JAPANESE CLEAN TECHNOLOGIES FOR SOUTH AFRICAN CEMENT INDUSTRY

6, September 2012

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List of clean technologies applicable to South African cement plants and their benefits

Clean Technology		Benefits
Waste Heat Recovery	Generating power using waste heat from kiln and supplying it to cement production	Reducing purchased power (= Reducing indirect emissions)
Co-processing (of wastes)	Burning effectively combustible waste in cement kiln or waste incinerator.	Contributing to establishment of recycling based society Reducing total fossil fuels consumption Reducing total GHG emissions reduction Life extension of landfill site due to reduction of volume of wastes disposed
Co-processing (of biomass)	Burning effectively biomass in cement kiln or waste incinerator.	
Decomposing of CFC and PFC	Decomposing CFC and PFC in cement kiln without any damage of product	Reduction of fossil fuels consumption required for decomposing CFC and PFC Reducing GHG emissions from CFC and PFC in local

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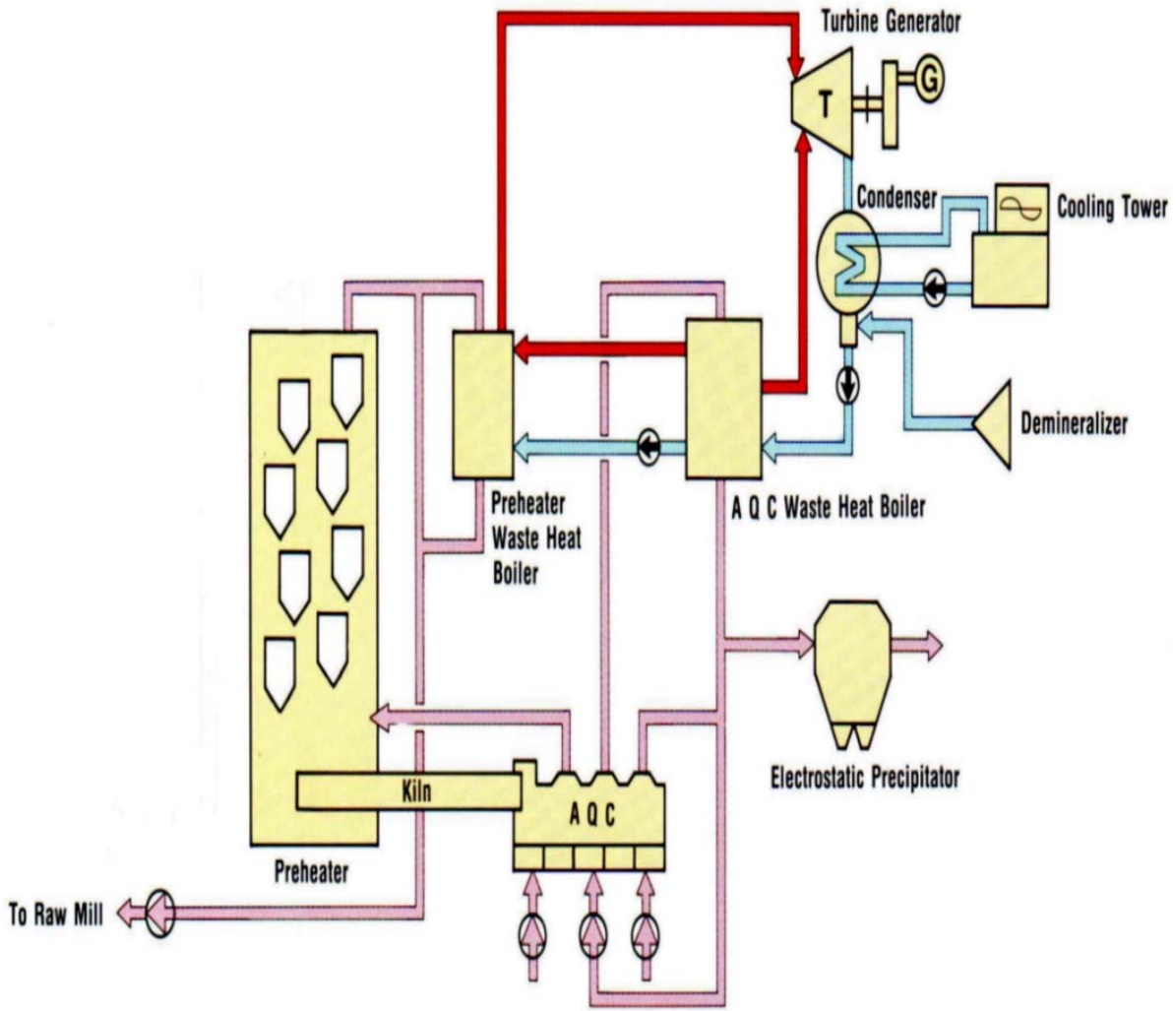
1. Waste Heat Recovery



Generating power using waste heat from kiln and supplying it to cement production

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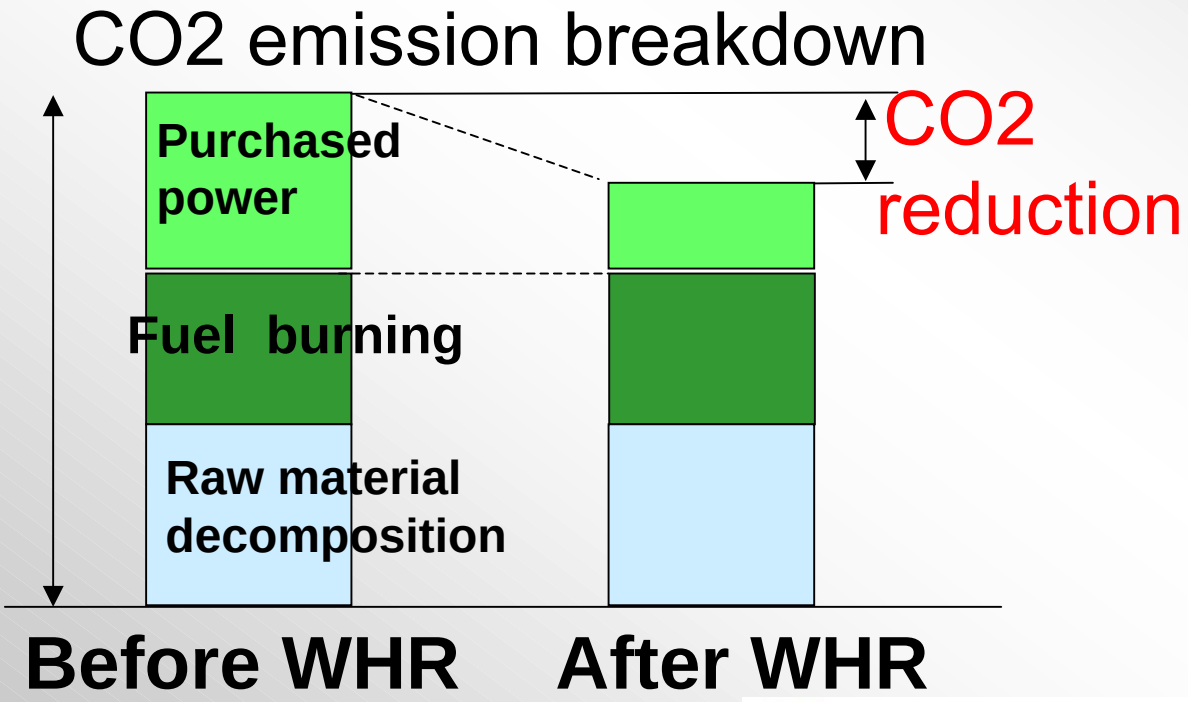
CO2 emission reduction by introducing Waste Heat Recovery

About one-third of electricity required for cement manufacturing process
Can be substituted by WHR generated electricity.



