

Taiheiyo Chlorine Bypass System

The Optimal Chlorine Removal Solution
for Stable Operation and Waste-utilization

Overseas Sales Department. Sales Division
Taiheiyo Engineering Corporation
June 23, 2023



WHY INVEST IN

WASTE- UTILIZATION?



A photograph of a park with lush green trees and a path. In the background, a woman and a child are walking. A large blue geometric shape is overlaid on the right side of the image, containing three white horizontal bars with text.

SUSTAINABILITY

CSR

CORPORATE BRANDING

WHY INVEST IN

CHLORINE REMOVAL?



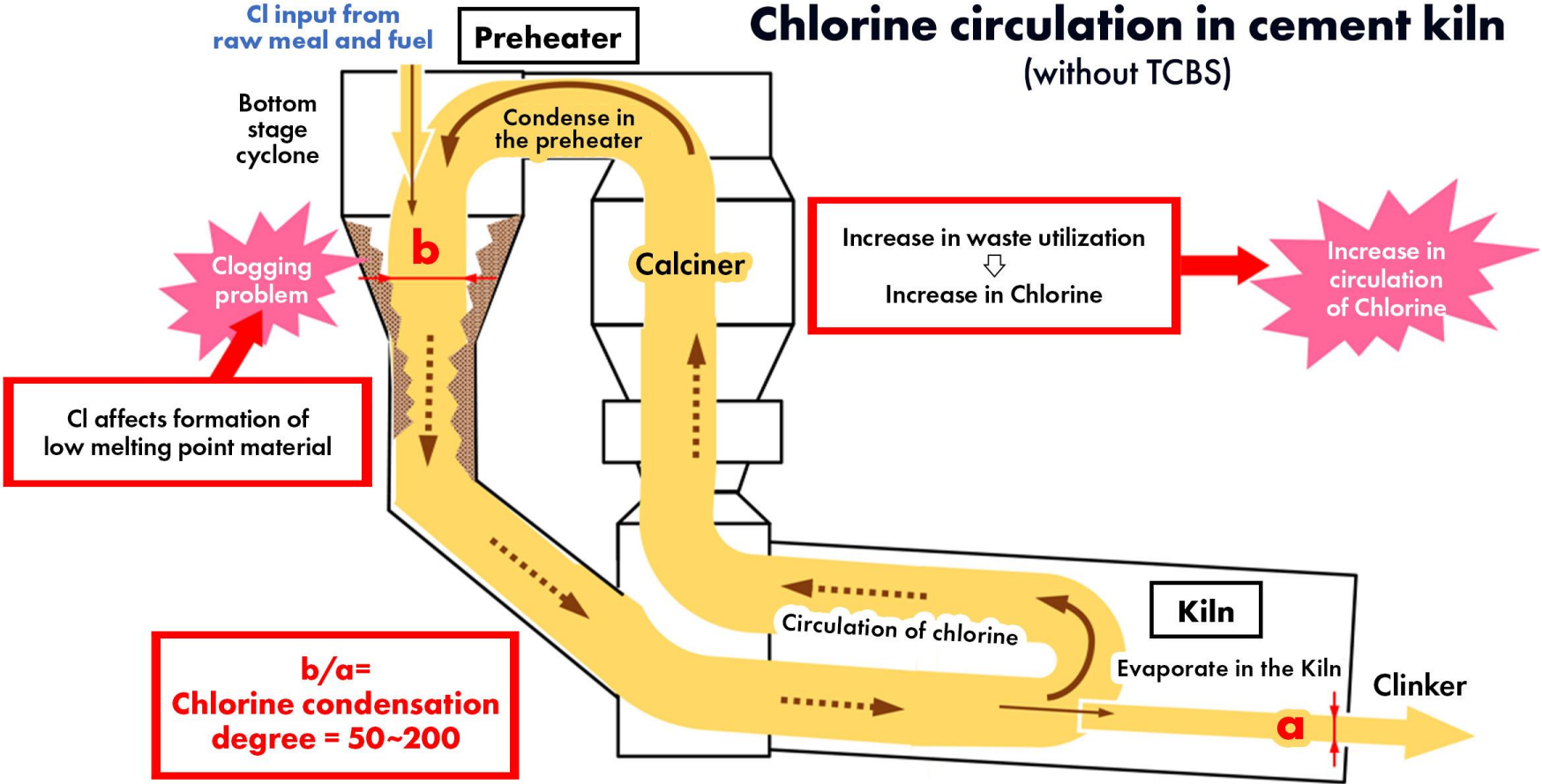


WASTE-UTILIZATION poses many operational issues.

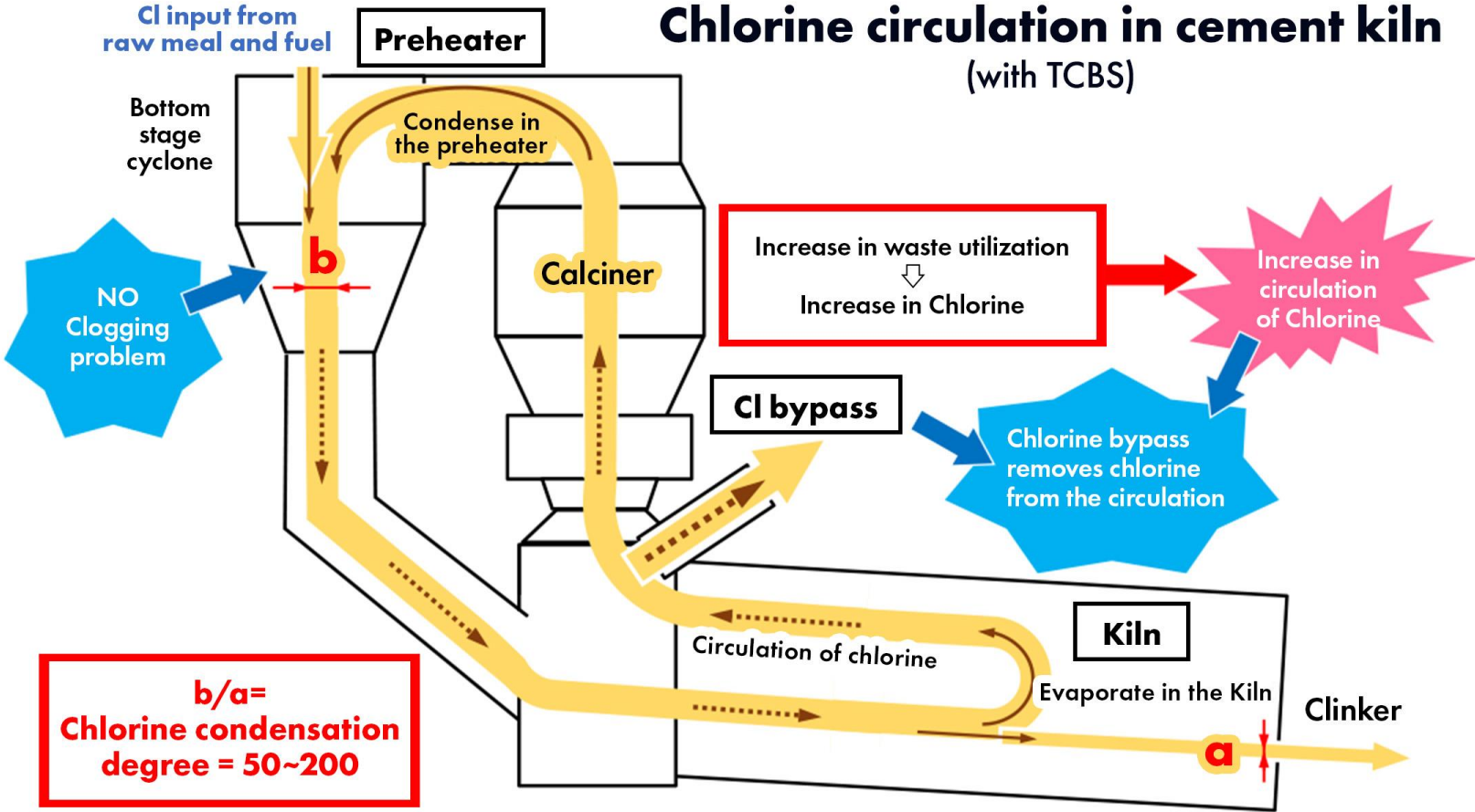
Among these, coating troubles remain as one of the most challenging.

