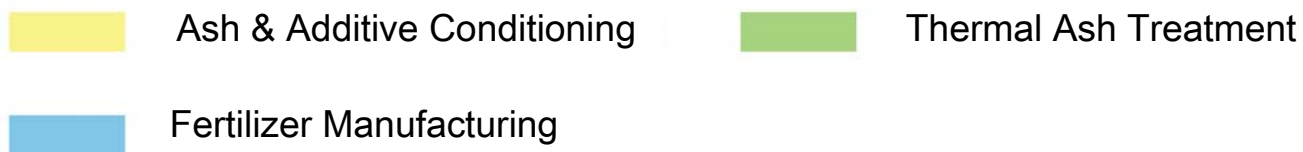
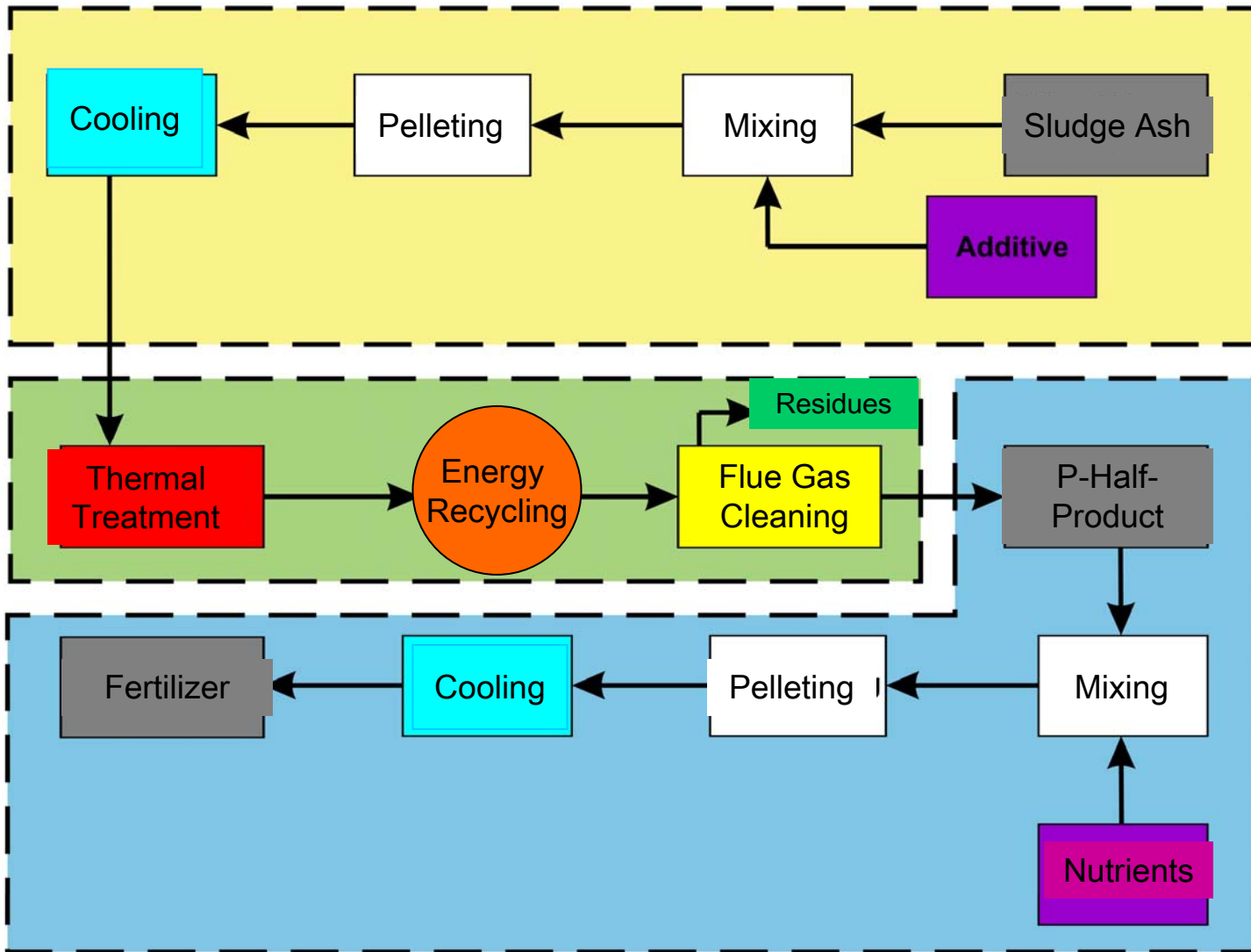