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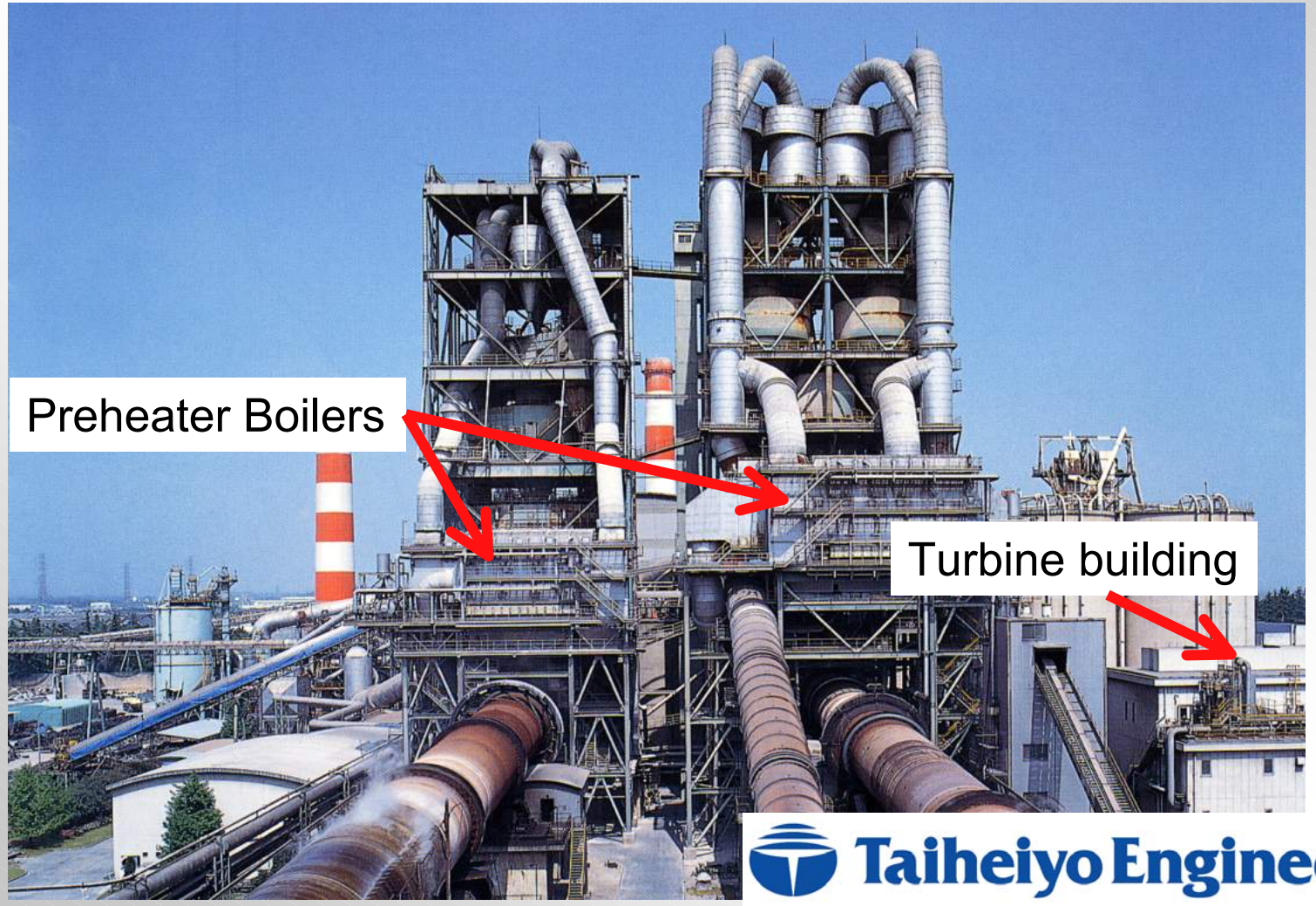
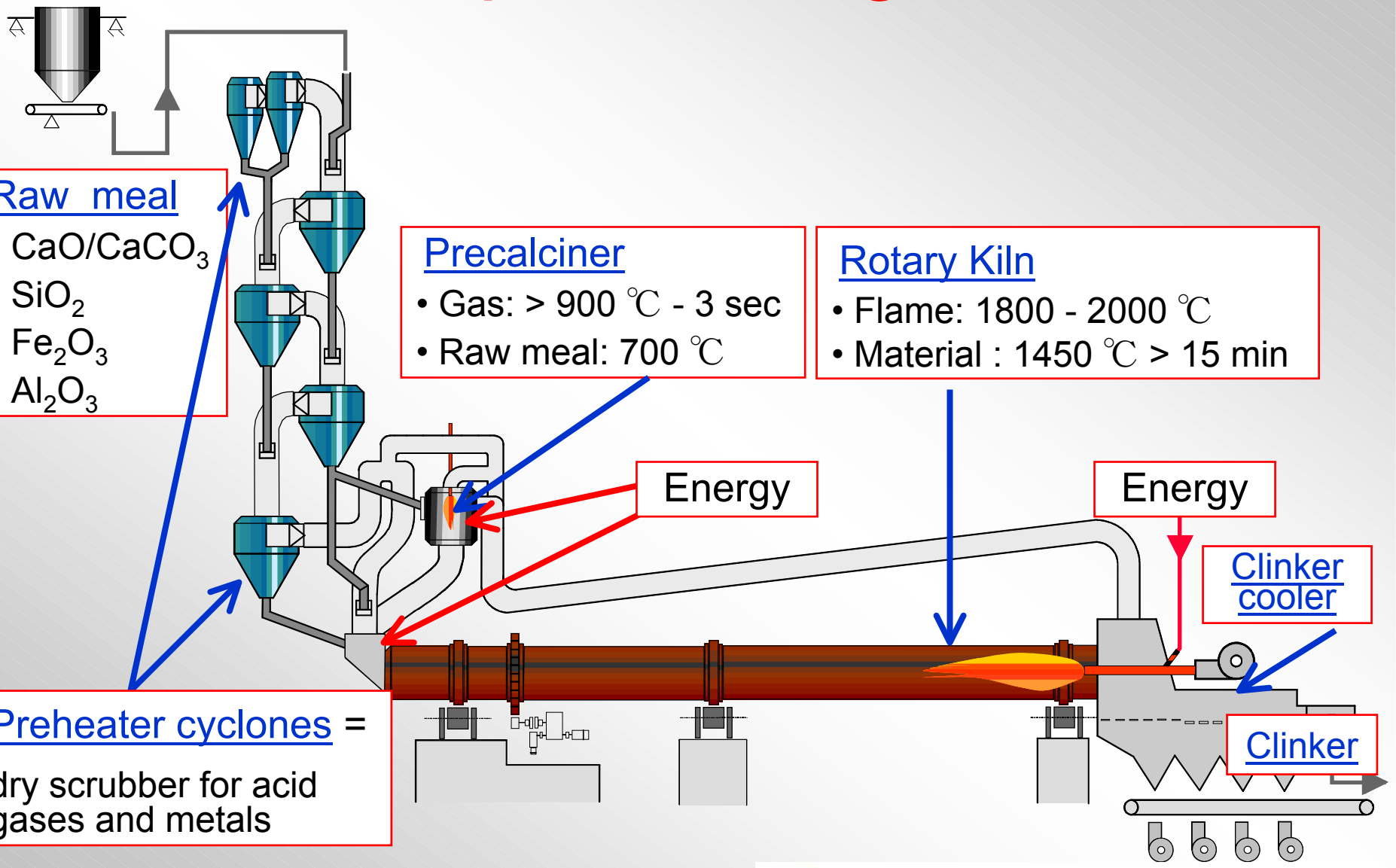
Waste Heat Recovery power generation system



2. Co-processing of waste



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Cement Rotary Kilns' Unique Characteristics

1. High temperature in a Kiln can decompose almost all of toxic organic substances.
2. Primary raw material, limestone, is the most widely used neutralizing agent for hazardous materials.
3. Ash component of waste is effectively used as raw material, thereby no secondary waste is generated from the cement plant.
4. Trace elements such as heavy metals are safely captured in the cement clinker.
5. Production capacity of Kiln is very large compared to waste material usage.

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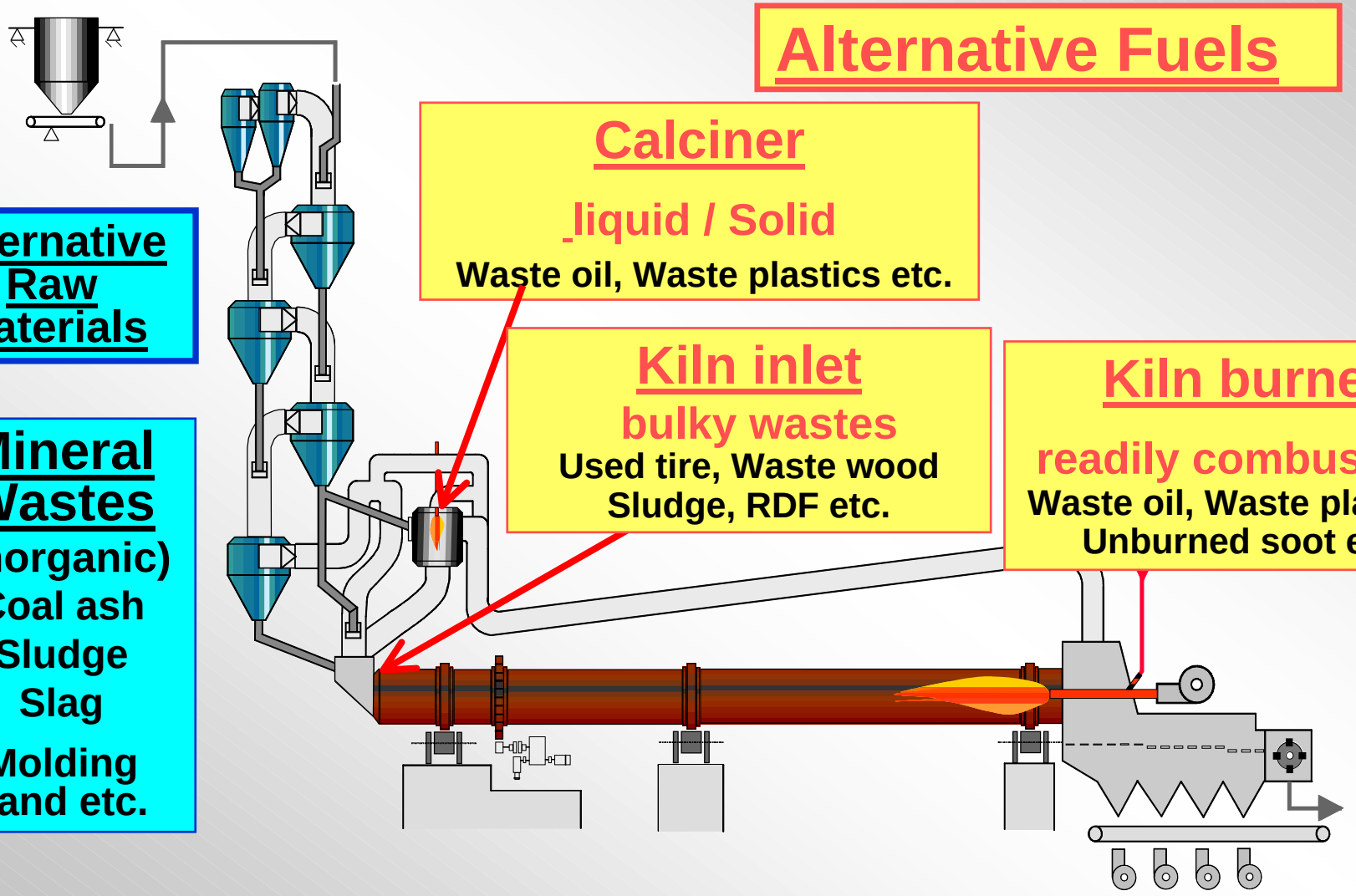
Co-processing of Waste in burning process