High chlorine content in the pyro process is the main cause for coating issues.

Chlorine circulation in cement kiln (without TCBS)



Chlorine circulation in cement kiln (with TCBS)

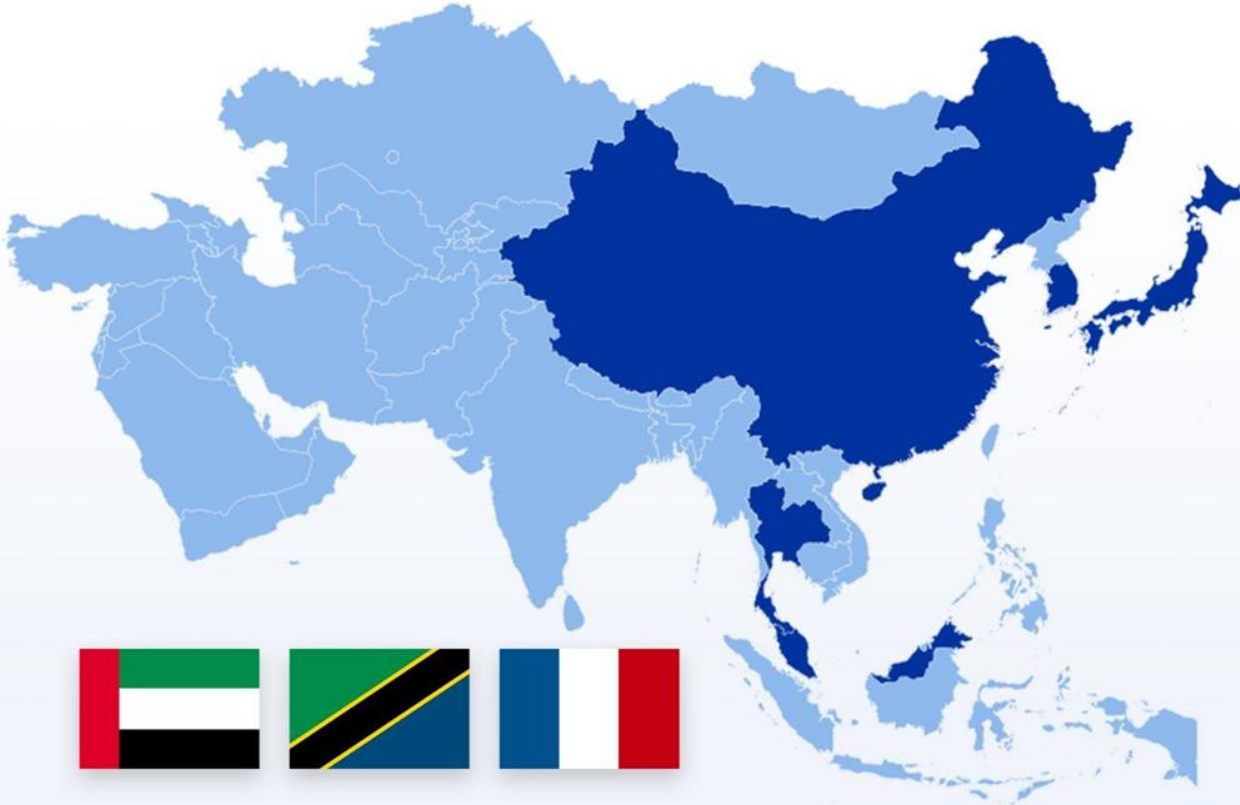


WHY INVEST IN

**TAIHEIYO
CHLORINE
BYPASS
SYSTEM?**



WE ARE ENABLING WASTE-UTILIZATION.



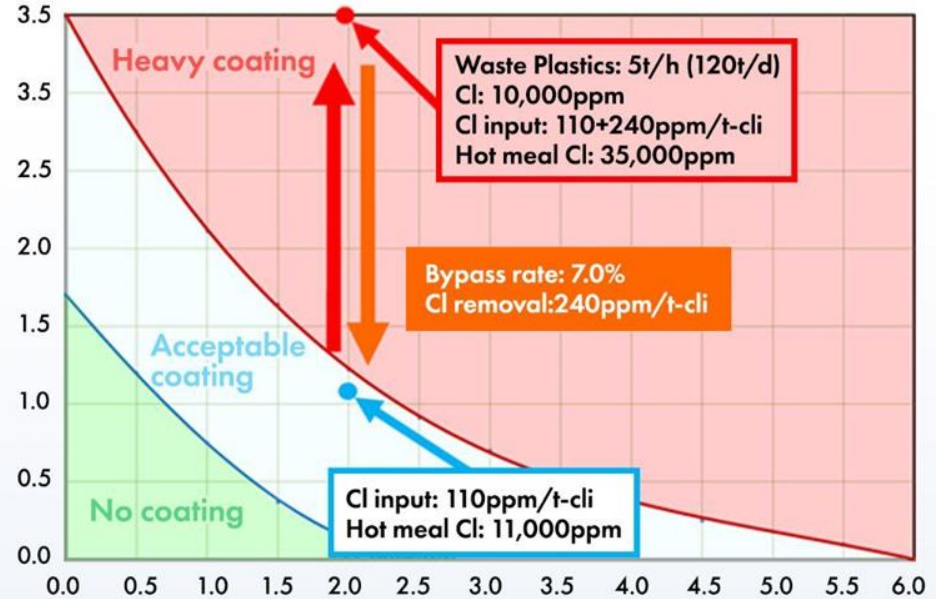
100⁺
installations
over 30 years.

