FAQ

A GTZ-Holcim Public Private Partnership

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Module 1: Introduction

Q: Does co-processing contribute to a sustainable development?

A: Yes, because co-processing reduces negative impacts on environment and health from unsound waste disposal, preserve fossil resources and minimize cost for cement production.

Q: How does co-processing fit into the concept of industrial ecology?

A: Co-processing uses waste from different industries as AFR and contribute to the reduction of the ecological footprint.

Q: What is a holistic approach in the context of co-processing?

A: A holistic approach as a successful implementation is only possible through involving all relevant stakeholders and considering legal, environmental, social, operational and OHS aspects.

Q: Which roles do government organisations have with co-processing?

A: Government organisations should provide the legal framework for co-processing to control environmental impacts and impacts on health and safety.

Module 2: Waste Management

Q: When do we call waste a waste?

A: The EC Framework Waste Directive 75/442/EEC, Article 1 defines waste as "any substance or object, which (a) the holder discards or intends or is required to discard or (b) has to be treated in order to protect the public health or the environment." Waste material can be solid, liquid, or pasty. Any waste material can be defined by its origin (industry, agriculture, mining etc), hence a proper list should always be established at national level to help create a common understanding and define a legal framework. Where no specific list has been defined, the EC Waste Catalogue might serve as a reference.

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Q: What are the waste management hierarchy and principles?

A: The waste management hierarchy sets out the preferred order of adoption of certain waste management practices and is a framework for prioritising those practices to achieve the best environmental outcome. From most preferred to least preferred, the practices are:

- waste avoidance;
- waste re-use;
- waste re-cycling;
- energy recovery from waste; and
- waste disposal.

The other principles for managing waste are:

- the polluter pays principle
- the user pays principle
- the producer responsibility principle

These aspects should be integrated in the national waste policy that is the base for the development of waste management.

Q: What means waste management?

A: Waste management is an area of core business for communities. It encompasses all activities and services that revolve around collecting, disposing and reducing waste. In dealing with waste management, communities should use the most effective technologies and methods available while also striving to protect environmental and public health, following the national waste policy.

Q: What are the main components of waste management?

A: The relevant components of waste management are waste generation forecast (for planning and design of logistic and treatment), public awareness (to ensure acceptance for collection system, improve disposal behaviour, meat and deal with public refusal against treatment plants), technical proposals (recycling technologies and waste treatment plants), organisation development (law enforcement, regulation of waste traceability, data generation, health and safety guidelines, environmental impact assessment for waste relating activities) and financial management (operational costs, possible revenues of recycling facilities, fees).

Q: What is required to prepare a waste management plan?

A: The required information for a waste management plan includes: considerations of the amount and type of waste (waste generation forecast), any hazardous characteristics of the waste, the likely impact on the environment, and proposed plans to deal with the waste.

Q: Who has to be involved in the development process of a waste

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management system?

A: The involved parties include the legislative body to develop the laws, executive authority (administration, all relevant departments, i.e. water, environment, sanitary and health) to give permits and sanctions, NGOs for environmental and social aspects, communities to ensure the consideration of individual situations and existing waste management structures (collection, informal sector, waste management companies), technical experts and consultants (engineers) and financial experts.

Q: Which waste treatment technology is suitable?

A: First of all: blue print waste treatment facilities, sometimes offered from plant manufacturers are often not suitable for developing countries (expensive and technically high developed). Waste technologies should always be a part of an integrated waste management. First of all, the waste policy and waste hierarchy have to be defined. This is the frame for waste management strategies and treatment targets. Depending on the strategies and selected measures, treatment options have to be selected. Typically, various concepts are presented with additional feasibility studies, environmental assessment and financial concepts. Relevant parameters to plan waste treatment facilities are waste materials, waste composition and characteristics, amount of waste generation and relevant local parameters (i.e. climate, water availability, location, geological and geographical situation).

Q: Why is education and promotion crucial for a functional waste management system?