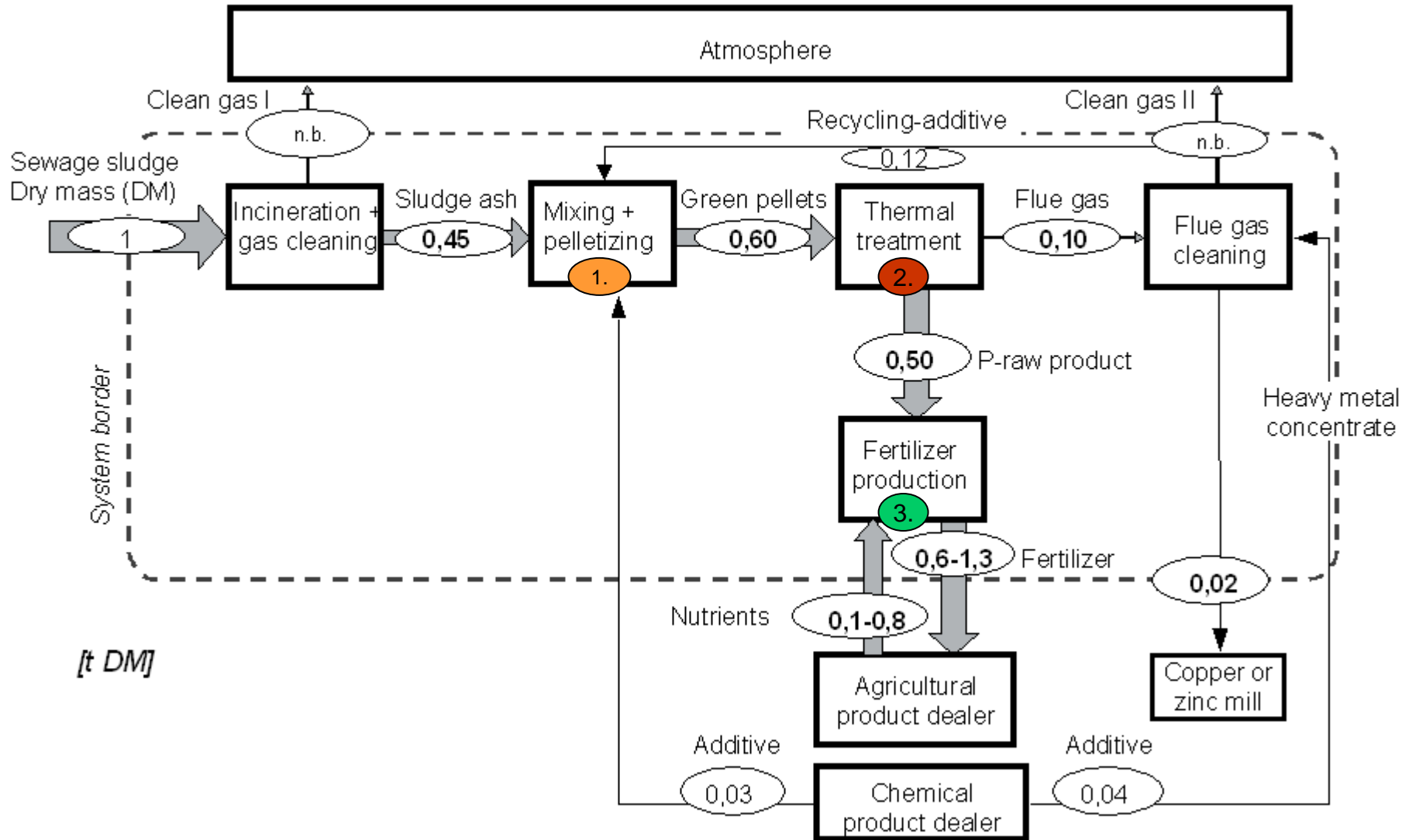