One of the most supplied
Chlorine Bypass System
as of 2022

Waste plastics utilization increases Cl and SO₃ content in hot meal, causing heavy coatings.

Taiheiyo Chlorine Bypass System solves heavy coating problems caused by chlorine.

CL content of hot meal (%)

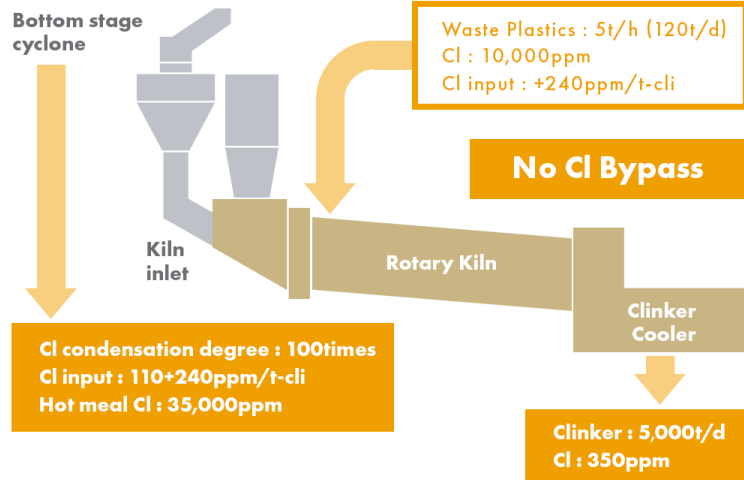


SO₃ content of hot meal (%)

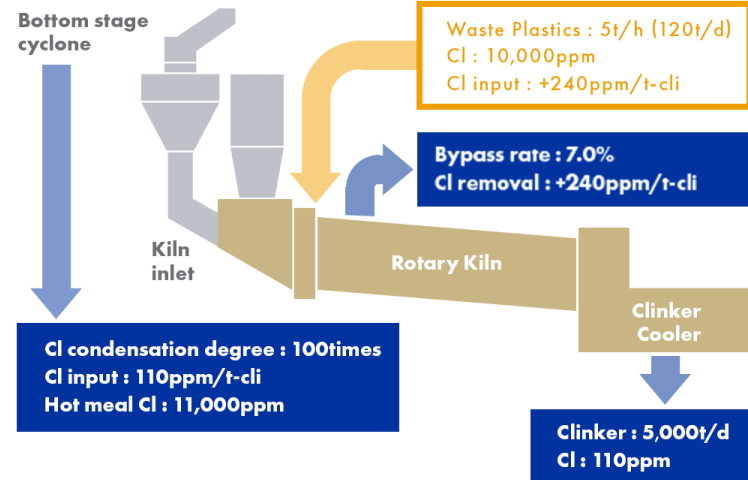
Example for Plastic Waste Utilization

Clinker production: 5,000 t/d

Heavy coating

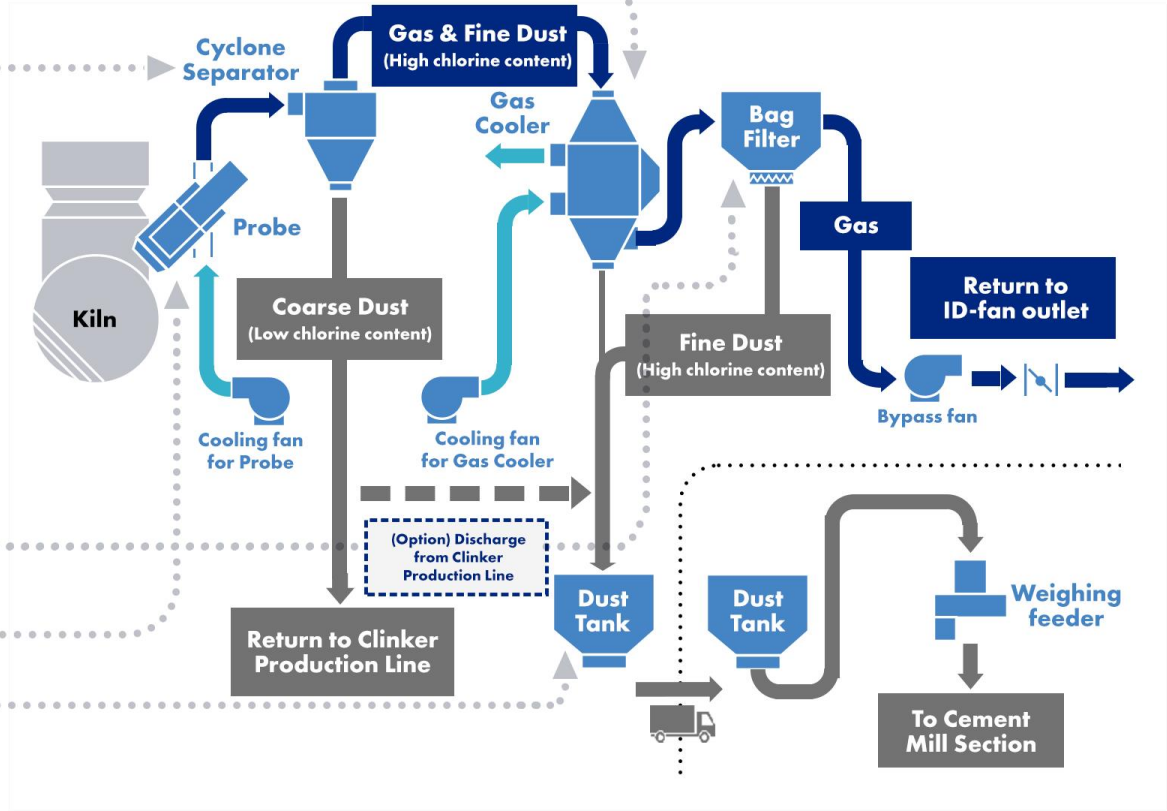
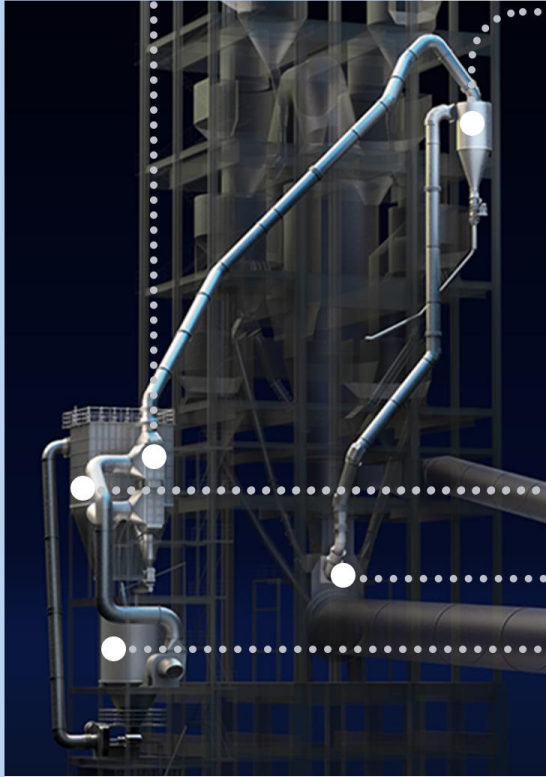


