged to the industrial and stormwater and acidic sewage system operating in the area of the Copper Smelter, and directed farther to the existing wastewater

treatment plant owned by Spółka z o.o. ENERGETYKA.

Similarly, sanitary sewage from rest and refreshment rooms in the planned facilities will be discharged to the existing sanitary sewage system localised in the premises of the Copper Smelter and then will be transferred via the sewage system of ENERGETYKA Sp. z o.o. to the existing sewage treatment plant. The sewage treatment plant is owned by Spółka z o.o. (limited liability company).

In comparison to the previous report from the modernisation of pyrometallurgy in the "Głogów I" Copper Smelter, the sites where waste is generated and the method of managing the waste generated by the copper production system based on a suspension roaster will not be changed.

Other elements of the environment

The planned undertaking will be localised in industrial areas and therefore it will not change the method of developing the area in question.

Modernisation of the copper production process line will not change the existing landscape and spatial conditions.

Implementation of the planned investment does not require trees to be cut down and areas to be excluded from agricultural production. Modernisation of the metallurgical processes conducted in Copper Smelter I will considerably reduce emission of dusty and gas substances discharged to the environment which will significantly influence improvement of the environmental conditions, and consequently the surrounding world of people, animals and plants. Hardening of the area designed for the planned facilities and usage of concrete surfaces will prevent infiltration of the media circulating in the cycles to the ground and further to groundwater and underground water.

Piezometric wells will be installed in the area of the modernised fuel base to enable monitoring pollution of the ground and water environment. In the case of the undertaking under consideration it is not necessary to establish the limited usage area and to initiate the procedure related to cross-border environmental impact. The investment is localised outside the borders of the existing and potential Natura 2000 areas. Therefore, it will not exert a negative impact on these areas as well as on other elements of nature located in the closest vicinity.

Final conclusion

According to the technical and process documentation of the planned undertaking, i.e. “Installation of a suspension roaster in the Głogów I Copper Smelter – update” shall not exert an adverse impact on the state of the environment in the area under consideration. The planned undertaking meets the requirements resulting from the best available techniques and environmental standards applicable in our country.