A: A critical component in any waste management program is public awareness and participation, in addition to appropriate legislation, strong technical support, and adequate funding. Waste is the result of human activities and everyone needs to have a proper understanding of waste management issues, without which the success of even the best conceived waste management plan becomes questionable. Each culture has its own dealing with waste and this has to be considered in the planning. Additionally education of administrational personnel is crucial for waste related developments (i.e. co-processing), to increase know how and to enable based on fact decisions (i.e. technology, permit procedures, development of regulation).

Q: What includes waste characterisation and why is it important for waste management plans?

A: Waste characterization means finding out how much paper, glass, food waste, etc. is discarded in the waste stream. Waste characterisation information helps in planning how to reduce waste, set up recycling programs, and conserve money and resources. Waste characterisation information is designed for solid waste planning. Waste characterisation data is collected by taking samples of waste and sorting it into material types like newspaper and aluminum cans, and weighing each type. Typically, samples are taken from trucks delivering waste to landfills and transfer

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stations from residential, commercial, and self-haul sources. In some cases, samples are taken from individual businesses to develop waste composition data for specific types of businesses.

Q: What is „waste to energy" concepts?

A: As primary resources for energy generation decrease in availability and increase in cost, some contents of waste became a new alternative for fuel substitution or energy generation. There are two main concepts. One concept is the use of methane as biogas with energy generation. Biogas is emitted because of biological degradation processes in landfills and anaerobic digestion plants. The second concept is to segregate the burnable fraction from waste and use these parts a refused derived fuel or alternative fuel in thermal processes (i.e. co-processing in cement plants).

Module 3: Understand Cement Production

Q: What requirements do conventional and alternative cement raw materials and fuels need to fulfill to make them suitable for cement production?

A: Alternative raw materials and alternative fuel ashes must chemically fit into the existing raw mix, i.e. not change its composition (and thus the quality characteristics of the product) intolerably.

The contents of the raw materials of volatilizable components (pyritic sulfur, organics, mercury, etc.) should not cause the exhaust gases to exceed emission limit values or, in the case of alternative materials, to greatly exceed the baseline emissions, i.e. the emissions without alternative materials. Alternative fuels should be low in chlorines and close to nil in mercury.

All materials (and all respective handling and process equipment) must comply with the applicable OH&S standards (special focus on hazardous, alternative fuels).

All materials should not impair the kiln operational stability and its availability.

Q: Are heavy metal emissions a problem in the cement industry? Which factors are responsible for changes in heavy metal emissions from cement kiln stacks?

A: With the exception of a few isolated mercury cases (if compared with the European WID limits), there are no problems known with heavy metal emissions from modern cement kilns.

Chromium inputs should be kept low for health reasons in the application of the final product (concrete).

Heavy metals are natural components of raw materials and fuels. Those volatilized in the kiln system from the fuels and raw materials are trapped (adsorbed) by the pulverized raw materials in the preheater / precalciner / raw mill system and fed back to the process via the kiln dedusting equipment.

80% of the heavy metal analyses of clean gas dusts remain below detection limits.

Module 3: Understand Cement Production

Heavy metal emission changes are mainly due to dedusting efficiency changes.

Q: In what respect do historic-but still in use cement production processes differ from the today's standard process (process technology, energy consumption, environmental friendliness)?

A: Some processes use wet raw materials preparation or dry preparation with subsequent water based raw meal granulation. All these processes are thermally less efficient. Also, none of their preheater solutions can match the cyclone preheater / precalciner with regard to retention capacity for emission components. The today's standard cement production technology is clearly best available technology (BAT).

Q: What is to be understood by adequate pre-processing of fuels? Why is it so important?

A: Cement kilns need to operate with an oxidizing kiln atmosphere but for lowest possible thermal exhaust gas losses the oxygen content should be as low as possible. This requires fuels which can be metered reliably and exactly. This again requires adequate fuel preparation whereby also water and ash content issues are of importance.

The higher the share of a fuel type in the total fuel mix, the better the preparation (pre-processing) needs to be.