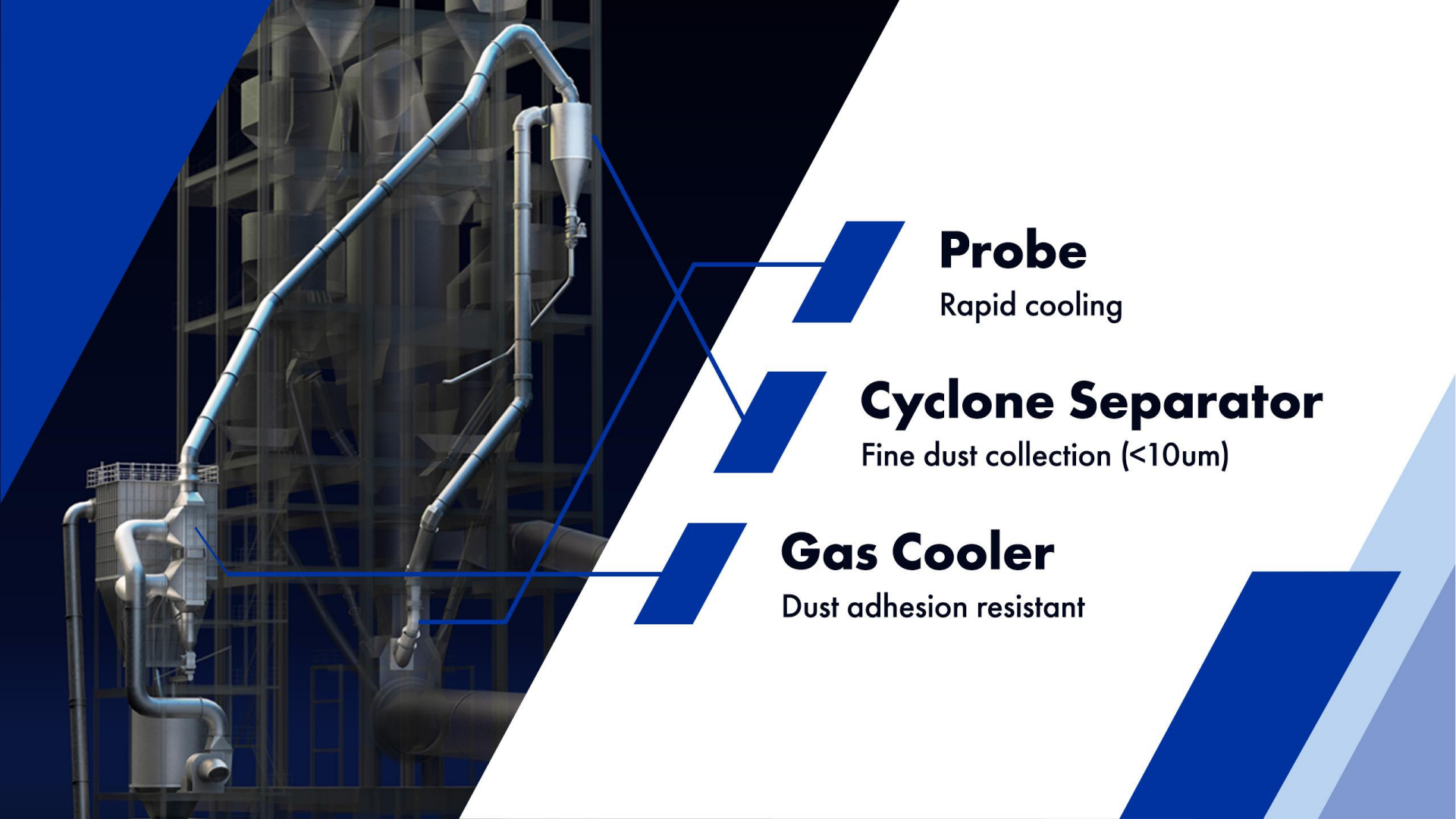
Acceptable coating





FEATURES





Probe

Rapid cooling

Cyclone Separator

Fine dust collection (<10um)

Gas Cooler

Dust adhesion resistant



Probe

Rapid cooling

Cyclone Separator

Fine dust collection (<10um)