# Industrial Process & Pilot Plant

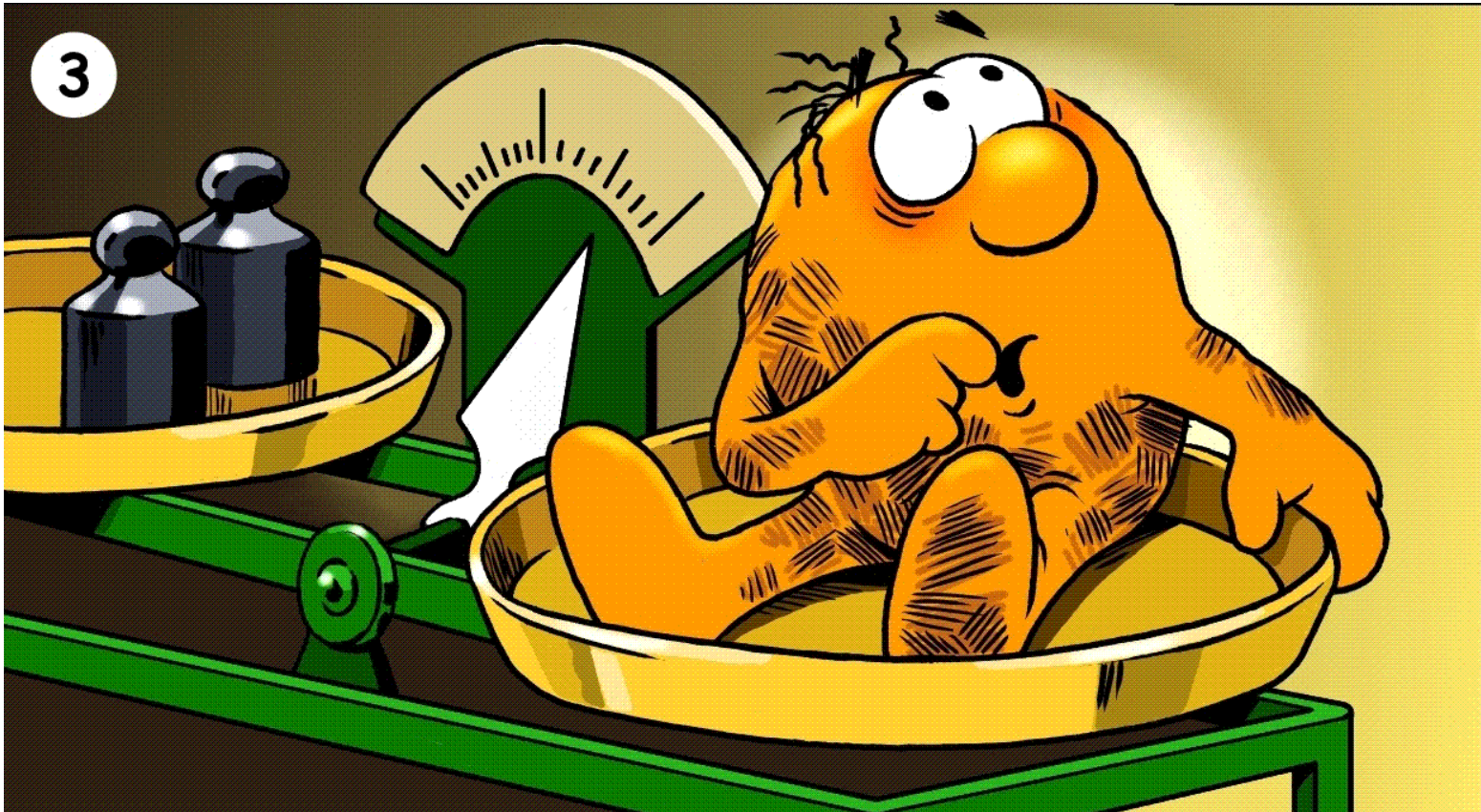




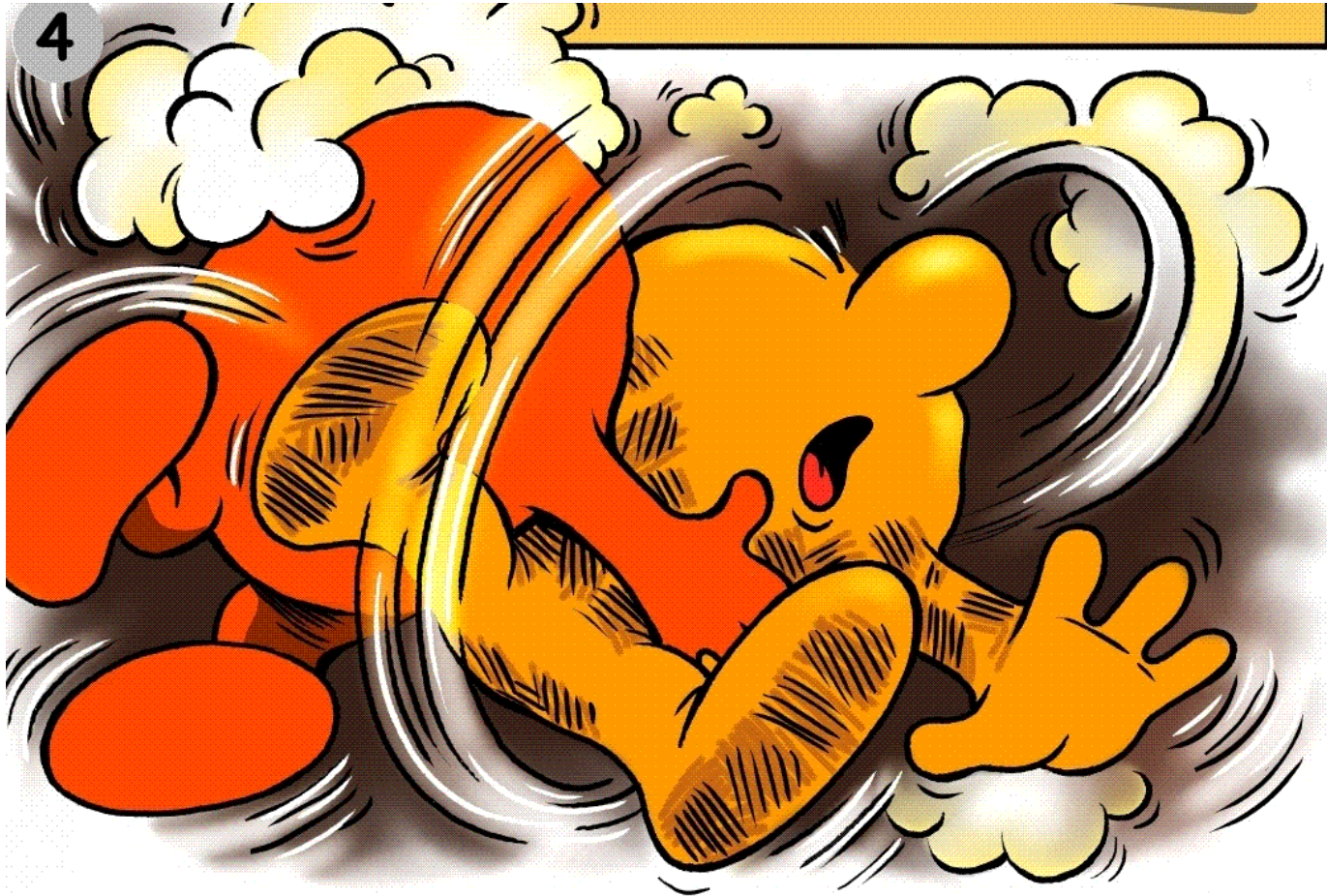




- Ash from selected sludge incinerators is delivered in silo trucks twice a week
- It is stored in two 24 m<sup>3</sup> ash silos



- Screw conveyors transport the ash from the silos to a conveyor belt on weigh modules
- Additives are stored in big bags and fed by oscillating conveyors



- The belt conveyor unloads the weighed materials to an elevator that lifts them to the upper floor
- The materials are fed to a paddle mixer and mixed with water



- The mixer unloads the material to a storage bin from where it is fed through an inlet feeder screw to the pellet mill.
- In the 55 kW pellet mill the mix is pressed to cylindrical pellets of 5mm diameter.
- Pellets are unloaded to an elevator and again lifted to the pellet cooler on the upper floor for being stabilized.
- After the pellet cooler they can be stored in a silo or directly conveyed to the furnace.