Alternative Fuels

Calciner

liquid / Solid

Waste oil, Waste plastics etc.

Kiln inlet

bulky wastes

Used tire, Waste wood
Sludge, RDF etc.

Kiln burner

readily combustible

Waste oil, Waste plastics,
Unburned soot etc.

Alternative Raw Materials

Mineral Wastes

(Inorganic)
Coal ash
Sludge
Slag

Molding sand etc.

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Important points in Co-processing of wastes and countermeasures

- To keep stable operation

  (Automatic control program)
- Uniformity in quality and quantity

  (Mixing, Feeder, processing …..)
- Reduction of ‘hazardous’ element (Cl, S…)

  (Coating prevention)

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Examples of Co-processing of waste in Japan

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Used tires transported for burning in kiln

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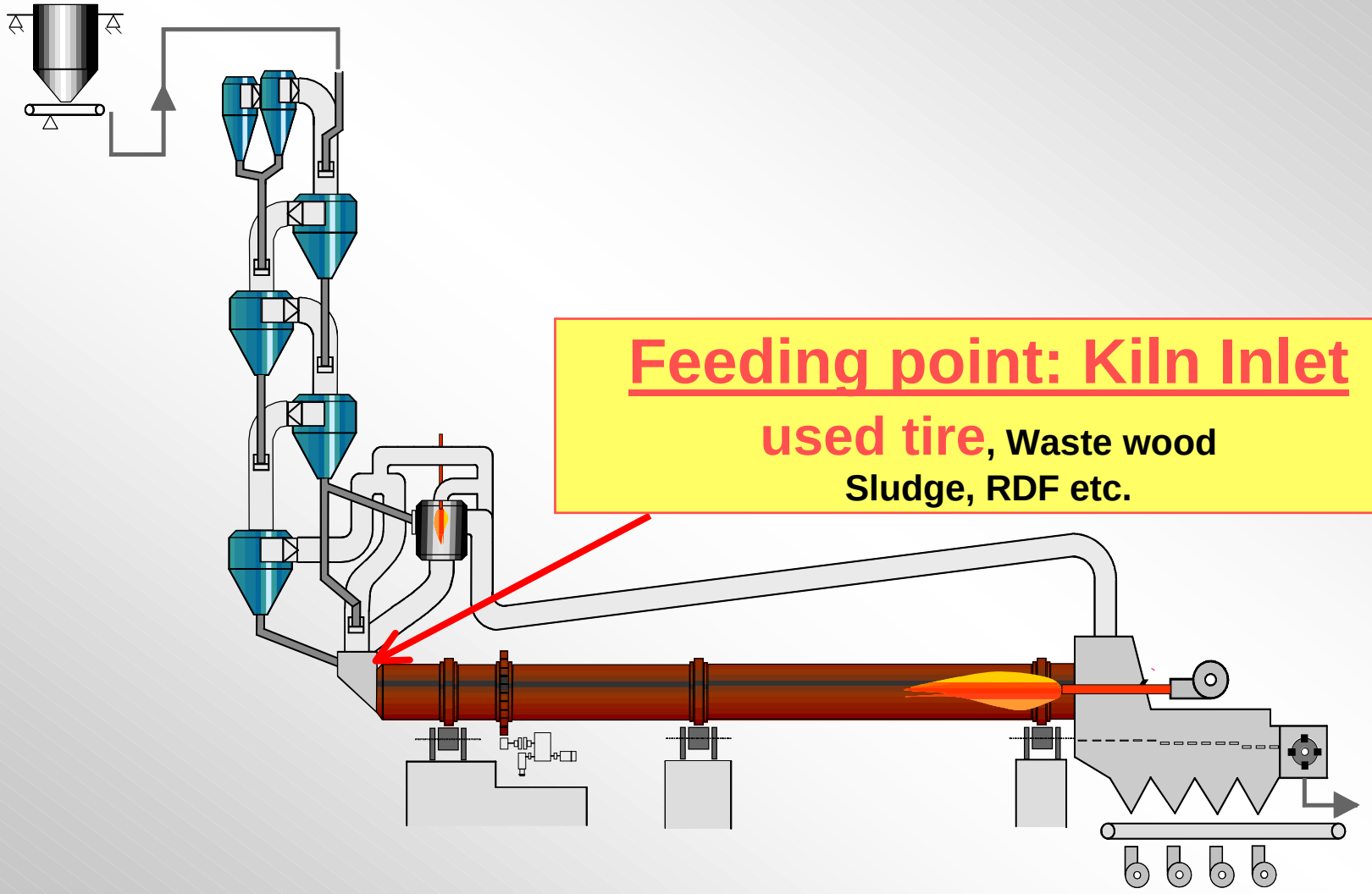

Feeding point: Kiln Inlet

used tire, Waste wood
Sludge, RDF etc.

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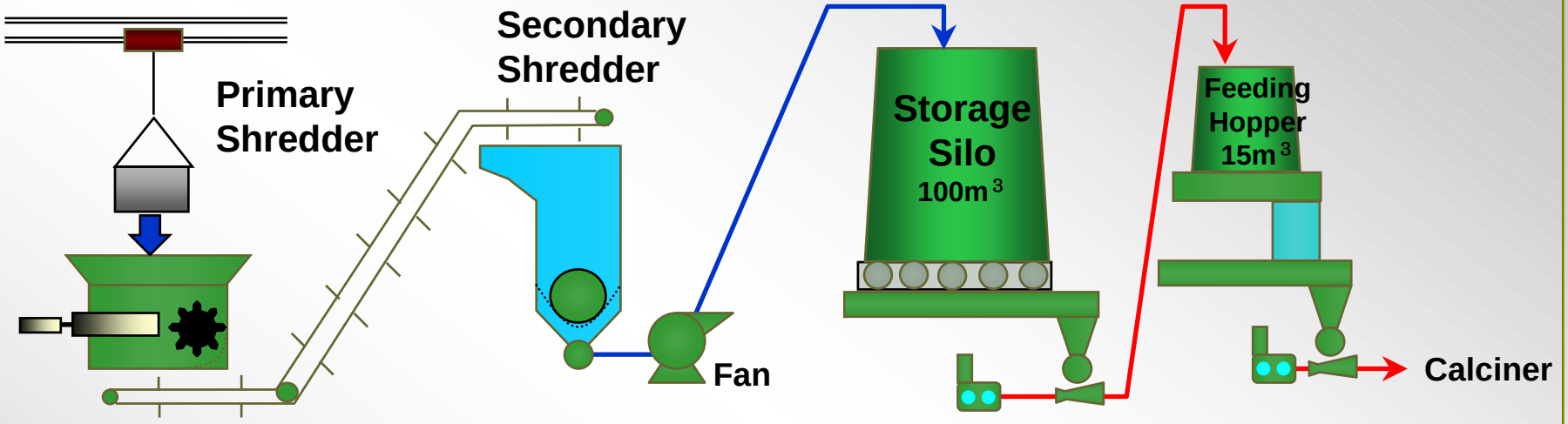
Flow diagram for waste plastics pre-treatment at Kumagaya Plant, Japan



■Capacity

2.5 t/h

Type of Waste Plastics

Material	Type	Note
Formed PE	sheet	Capacity 8,500 t/y
Bridged PE	sheet・rolled solid	
PET, PE, phenol	rolled	
PET,PE	rolled	