Gas Cooler

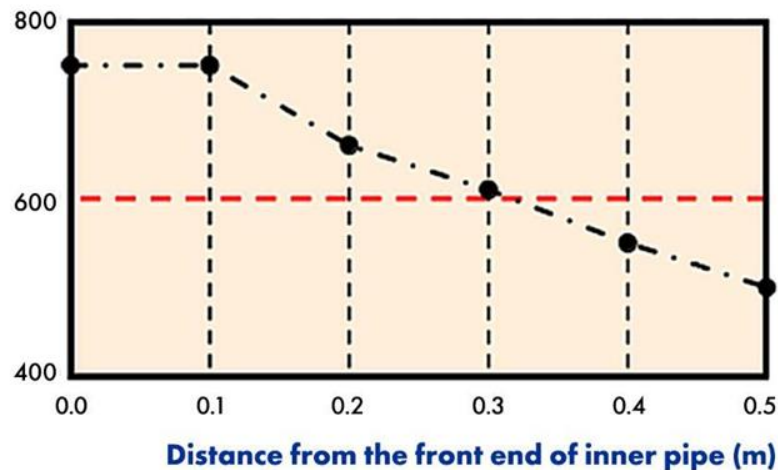
Dust adhesion resistant

TAIHEIYO CHLORINE BYPASS PROBE

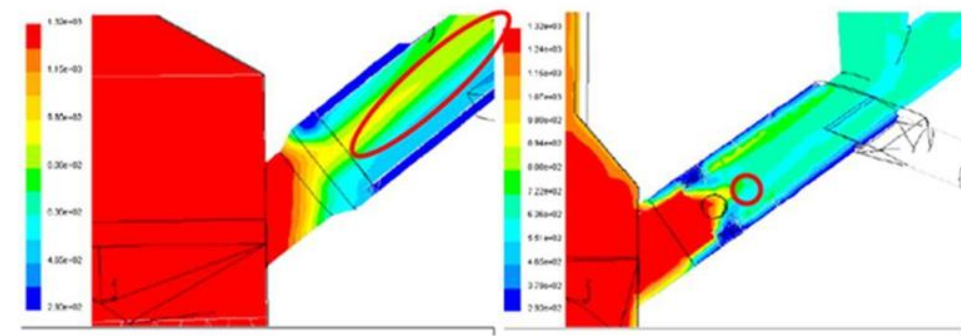
RAPID COOLING

Transition of Gas Temperature Taiheiyo type Probe

Gas temperature (°C)



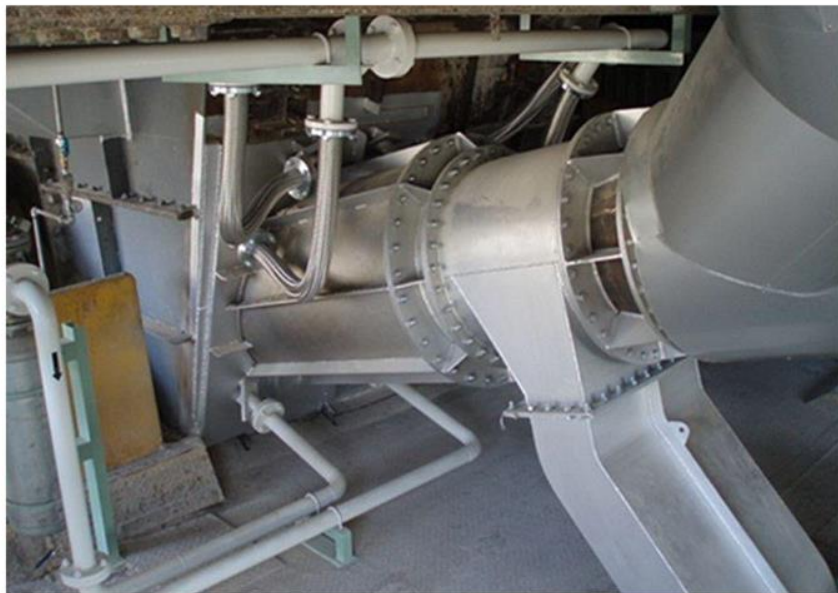
Hot Gas Cooling Simulation



Conventional type probe

Taiheiyo type probe

TAIHEIYO CHLORINE BYPASS PROBE COMPACT





Probe

Rapid cooling

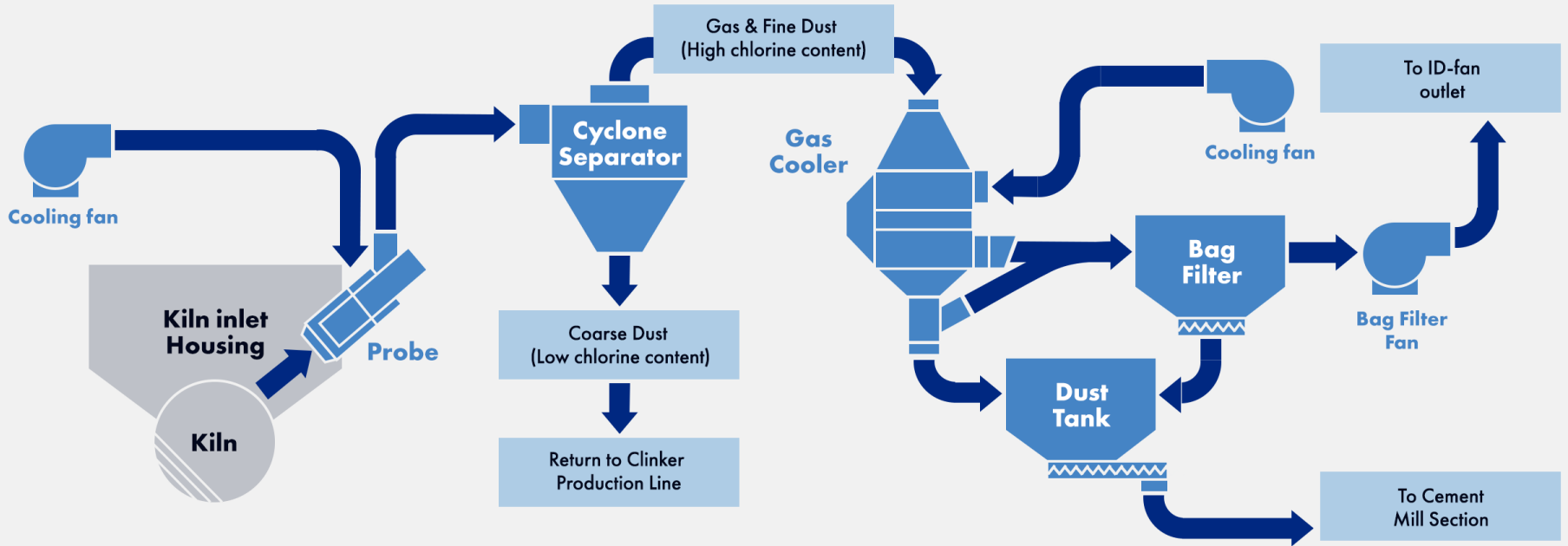
Cyclone Separator

Fine dust collection (<10um)