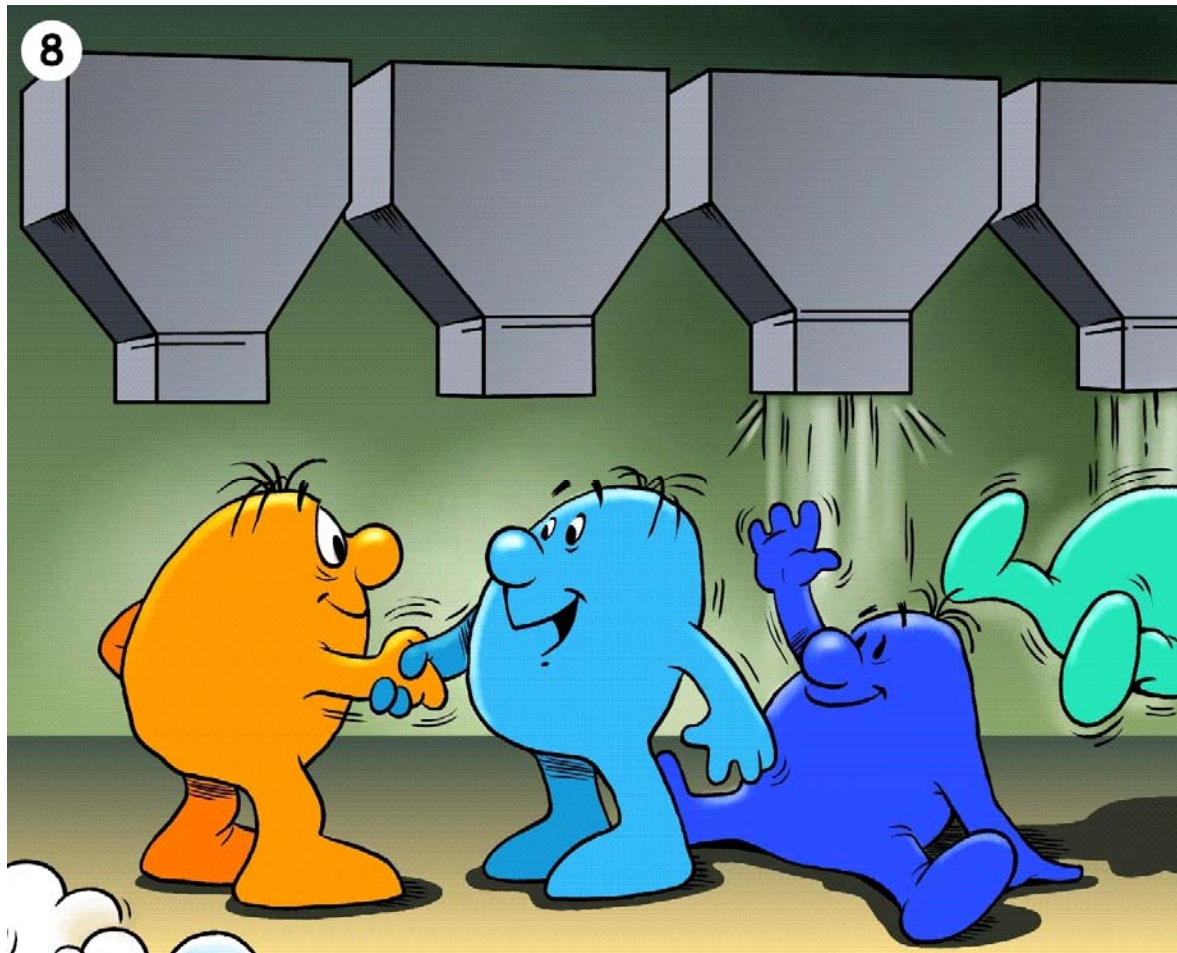


- Conveyor belts take the pellets from the storage silo to a bin mounted on weighing modules
- Finally, pellets are fed by an air-cooled oscillating conveyor to the kiln, where they are exposed to 1.000°C for 20 minutes.





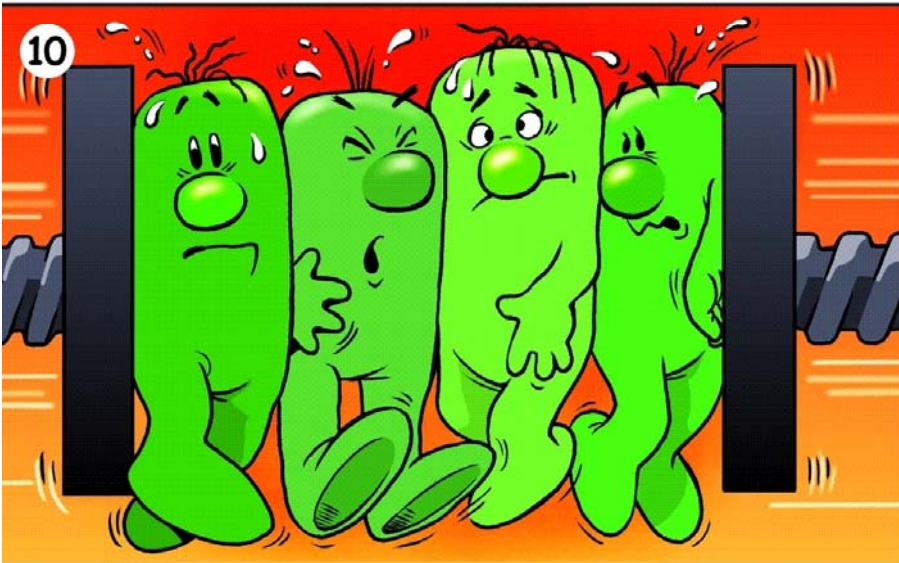
- Four water cooled screw conveyors cool pellets down to about 60°C and take them to another weighing device.
- Belt conveyors take them over and transport them to another silo in front of the production hall.
- From the silo, pellets can be unloaded to big bags or to a hammer mill, where they are ground to fine powder for further processing.
- P-fertilizer powder can be redirected to the dosage station or unloaded to exchangeable transport containers.