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Shredder for waste plastics

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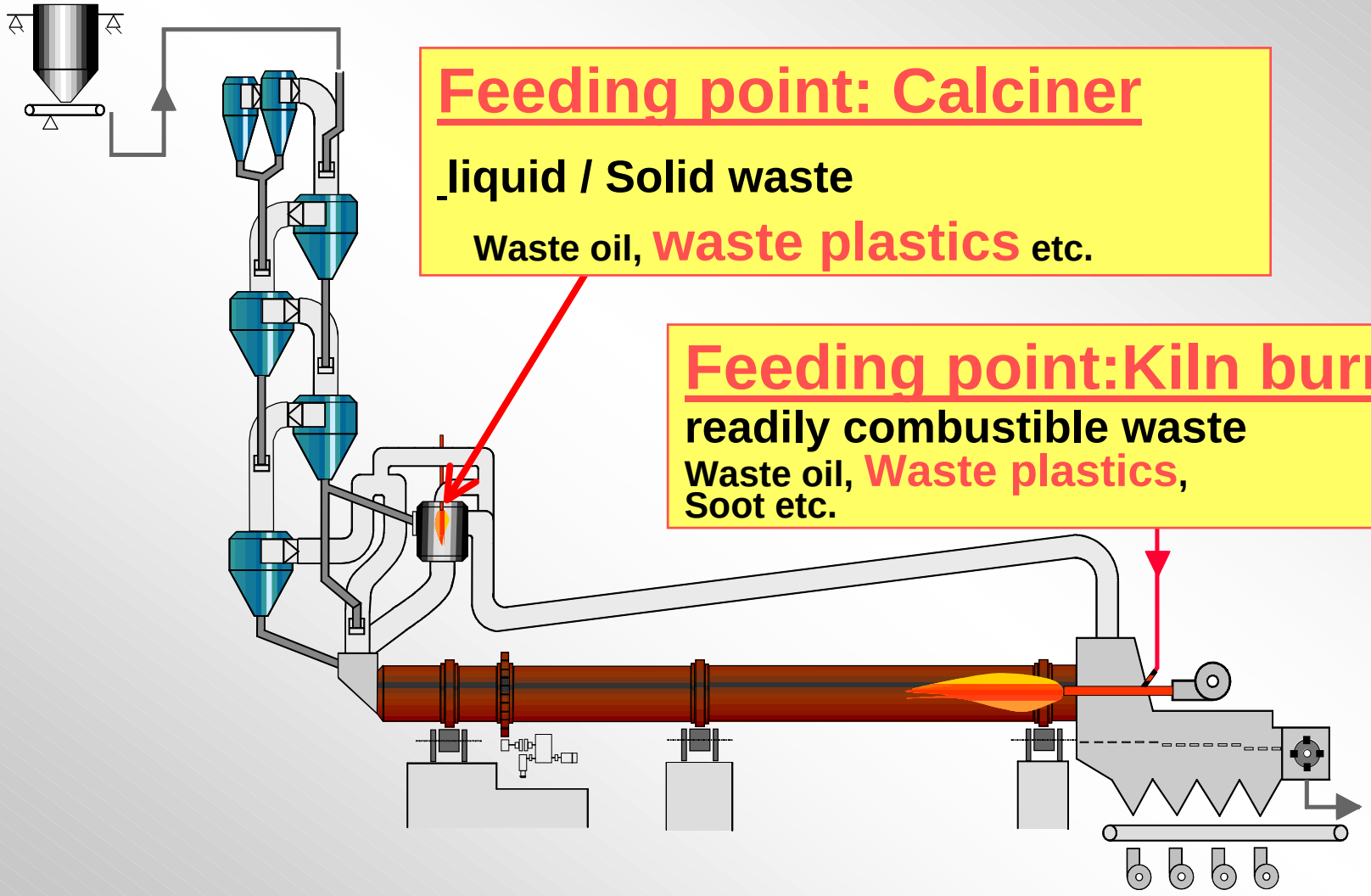

Feeding point: Calciner

- liquid / Solid waste

  Waste oil, waste plastics etc.

Feeding point:Kiln burner

readily combustible waste

Waste oil, Waste plastics,
Soot etc.

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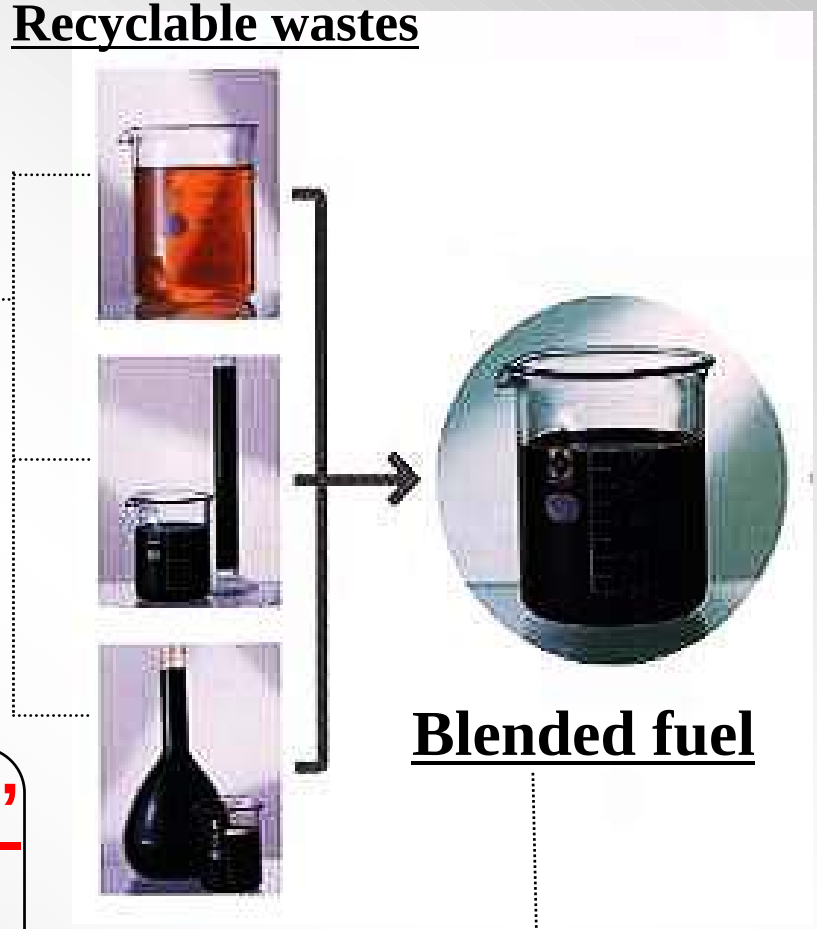
Blended fuel from wastes

Recyclable wastes (liquid / sludge)

- **Waste oils** (lubricant, cutting, hydraulic, animal/vegetable, ship/vessel etc.)
- **Waste solvent** (alcohol, organic acid etc.)
- **Sludge** (tank sludge, paint, water treatment sludge etc.)
- **Waste alkali**
- **Others**

Blending treatment by waste oil company



Specification of "Blended fuel"