Gas Cooler

Dust adhesion resistant

Example of flow





Probe

Rapid cooling

Cyclone Separator

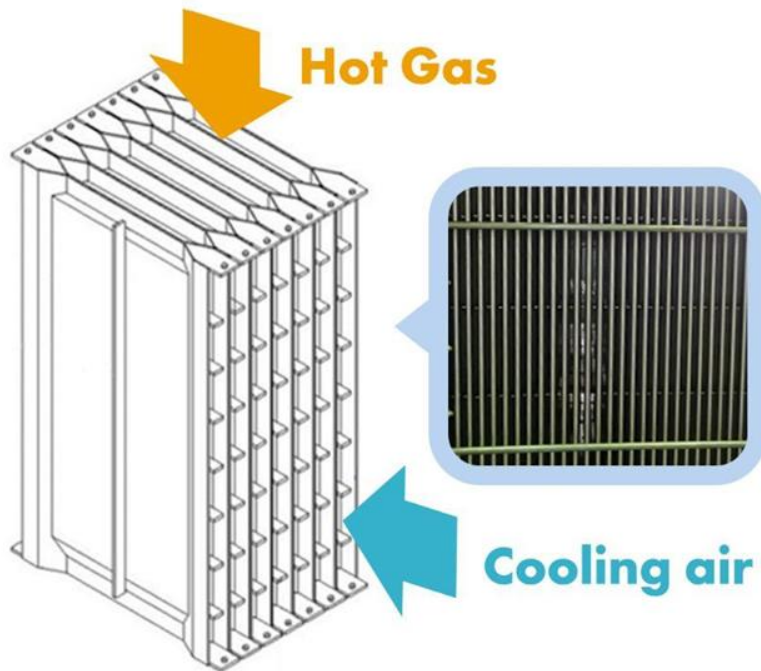
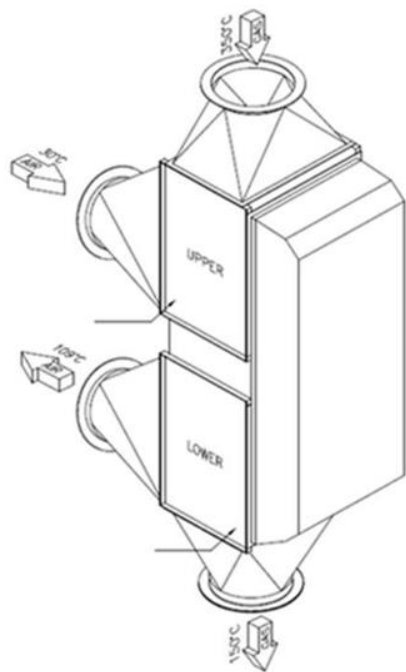
Fine dust collection (<10um)

Gas Cooler

Dust adhesion resistant

TAIHEIYO CHLORINE BYPASS GAS COOLER

COMPACT GAS-AIR TYPE GAS COOLER





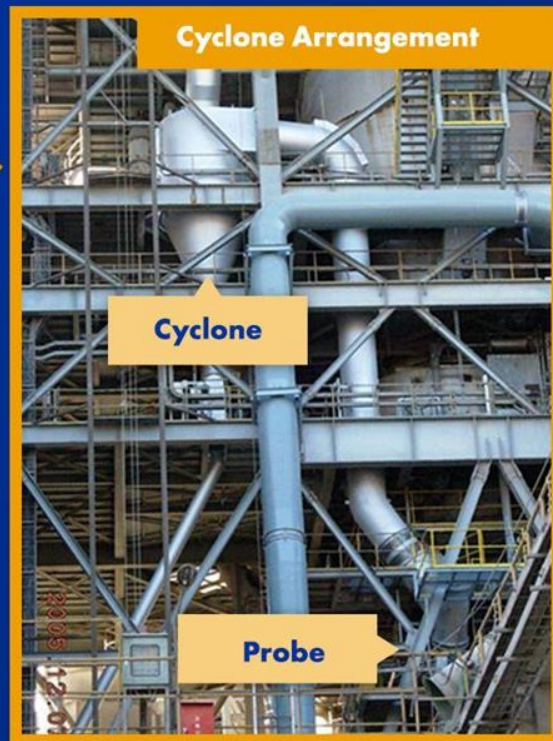
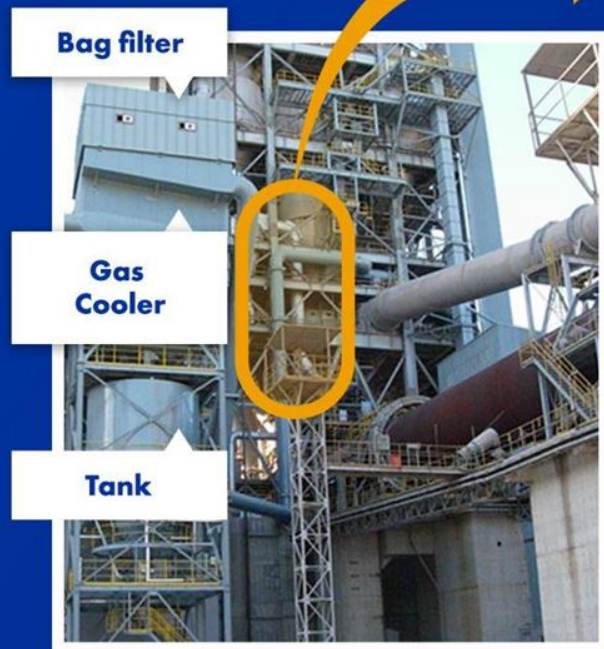
PAST INSTALLATION

TAIHEIYO CHLORINE BYPASS SYSTEM

INSTALLATION DATE:

year 2008

COUNTRY: KOREA



Supply List (as of April 2023)

| No. | Country | Process | Capacity (t/d) | Bypass ratio (%) | Year | Remark |
|-----|---------|---------------|----------------|------------------|---------------|---------------------|
| 103 | Korea | NSP | 6,000 | 10.0 | 2023 On going | Ratio-up 5.0→10.0 |
| 102 | Korea | NSP (RSP) | 5,600 | 9.8 | 2023 On going | Ratio-up 5.0→9.8 |
| 101 | Korea | NSP (RSP) | 5,850 | 10.0 | 2023 On going | Ratio-up 5.0→10.0 |
| 100 | Korea | NSP | 4,400 | 10.0 | 2023 | Ratio-up 5.0→10.0 |
| 99 | Taiwan | NSP | 4,600 | 4.0 | 2022 On going | |
| 98 | Japan | NSP (DD) | 2,257 | 10.0 | 2021 | Ratio-up 3.4 → 10.0 |
| 97 | Korea | NSP (5-stage) | 4,100 | 13.0 | 2021 | Ratio-up 7.0 → 13.0 |
| 96 | Korea | NSP (MFC) | 5,500 | 10.0 | 2021 | Ratio-up 1.7 → 10.0 |
| 95 | Korea | NSP | 4,060 | 10.0 | 2021 | Ratio-up 2.0 → 10.0 |
| 94 | Korea | NSP (RSP) | 7,500 | 13.0 | 2020 | Ratio-up 9.0 → 13.0 |
| 93 | Korea | NSP (RSP) | 7,500 | 13.0 | 2020 | Ratio-up 9.0 → 13.0 |
| 92 | Korea | NSP (MFC) | 8,700 | 8.8 | 2020 | Ratio-up 3.8 → 8.8 |
| 91 | China | | 3,000 | 7.0 | 2019 On-going | |