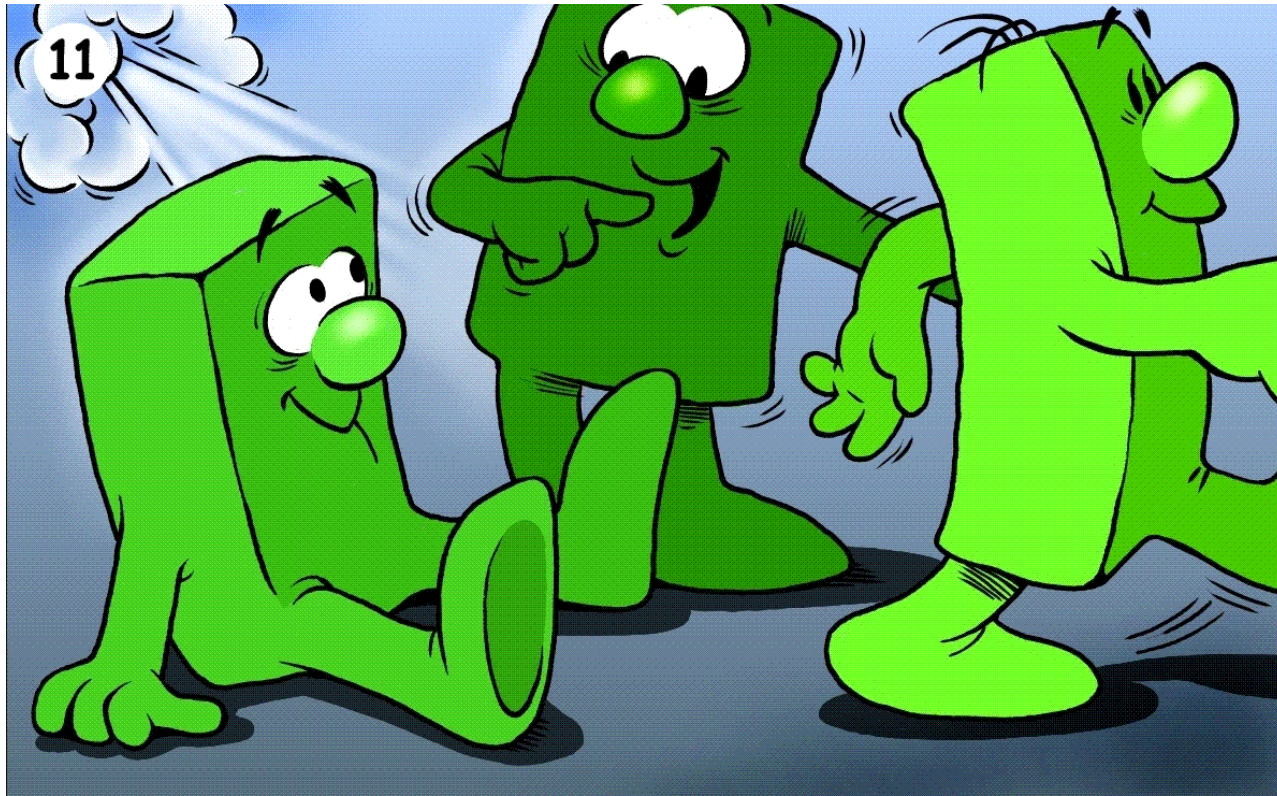
- Nutrients such as potash, sulphate of potash, phosphoric acid or triple super phosphate are stored in big bags and fed by oscillating conveyors to the conveyor belt on weighing modules



- Weighed quantities of milled P-fertilizer and nutrients are passing the same conveying devices again and fed to the paddle mixer.



- The mix is fed to the pellet mill conditioner where steam and other granulation aids can be added.



- After the press, fertilizer pellets may be crumbled by fluted rolls to adjustable, nearly spherical shapes that meet the standards of usual fertilizer spreaders and fertilizer blenders.
- Ready-made fertilizer granules are stored in the transportable containers that are picked-up and delivered by truck to their final destinations.

- Silos
- Storage bins, partly mounted on weighing modules
- Big bag stations
- Screw- and belt conveyors, partly mounted on weighing modules
- Mixer
- Pellet mill
- Short drum rotary kiln
- 3-stage air pollution control system with chlorine recovery
  - Quenche (spray dryer)
  - Baghouse filter
  - Acidic scrubber
  - Mixing and stirring tanks for additive recovery
- Process controlling device with tracing & tracking function
- Laboratory equipment for quality control (XRF)

The plant is designed to treat 7-10 tons of ash per day in continuous operation. It covers approximately 400m<sup>2</sup> and has a maximum height of 11m.