LHV: 4,500 – 5500 kcal/kg

Chlorine, viscosity, moisture, flushing point

→ Cement plants

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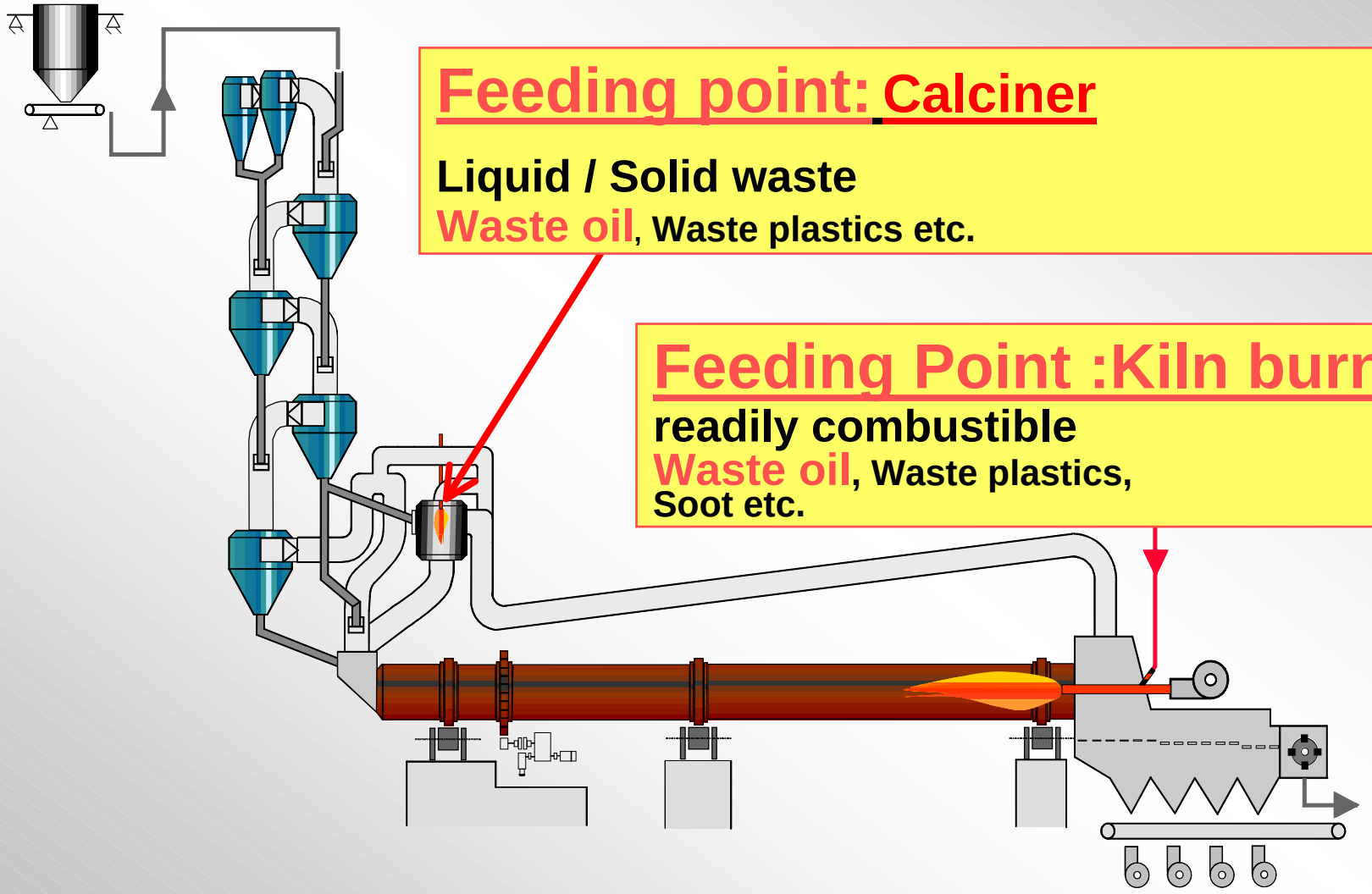

Feeding point: Calciner

Liquid / Solid waste

Waste oil, Waste plastics etc.

Feeding Point :Kiln burner

readily combustible

Waste oil, Waste plastics,
Soot etc.

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Use of waste “Pachinko” Machine (RDF)

Waste Pachinko machine, will be processed into RDF after crushing and kneading.

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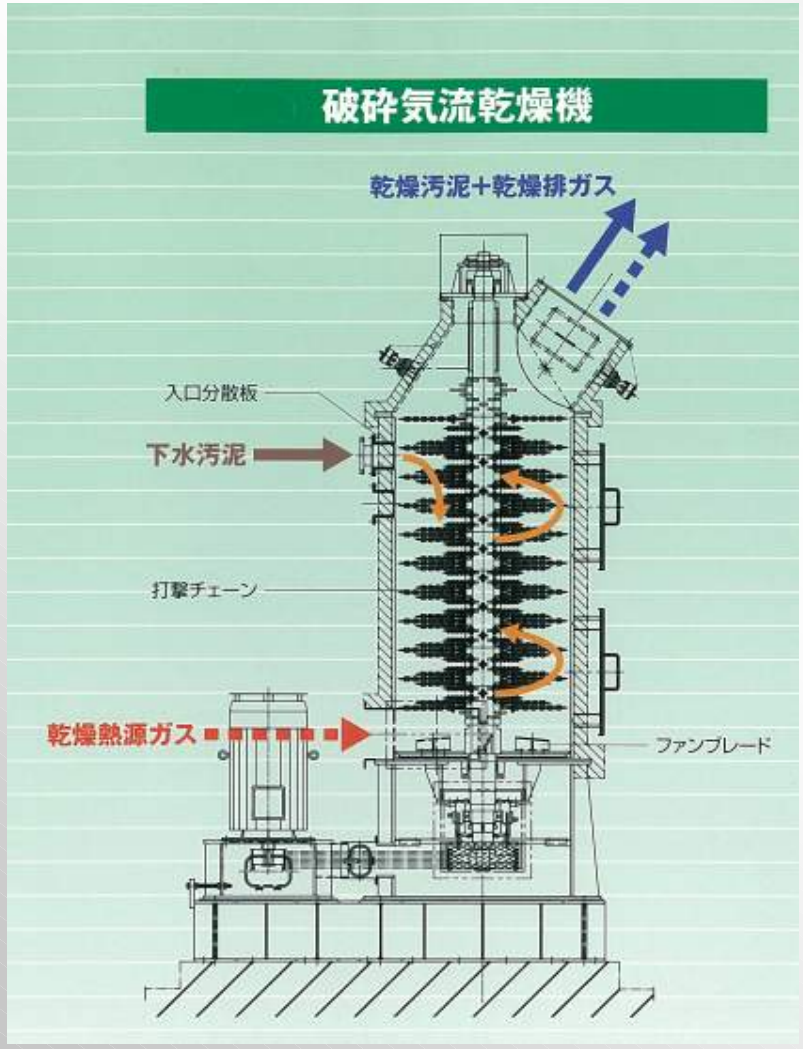
TSDS: Drying /Crushing of Sewage Sludge

（TSDS:Taiheiyo Sludge Drying System）



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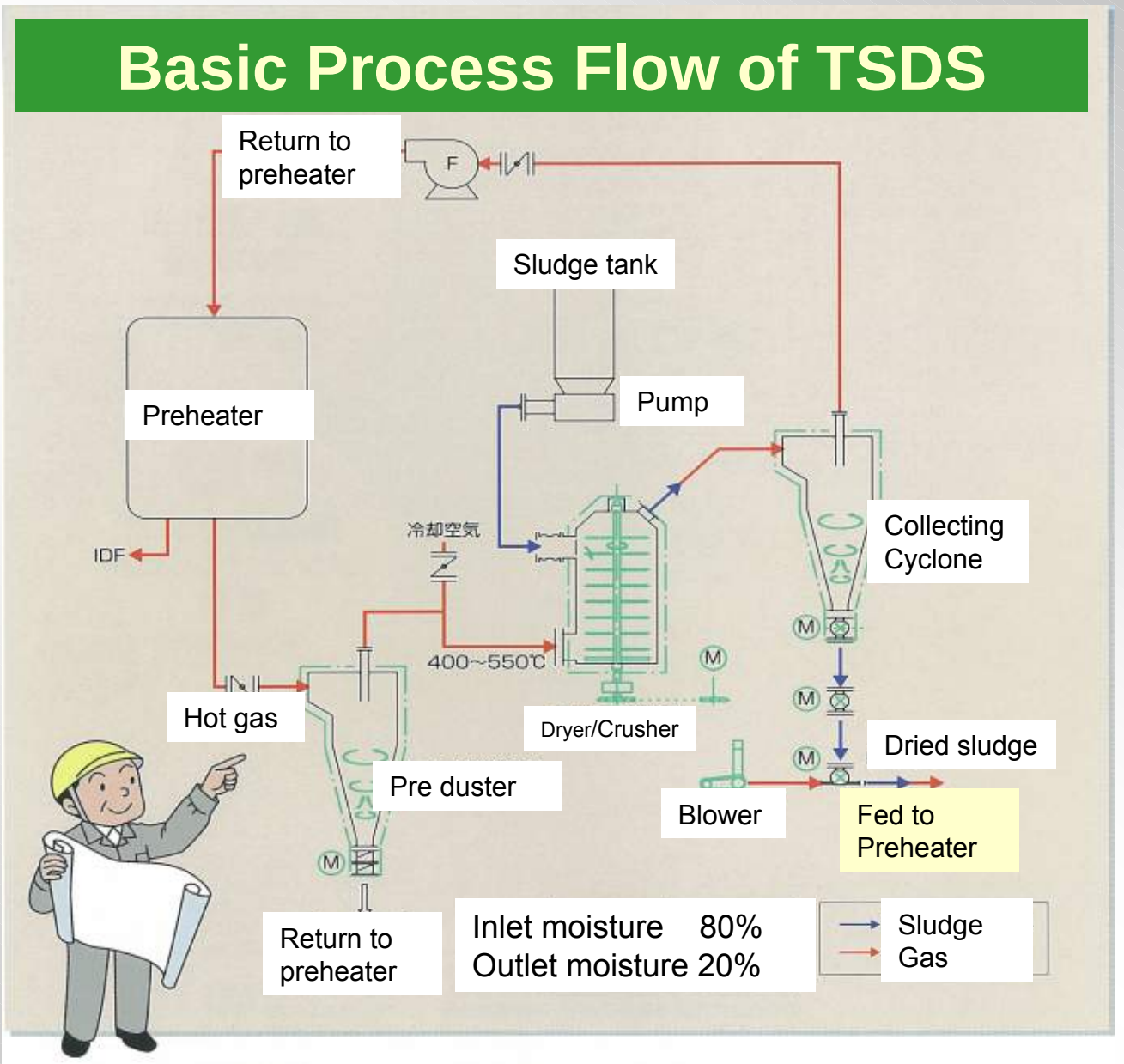
Basic Process Flow of TSDS