Supply List (as of April 2023)

| No. | Country | Process | Capacity (t/d) | Bypass ratio (%) | Year | Remark |
|-----|----------|---------------|----------------|------------------|------|---------------------|
| 90 | Japan | NSP (DD) | 4,000 | 10.0 | 2019 | Ratio-up 2.4 → 10.0 |
| 89 | Japan | NSP | 4,000 | 10.0 | 2018 | Ratio-up 6.7 → 10.0 |
| 88 | Japan | NSP (RSP) | 5,100 | 10.0 | 2018 | Ratio-up 4.0 → 10.0 |
| 87 | Japan | NSP (RSP) | 3,800 | 10.0 | 2018 | Ratio-up 6.5 → 10.0 |
| 86 | Korea | NSP (RSP) | 5,500 | 5.0 | 2017 | |
| 85 | Japan | NSP (RSP) | 5,112 | 10.0 | 2017 | Ratio-up 5.0 → 10.0 |
| 84 | Korea | NSP | 6,000 | 5.0 | 2017 | |
| 83 | Korea | NSP | 4,700 | 7.0 | 2015 | |
| 82 | Korea | NSP | 4,800 | 7.0 | 2015 | |
| 81 | Japan | SP | 1,363 | 6.0 | 2015 | Ratio-up 3.0→6.0 |
| 80 | Thailand | NSP | 10,100 | 7.0 | 2015 | |
| 79 | Korea | NSP | 9,100 | 5.0 | 2014 | |
| 78 | China | NSP (SF) | 3,000 | 10.0 | 2014 | |
| 77 | Thailand | NSP (5-stage) | 5,750 | 5.0 | 2014 | |
| 76 | Japan | SP | 4,950 | 4.0 | 2014 | Ratio-up 2.0 → 4.0 |
| 75 | Japan | NSP | 6,840 | 5.4 | 2014 | Ratio-up 2.4 → 5.4 |
| 74 | Japan | SP | 4,000 | 7.0 | 2014 | |
| 73 | Malaysia | RSP | 4,000 | 3.0 | 2013 | |

Supply List (as of April 2023)

| No. | Country | Process | Capacity (t/d) | Bypass ratio (%) | Year | Remark |
|-----|----------|------------|----------------|------------------|------|---------------------|
| 72 | China | NSP (SF) | 2,000 | 12.0 | 2013 | |
| 71 | Japan | NSP (C-SF) | 4,700 | 4.8 | 2013 | Ratio-up 2.4 → 4.8 |
| 70 | UAE | | 1,900 | 3.0 | 2013 | |
| 69 | Tanzania | | 1,500 | 12.0 | 2013 | |
| 68 | Japan | NSP (RSP) | 5,100 | 7.0 | 2012 | Ratio-up 3.4 → 7.0 |
| 67 | Japan | NSP (RSP) | 2,880 | 7.0 | 2012 | Ratio-up 3.5 → 7.0 |
| 66 | China | NSP (SF) | 2,200 | 12.0 | 2012 | |
| 65 | Japan | SP | 4,000 | 4.0 | 2012 | |
| 64 | Japan | NSP (RSP) | 3,800 | 6.5 | 2012 | Ratio-up 3.0 → 6.5 |
| 63 | China | NSP (RSP) | 4,600 | 3.0 | 2011 | |
| 62 | China | NSP (SF) | 3,000 | 10.0 | 2011 | |
| 61 | Japan | NSP (DD) | 5,000 | 10.0 | 2011 | Ratio-up 6.3 → 10.0 |
| 60 | Japan | NSP (SLC) | 4,400 | 10.0 | 2011 | |
| 59 | Korea | NSP (RSP) | 7,000 | 5.0 | 2011 | |
| 58 | Japan | NSP (RSP) | 2,800 | 3.0 | 2011 | |
| 57 | Japan | NSP (DD) | 3,850 | 3.0 | 2011 | |
| 56 | Japan | SP | 2,736 | 6.0 | 2011 | Ratio-up 3.0 → 6.0 |
| 55 | Japan | NSP | 6,840 | 2.4 | 2010 | |

Supply List (as of April 2023)

| No. | Country | Process | Capacity (t/d) | Bypass ratio (%) | Year | Remark |
|-----|---------|------------|----------------|------------------|------|---------------------|
| 54 | Japan | SP | 3,340 | 3.9 | 2010 | |
| 53 | Korea | NSP (RSP) | 7,000 | 5.0 | 2010 | |
| 52 | China | NSP (SF) | 2,200 | 10.0 | 2010 | |
| 51 | Japan | NSP (C-SF) | 7,400 | 10.0 | 2010 | Ratio-up 7.0 → 10.0 |
| 50 | Korea | NSP (SF) | 4,800 | 5.0 | 2009 | |
| 49 | Japan | SP | 3,800 | 4.0 | 2009 | Ratio-up 1.5 → 4.0 |
| 48 | Korea | NSP (RSP) | 6,000 | 5.0 | 2008 | |
| 47 | Korea | NSP (SF) | 5,500 | 5.0 | 2008 | |
| 46 | Korea | NSP (RSP) | 6,000 | 5.0 | 2008 | |
| 45 | Japan | SP | 2,736 | 3.0 | 2008 | |
| 44 | Japan | NSP (DD) | 5,000 | 6.3 | 2007 | |
| 43 | Japan | SP | 3,900 | 6.0 | 2007 | |
| 42 | Japan | NSP (RSP) | 4,950 | 7.0 | 2007 | Ratio-up 2.1 → 7.0 |
| 41 | Korea | NSP (SF) | 5,500 | 5.0 | 2005 | |
| 40 | Japan | NSP (RSP) | 4,950 | 7.0 | 2005 | |
| 39 | Japan | NSP (RSP) | 2,352 | 5.7 | 2005 | |
| 38 | Japan | NSP (DD) | 2,400 | 3.7 | 2004 | |
| 37 | Japan | NSP (DD) | 5,000 | 5.0 | 2004 | Ratio-up 1.5 → 5.0 |