# Summary

## Material Conditioning

- Type and amount of additives are selected according to the ash type and quality, the legal requirements in terms of heavy metal limits and the pursued fertilizer quality in terms of secondary and trace nutrients.
- The first production step aims at the homogenization of input materials – ash and additives – to facilitate complete and timely chemical reactions between heavy metals and chlorines.
- Pelleting prevents fine ash particles from being taken along by the gas- and airflow to the flue-gas cleaning system.



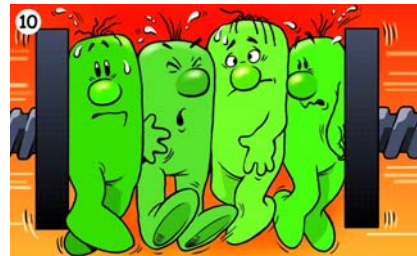
# Thermal Treatment & Gas Cleaning System

- 98% of ash mass fractions and 50% of additive mass fractions end up in the product. Product output is approximately 110% of ash input.
- 99% of cadmium, mercury and lead, >90% of copper and zinc and about 50% of tin and molybdenum are removed and retained in the air pollution control system as metal hydroxides.
- 75% of chlorines are recovered from the air pollution control system and conditioned to be recycled as new additives.



## Fertilizer Manufacturing

- Unlike the industrial manufacturing plants, the pilot plant disposes of one line of mechanical equipment for two different purposes: raw material conditioning and fertilizer manufacturing.
- Because of limited space for storage and transport, most of the fertilizer manufacturing is handled by subcontractors, fertilizer or animal feed producing companies.
- The pilot plant is predominantly used for product development and the production of fertilizer samples.
- To avoid contamination from untreated ash, fertilizer production is limited to one or two days a week.