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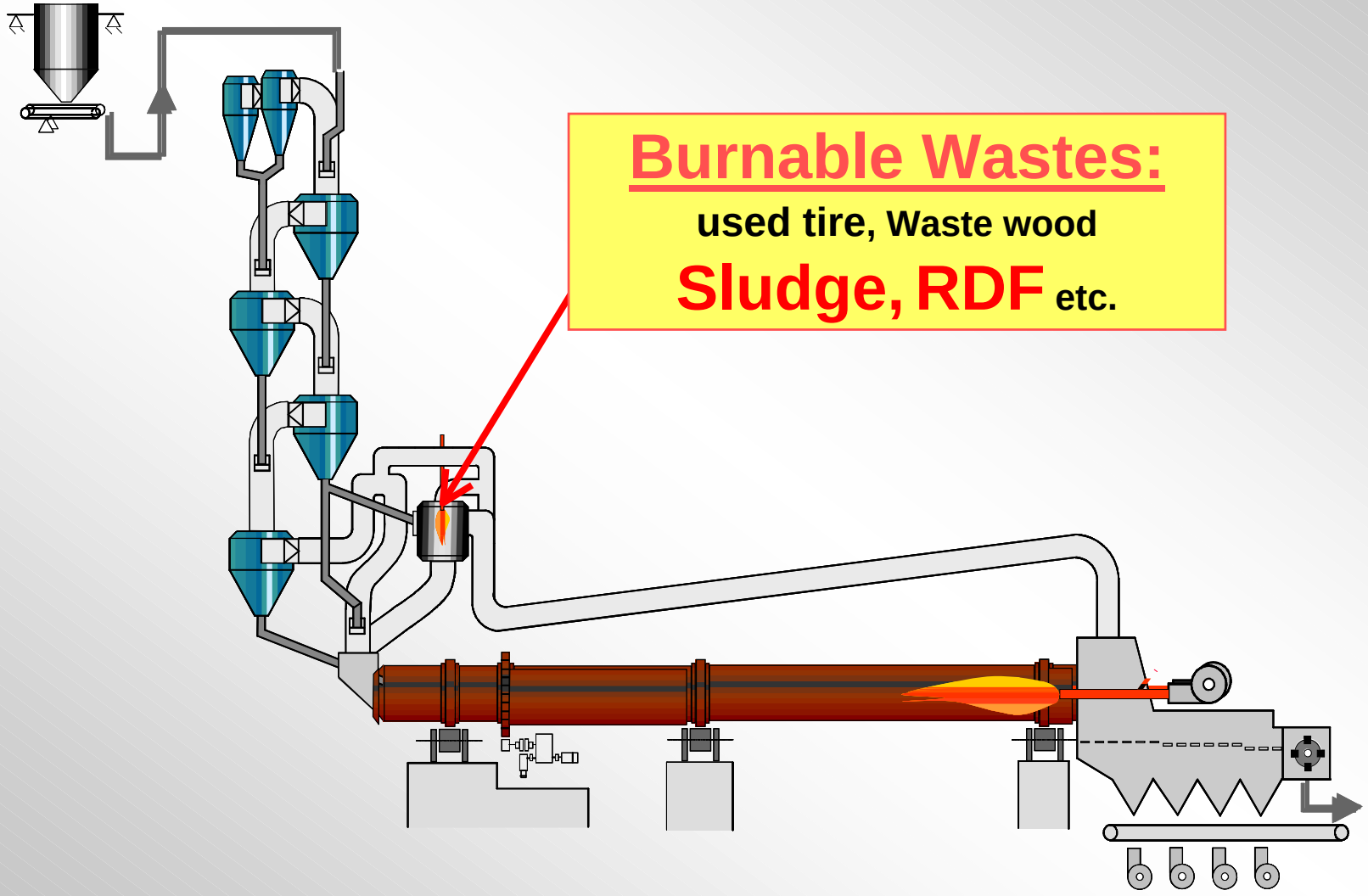

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3. Co-Processing of Biomass

- Biomass co-processed in Japan
  - Wood chip
  - Scrap wood from demolished house
  - Waste straw mat
- Treatment for biomass co-processing is similar to solid waste.

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Operation difficulties from Co-Processing

Some of the wastes contain high chlorine and sulfur components.

⇒coating trouble at preheater and Kiln inlet may occur.

Taiheiyo Chlorine By-Pass System

Taiheiyo Coating Solution System

are the solutions.

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Countermeasures for more Co-Processing

1. Taiheiyo Chlorine Bypass System
   →To prevent coating trouble by removing chloride contained in kiln exhaust gas
2. TCS: Taiheiyo Coating Solution System
   →To prevent coating by absorbing SO_2 gas and sulfur compound with dispersed raw meal at Kiln end.
3. Kiln Control Programs
   →Raw Mix Control, Preheater Control
   →Auto adjustment for stable Kiln operation by Model Predictive Control

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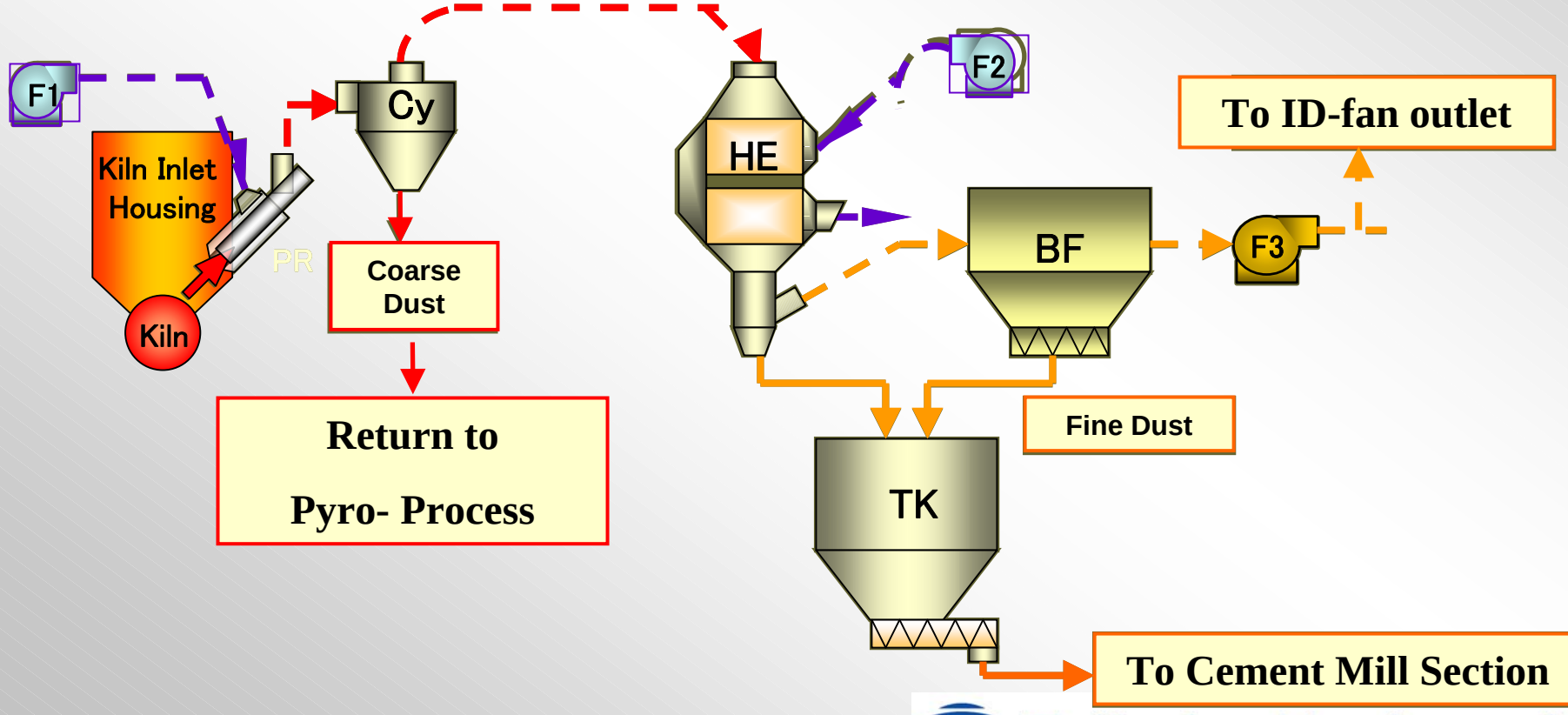
Taiheiyo Chlorine By-Pass System