Q: Are there other advantages of the use of cement kilns for co-processing selected waste streams than those mentioned? By the way, what are the disadvantages?

A: One important aspect has not been mentioned: It is the economic advantage of using already existing equipment for dealing with a new task.

Disadvantages? Close to none, in our perception. Some people fear, however, that a cement kiln solution for selected waste streams would not be BAT, would be operated irresponsibly / unprofessionally by the cement plant operator or would delay total solutions for all waste streams.

Q: Hard to believe that emissions will not change to the worse, even if everything is done correctly. Are there cases where AFR use had to be stopped for any reasons or where permits where denied at all or not renewed?

A: Yes, a few such cases are known. They usually result from the opposition of people living in the vicinity of cement plants with a poor environmental record (dirty stacks, buildings, roads) and corresponding poor communication behavior.

Q: Why are some people against waste incineration in general and against co-processing in particular?

A: Wastes are raw materials, but in the wrong place and often also not in the right

Module 3: Understand Cement Production

form. They should preferably be reused again as raw materials (see "waste hierarchy"). So, some people accept incineration only as a last link in the waste management chain and require priority implementation of the upstream links first. They perceive co-incineration as a door opener to direct incineration thus bypassing the desired waste hierarchy.

Q: Sometimes the term of "bypass technology" is found together with co-processing/co-incineration/co-firing. What is this all about?

A: In the cement industry two types of bypass systems are distinguished: the kiln bypass and the "DOM-dust-to-cement-mill" bypass.

The kiln bypass system guides part of the rotary kiln dust and gases to a quench and dedusting system. Aim is, for operational reasons, to limit chlorine and sulfur circulation in the kiln system to non disturbing levels.

The extracted dust is enriched in mainly chlorines and sulfur and is added to the cement mill (final product) or landfilled.

The DOM-dust bypass (as the name implies) extracts the "direct operation mode" dust from the main dedusting equipment and feeds it to the cement mill. Aim is to limit the enrichment of volatile elements (mainly heavy metals and organics) in the fine dust fraction (for reasons of potential emissions and of OH&S issues).

Q: How can alternative fuels utilization contribute to CO2 reduction of the industry or a country?

A: Some alternative fuels are renewable alternative fuels, i.e. their carbon content originates from the CO2 in the atmosphere (biomass as e.g. waste wood, rice husks, nut shells, animal meal, etc.). In addition, presently also CO2 and other greenhouse gases from waste disposal and incineration are not counted in national CO2 balances. Therefore, using biomass and waste derived alternative fuels, contributes to (calculated) low emission numbers.

Q: If cement kiln emission "do not change" when using AFR, why do authorities often regulate emissions together with the issuing of a respective permit?

A: There are countries with a still poorly developed environmental legislation. Authorities may then want to profit from the opportunity to correct such shortcomings (at least partially). Also, they may belive that emission increases would inevitably accompany an alternative fuels co-processing scheme or they may feel public pressure from stakeholders to play an active role.

Finally also the cement plant operator may wish to have to stick to emission limit values in order to demonstrate compliance with responsible and efficient lawmaking.

Module 4: Application of Pre- and Co-Processing

Q: There are five main families of alternative fuels. What about gaseous, alternative fuels?

Gaseous alternative fuels do exist, often unfortunately in small quantities only. The best known is landfill gas from engineered landfills. The standard solution, however, is to use this landfill gas to produce electricity by means of gas motors.

Q: The alternative fuels utilization rate in the Holcim Group appears to plateau between 10 and 15%. Individual companies, however, reach 50% and individual plants even 100%. What are the reasons thereof?

The low hanging fruits have been harvested since quite some time. In addition, new Group countries (e.g. India and China with no alternative fuels record) do presently dilute the Holcim numbers. Today, AFR business development is more complex and time consuming. In industrially developing countries nature protection and waste management often do not have a very high priority. Often also the awareness for the importance of waste management, or simply the necessary funds, are missing. Another problem is long transport distances and related cost.