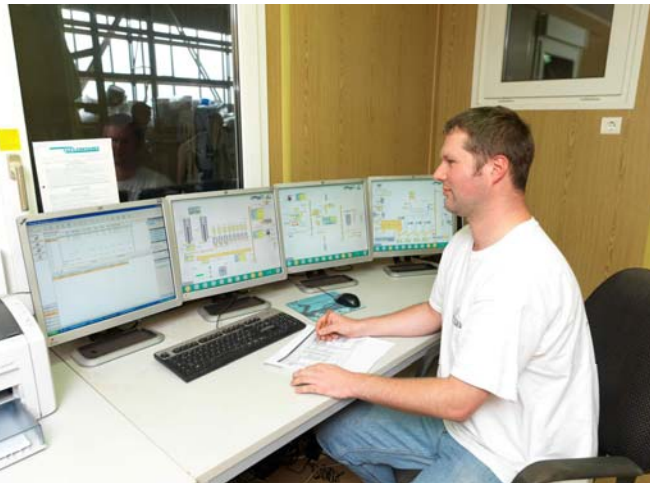




55 kWh pellet mill with conditioner and storage bin

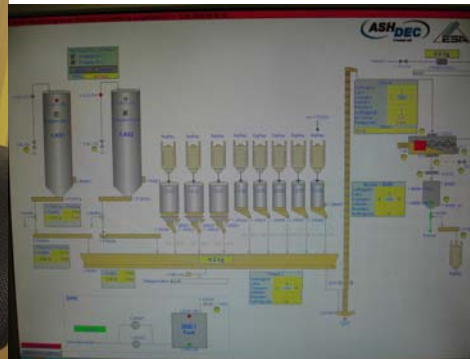


Green pellet silo and big bag station



Process control center

Screenshot





Drum rotary kiln with cooling screw conveyors



Baghouse filter



Quenche

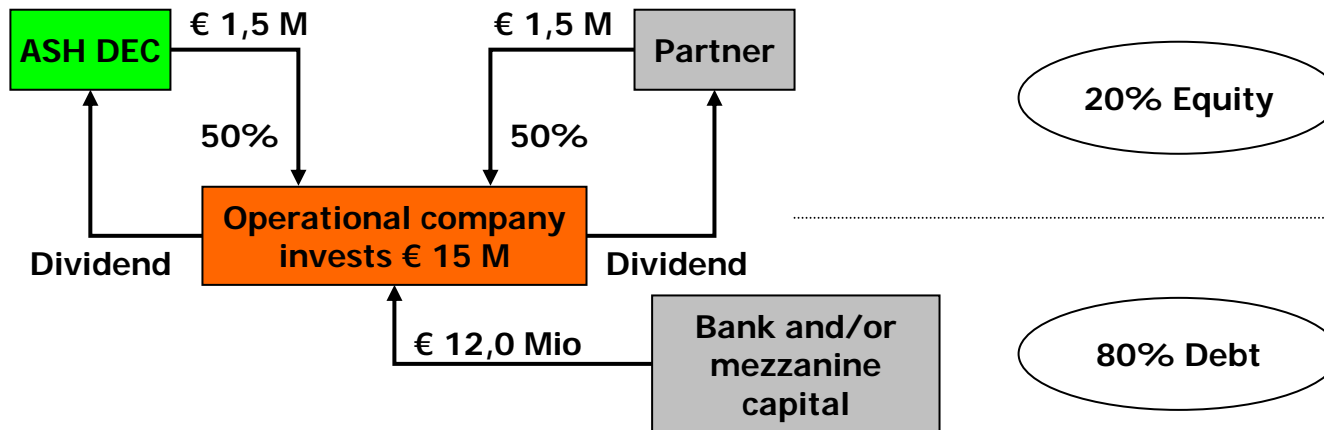


Flue gas cleaning, acidic scrubber



Furnace lining

## Investments and Ownership



ASH DEC plants shall be set-up and operated by independent project companies. Operators of sewage sludge incinerators and interested stakeholders are invited to take shares in the investment. The share distribution will be negotiated individually in accordance with the mutual interests at the time of investment. The offer to take shares is optional and not conditional to a contract for building and operating a plant.

ASH DEC sells a turnkey manufacturing plant and transfers the know-how and intellectual property rights to the project company. The project company covers the investment with equity capital and loans. The first project companies will not achieve the optimal relationship between equity capital and loans. The gap shall be balanced by grants from public funding agencies.

Condition for building and operating a manufacturing plant is a long-term ash delivery contract and the respect of those quality parameters that have been determined during the planning phase. In principle, ashes from municipal sewage sludge and sludge from food and feed plants will meet the quality requirements. Low dosage of additives for the air pollutions control system is a benefit to the economic performance of the plant.

## Know-how, responsibility and execution



	Project development	Concept	Design	Engineering	Construction	Operation	Distribution
Know-how	ASH DEC	ASH DEC/ TREVIS	TREVIS/ ASH DEC	TREVIS	TREVIS	Operational company	Fertilizer Distributor
Responsibility	ASH DEC	ASH DEC	ASH DEC	ASH DEC	ASH DEC	Operational company	ASH DEC
Execution	ASH DEC	TREVIS/ ASH DEC	TREVIS	TREVIS	TREVIS/ Subcontractors	Operational company	Fertilizer Distributor

ASH DEC jointly develops the projects with the shareholders of the project companies. The project development phase comprises negotiations with location partners, conceptual design of the project, including a short description of the plant, the preliminary negotiations with public authorities and the business plan of the company.

The associated company TREVIS INGENIEURE AG (Basel) joins the project at the time of starting the plant concept and conducts the conceptual design and the design and engineering of manufacturing plants including the specifications and the tender for machinery and equipment.

The project company operates the manufacturing plants. Preferably synergy effects with the incineration plants are sought, e.g. for the joint use of infrastructure and amalgamation of the duties. Employees of the incineration company shall - after being trained by ASH DEC – take care of controlling, supervising and routine maintenance of the facility against cost reimbursement.

# Industrial Manufacturing-Plant

The typical modular ASH DEC plant shall be built on site of a sewage sludge incineration plant and shares the existing infrastructure:

- Typical design capacity: 4 t/h, 30.000 t/year
- Space requirement: 1.000 m<sup>2</sup>
- Height: ~ 15 m
- Investment cost: € 15-18 Mio. +\*)
- Expected sales revenues per year: € 13-24 Mio. \*)
- Pay-back time: 3,0-4,0 years\*)

+) The investment cost is calculated for a turnkey facility not including the cost of land, basements and concrete buildings. The higher price band stands for manufacturing-plants to produce ready made fertilizers. The lower price band stands for plants to produce a P-raw product that is being processed to a final fertilizer by an external facility.

\*) Approximation depending on the product range and the market situation, calculated at June 2008 market prices.

# Comparative Advantages of the Thermo-Chemical P-Recovery Technology

- Worldwide first P-recycling process to produce a fully licensed fertilizer.
- Production cost lower (!) than for rock phosphate based P-fertilizers plus extra benefits through ash gate fee.
- Can substitute about 30% of European rock phosphate and its derivatives imports.
- Potential to become the biggest “phosphate mine” in Europe.
- The process is ready for transfer to the industrial scale – 5 industrial projects presently in the conceptual design phase.