To prevent coating at Kiln inlet caused by low melting point chloride substance



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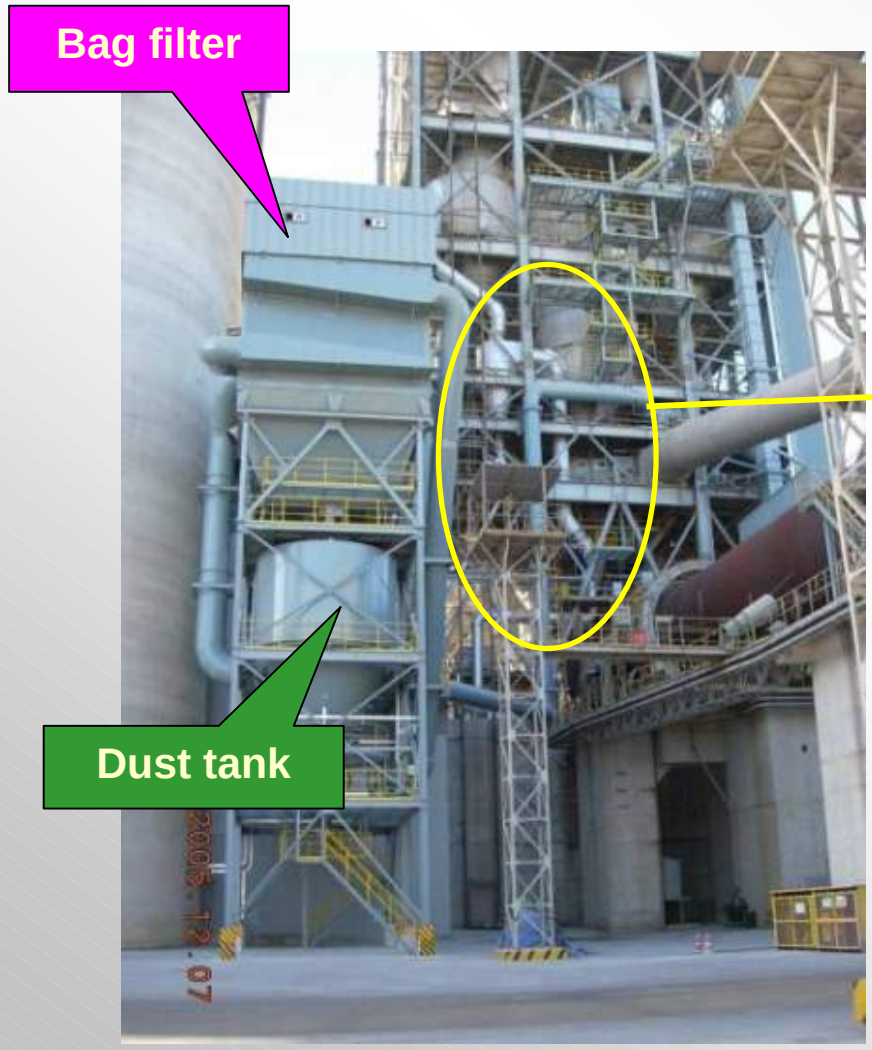
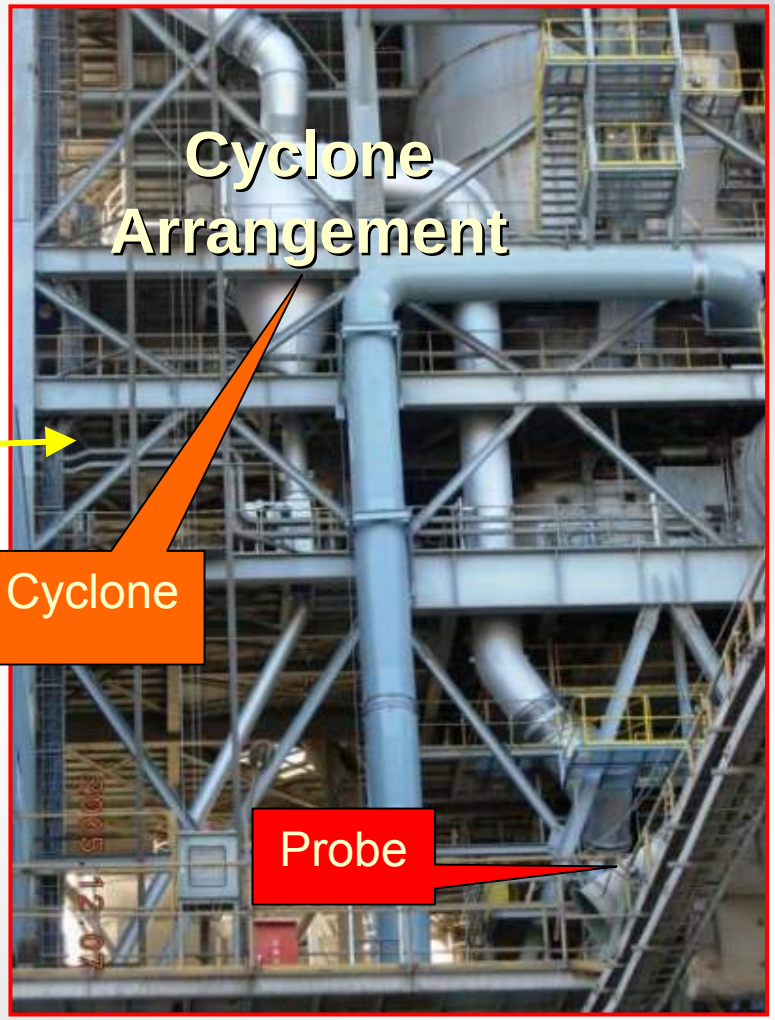
Actual Installation of Taiheiyo Chlorine bypass system





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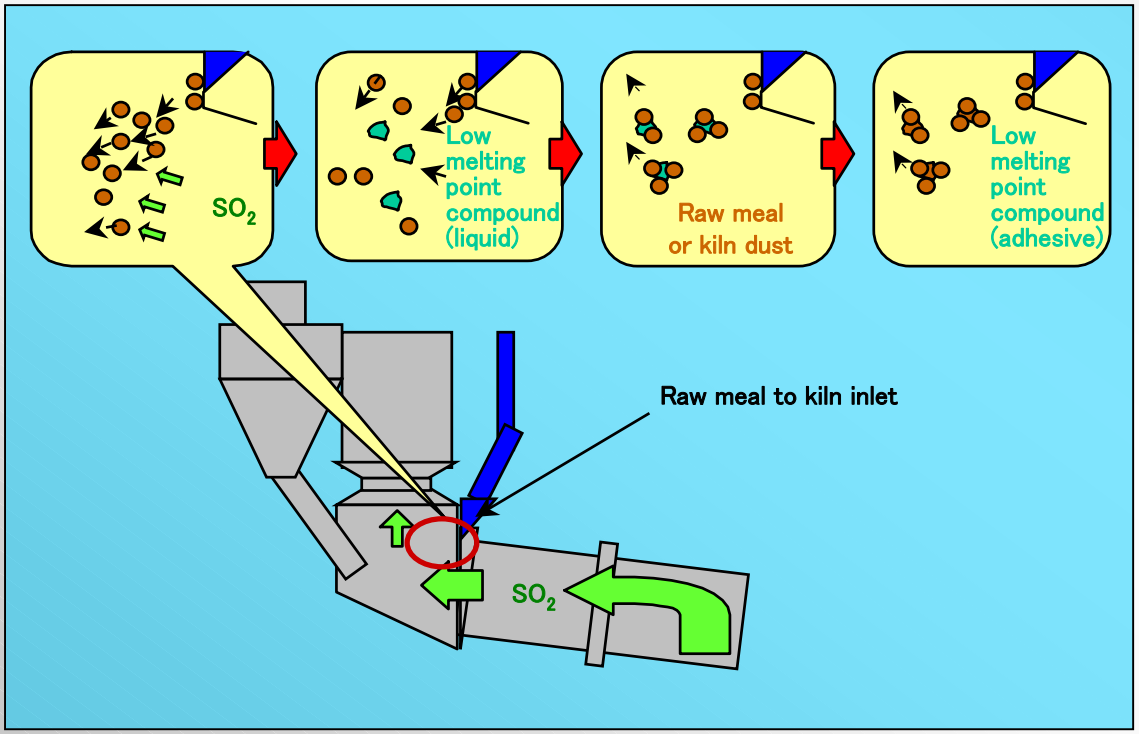
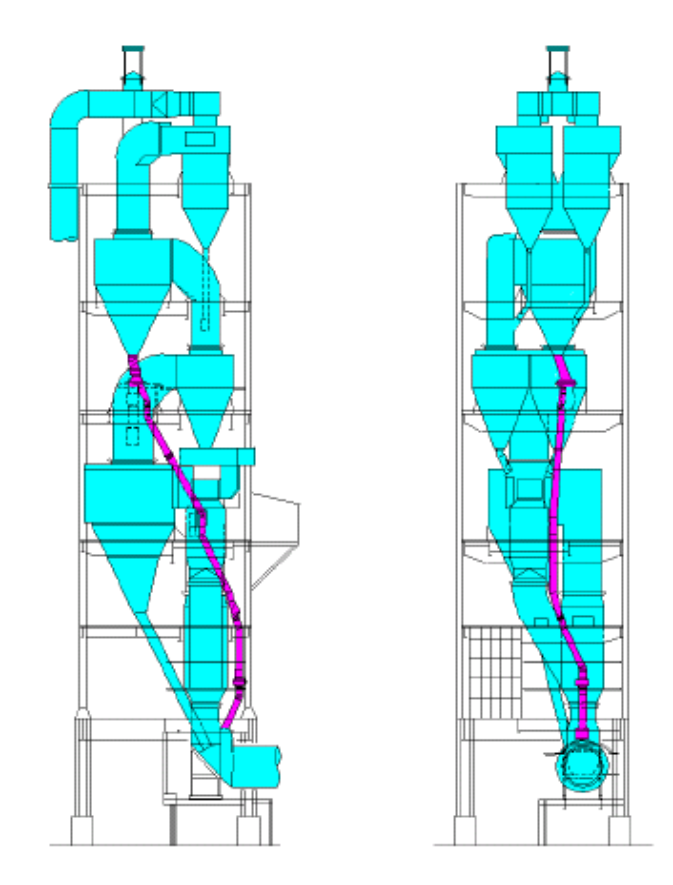
TCS (Taiheiyo Coating Solution) System