A 50% and higher substitution rate is normally possible in any cement plant with an adequate alternative fuels mix and appropriate pre-processing levels. 100% are possible if the fuel mix includes around 50% liquid alternative fuels.

Q: What is the difference between pre- and co-processing?

Pre-processing includes all process steps required to make waste derived alternative fuels (or raw materials) fit for reliable feeding to the co-processing stage (cement kiln). Reliability includes constant mass flow and energy feed. These can be assured by crushing / grinding, drying, homogenizing and adequate design of the storage and extraction equipment.

Co-processing (also referred to as co-incineration or co-firing) includes the process of using the pre-processed alternative fuels as a component in the fuel mix of the respective industrial process. It also includes the kiln feed equipment which is an essential element for efficient co-processing.

Q: If co-processing changes the characteristics of a material from hazardous to non-hazardous, why then some people remain opposed to incineration, even to co-processing in cement kilns?

Hard to say. Some might feel a lack of trust in people, in process technology, in the adequacy of the direction of the development ("incineration" instead of material recycling).

Q: Do you really believe in the "zero additional emissions" statement? Please, detail!

Mercury and chlorine emissions may increase if the total input is increased. Sulfur

Module 4: Application of Pre- and Co-Processing

emissions may increase / decrease if the volatile sulfur input with the raw materials is increased / decreased. CO emissions (often not regulated in the cement industry) and sometimes VOCs may increase if fuel feed points are overloaded.

NOx emissions may decrease when alternative fuels (fed to the main firing) carry moisture and mineral matter or do need higher excess air factors which all have a flame cooling effect.

There are some more, mostly minor effects. Over all, the environmental benefits of less NOx and CO2 as well as of improved waste management override the few possible negative effects by far.

Q: Is there also a potential for emission improvements? Details?

Yes, see question above. This holds particularly true if the total system is considered. What would e.g. be the emissions to air, water and soil if the alternative fuels would be processed in some other kind of equipment, e.g. digestion or open fires in a not secured landfill or backyard.

Q: How can we recognize / prevent wrong feed point selection and feed point overload?

Comparatively easily from increased CO- and VOC numbers from the continuous emissions monitoring equipment. Countermeasures can include finer fuel, improved dosing, input reduction or excess air factor adjustment.

Q: There was an instruction about quality assurance of alternative fuels. What about quality assurance of products of the industry?

Cement plants are mass producers of a comparatively cheap product. Producing out-of-specs materials is out of question. Cement plants therefore need and do have elaborate quality assurance systems. These are normally sufficient to also deal with effects from alternative fuels.

Q: Bypass systems have been mentioned. What exactly do you mean by these terms?

Bypass systems are used to partially bypass process stages, thus preventing the enrichment (by extraction) of disturbing or undesired compounds/elements. Sometimes, cement kiln systems include a preheater bypass system to limit the enrichment of (mainly) chlorines in the kiln system. Cement kiln systems should also be equipped with a DOM (direct operation mode) dust bypass to limit enrichments of some compounds in the external dust circuit. In both cases the extracted materials are fed back to the system, more exactly to the cement mill for incorporation into the final product.

Q: Transportation and pre-processing (handling) of hazardous materials can

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be critical. What improvements are possible in this sector?

Collection and transportation should only be contracted to efficient, well established, professionally working companies with a clean vehicles fleet.

Pre-processing of hazardous materials needs to strictly follow the rules of a well established and controlled OHS system.

Both systems should be subject to regular internal and external auditing.

Module 5: Operational Health & Safety

Q: Why an OH&S system is needed in the AFR business?

A: Because people must be aware of risks and informed on how to make responsible decisions to work in a health and safe manner.

Q: What approach is recommended for dealing with OH&S risk in AFR?

A: When avoidance is not possible, minimizing risks by:

1. Technical measures
2. Administrative measures
3. Personal preventive measures

Q: What is a Risk assessment?