Raw meal feeding from upper stage cyclone to avoid coating formation





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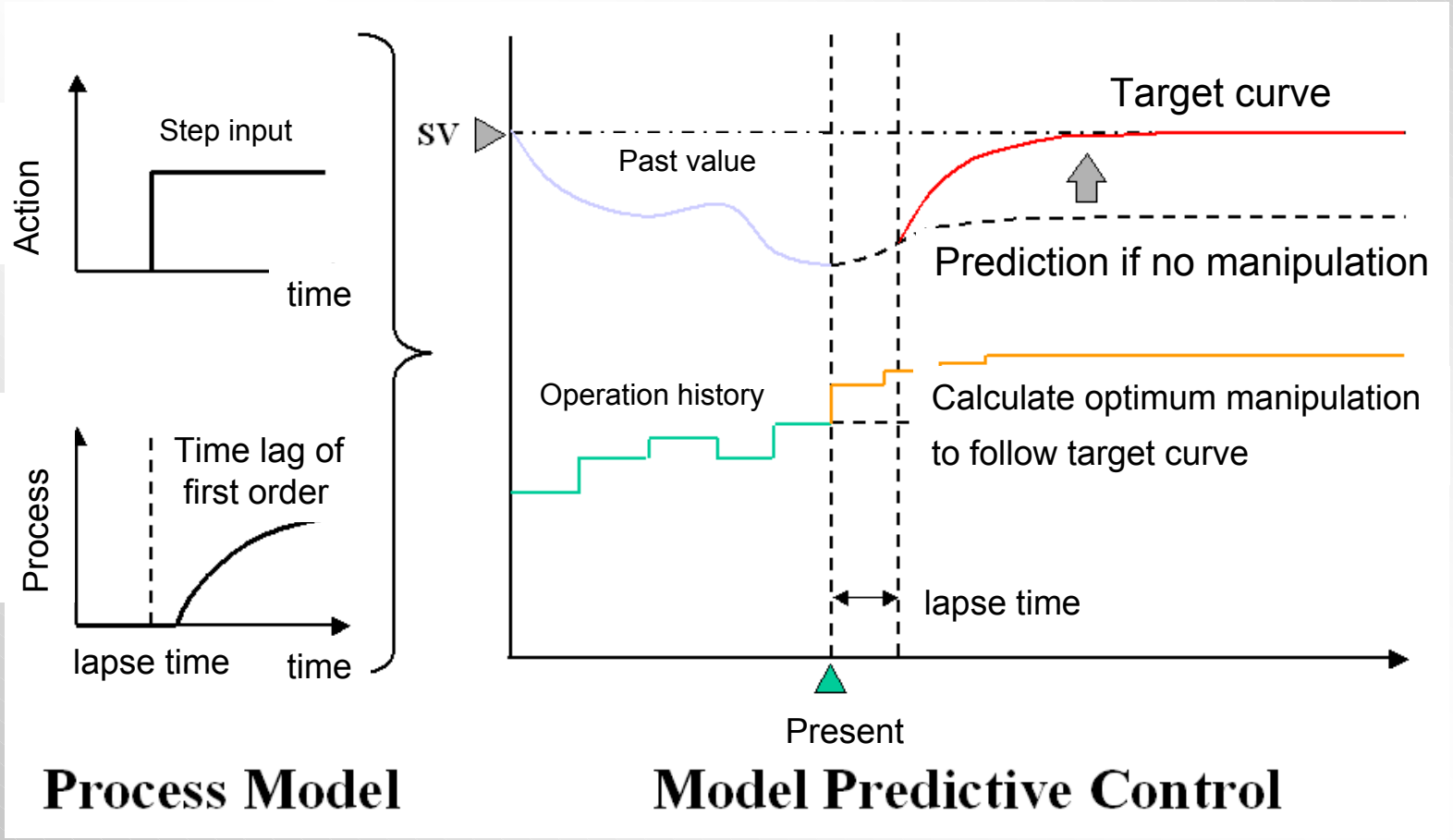
Automatic Control (adjustment)Programs for maximum Co-Processing

Raw Mix Control Program



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4. Decomposing of CFC and PFC

- Advantages of decomposing CFC and PFCs in Cement kiln
  - Stable decomposition (CFCs decompose at 900℃)
  - No additional equipment required
  - No additional energy required
  - No big investment required

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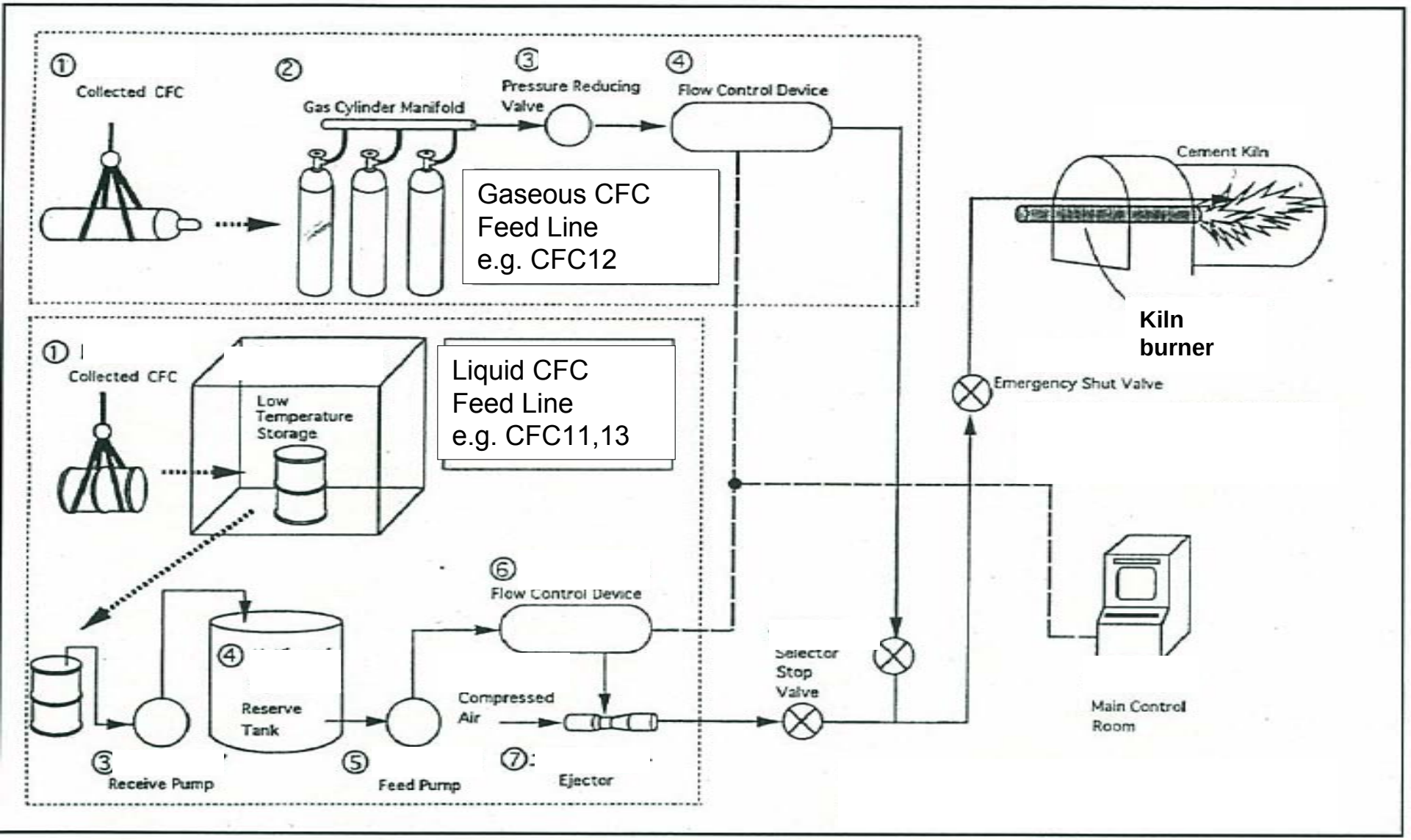
CFC and PFC Decomposition system



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