A: It is the examination of the probability and magnitude/impact of an event that could occur.

Q: How to minimize risks during AFR site selection?

1. With a proper zoning for AFR facilities, away from population settlements and other industries that can affect the AFR process or vice versa
2. With a good infrastructure: Including technical solutions such as filters for vapors, odors and dust that stop these getting into ground or surface waters; fire protection, etc.
3. With properly trained management and employees with regard to the handling and processing of AFR

Q: What should be taken in consideration regarding safety & security management systems in AFR sites?

1. Each site must have a unit for safety & security management
2. A Risk Manager is responsible for the arrangement and performance of the unit

Q: Why is documentation and information a must in the OH&S management

Module 5: Operational Health & Safety

system?

A: Because:

1. Documentation and information are the basis for openness and transparency about health & safety measures
2. It shows what has been done (records, evidence, defense, liability), it should be kept for 30 years
3. Information must be available for employees and authorities before starting any pre and co-processing activity and during the whole AFR process;
4. Even when the site closes, documentation must be kept for 5 more years

Q: Why OH&S training should be provided at all levels in the AFR business?

1. Marketing, sales, pre & co-processing personnel should be trained in health and safety management before starting with co-processing at a new facility site
2. Hazardous operations training for new workers and sub-contractors should be completed before starting pre & co-processing. Periodic re-certifications are required
3. Induction training in safety for all visitors and third parties is recommended
4. Understanding risks and how to mitigate them are key to training in health & safety management system
5. Training in health & safety management and providing information to authorities is the basis for building credibility as a serious and responsible AFR business

Q: Why are emergency and spill response plans required for the AFR business?

1. Because good, regular emergency/spill response planning and emergency response simulations, including the neighboring industries and the authorities, contribute to the acceptable use of AFR
2. As well as to contain incidents from escalating

Module 6: Legislation & Permitting

Q: Why is a legal framework necessary?

A legal framework is necessary to guarantee legal certainty for all relevant players, to give legitimacy to administrative action, to improve environmental protection and waste management practices and finally to fulfill international obligations (Basel Convention).

Module 6: Legislation & Permitting

Q: Is a special Waste Act necessary?

This has to be answered case by case. Environmental framework laws may be sufficient if they provide for binding rules and enforcement instruments, otherwise a national waste law should be adopted. Depending on the tradition of the country, pre- and co-processing activities may also be covered by pollution control law.

Q: Is a special Regulation on pre- and co-processing necessary?

A Waste Act is not suited to provide technical standards. *Implementing regulations* are necessary to concretise the general principles laid down in the Act, such as emission control standards, details concerning the licensing procedure, monitoring, operation requirements and the AFR that are suitable for co-processing. Thus, pre-processing and co-processing activities should be regulated by regulations of the competent Ministries.

Q: What happens if no regulation exists?

If *no specific regulation covers pre- or co-processing*, the plant operator could apply for a permit under the general environmental law in force (for instance EIA-Regulations). In this case, international standards should serve as reference.

Q: What is the appropriate reference for emission limit values (is EU law not to strict for our country?)

Cement plants are able to comply with European standards also in countries outside Europe. Most developing countries are orientated towards EU standards as far as emissions limit values are concerned. For existing plants, in some cases transitional periods might be appropriate.

Q: What types of waste are suitable for co-processing and should there be a regulation defining the suitable waste?

A large number of waste types are currently being considered as suitable for energy recovery. Nevertheless, not all waste materials are recommended for co-processing in cement plants. National regulation should exclude these materials from co-processing. Some countries opted also for a positive list containing suitable materials for co-processing.

Q: What should be considered in the permit?

The permit should define the *categories of waste* that are licensed for co-processing in the concerned plant. The permit has also to define the emissions limit values to be respected and the concrete monitoring and reporting obligations of the operator.

Module 7: Corporate Social Responsibility and Communication

No FAQs for the time being.

Module 8: Life Cycle Assessment in the Cement Industry

No FAQs for the time being.