Supply List (as of April 2023)

| No. | Country | Process | Capacity (t/d) | Bypass ratio (%) | Year | Remark |
|-----|---------|-------------|----------------|------------------|------|--------------------|
| 36 | Japan | SP | 4,950 | 2.0 | 2003 | |
| 35 | Japan | NSP (C-SF) | 7,000 | 6.3 | 2003 | Ratio-up 4.3 → 6.3 |
| 34 | Japan | NSP (RSP) | 2,880 | 3.5 | 2003 | |
| 33 | Japan | NSP (C-SF) | 2,800 | 6.0 | 2003 | |
| 32 | Japan | NSP (RSP) | 4,950 | 3.0 | 2003 | |
| 31 | Japan | NSP (DD) | 4,000 | 2.5 | 2003 | |
| 30 | Japan | NSP (C-SF) | 2,800 | 6.0 | 2003 | Ratio-up 2.0 → 6.0 |
| 29 | Japan | NSP (RSP) | 5,100 | 3.6 | 2002 | Ratio-up 2.6 → 3.6 |
| 28 | Japan | NSP (GG) | 3,000 | 2.0 | 2002 | |
| 27 | Korea | NSP (N-MFC) | 7,752 | 0.5 | 2002 | |
| 26 | Korea | SP | 3,048 | 0.5 | 2002 | |
| 25 | Korea | SP | 4,048 | 1.0 | 2002 | |
| 24 | Japan | NSP (RSP) | 3,800 | 3.0 | 2002 | |
| 23 | Japan | NSP (MFC) | 3,300 | 2.5 | 2002 | |
| 22 | Japan | NSP (DD) | 4,440 | 3.0 | 2001 | |
| 21 | France | SP | 3,600 | 5.0 | 2001 | |
| 20 | Japan | SP | 4,000 | 2.2 | 2001 | |
| 19 | Japan | NSP (C-SF) | 7,400 | 5.0 | 2001 | Ratio-up 2.0 → 5.0 |

Supply List (as of April 2023)

| No. | Country | Process | Capacity (t/d) | Bypass ratio (%) | Year | Remark |
|-----|---------|-------------|----------------|------------------|------|--------------------|
| 18 | Japan | NSP (RSP) | 4,900 | 5.0 | 2001 | Ratio-up 1.5 → 5.0 |
| 17 | Japan | NSP (N-KSV) | 2,800 | 3.0 | 2000 | |
| 16 | Japan | NSP (RSP) | 4,700 | 2.6 | 1999 | |
| 15 | Japan | NSP (C-SF) | 2,800 | 1.7 | 1998 | |
| 14 | Japan | NSP (C-SF) | 4,700 | 2.4 | 1998 | |
| 13 | Japan | NSP (DD) | 5,000 | 2.0 | 1998 | |
| 12 | Japan | NSP (N-KSV) | 2,600 | 1.7 | 1998 | |
| 11 | Japan | NSP (N-KSV) | 2,600 | 2.0 | 1998 | |
| 10 | Japan | NSP (SF) | 7,300 | 1.5 | 1997 | |
| 9 | Japan | NSP (SLC) | 4,400 | 1.5 | 1997 | |
| 8 | Japan | NSP (C-SF) | 3,100 | 2.0 | 1996 | |
| 7 | Japan | NSP (RSP) | 4,900 | 1.0 | 1995 | |
| 6 | Japan | NSP (RSP) | 4,900 | 1.5 | 1995 | |
| 5 | Japan | NSP (RSP) | 4,900 | 1.0 | 1995 | |
| 4 | Japan | NSP (RSP) | 2,400 | 1.2 | 1995 | |
| 3 | Japan | NSP (C-SF) | 7,400 | 1.8 | 1994 | |
| 2 | Japan | NSP (C-SF) | 4,900 | 2.0 | 1993 | |
| 1 | Japan | NSP (RSP) | 5,240 | 1.5 | 1989 | |

The image features a complex industrial distillation column on the left side, set against a dark background. The column is a tall, cylindrical structure with a metal framework, containing several horizontal trays. A network of silver-colored pipes and conduits is attached to the column, with some pipes curving upwards and others downwards. On the right side, a large, solid blue triangular shape overlaps the image, containing the text 'ABOUT OUR COMPANY' in white, bold, sans-serif font. The overall aesthetic is industrial and professional.

ABOUT OUR COMPANY

TEC in numbers

140+

years of experience in the cement industry through our parent company Taiheiyo Cement



1976

year of foundation of Taiheiyo Engineering Corporation



100+

million dollars in annual sales (FY 2020)



176

employees in total (FY 2021)



2

offices:
Tokyo Headquarters & Fukaya Office



▲ Tokyo Headquarters

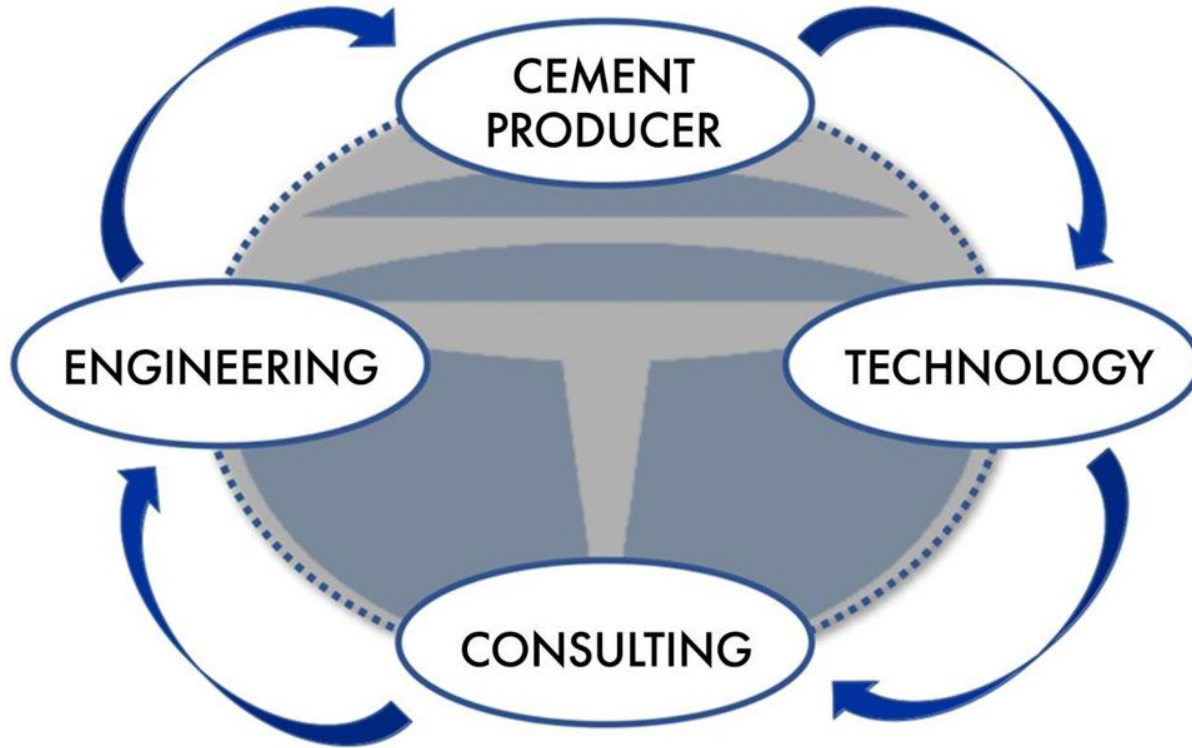
▲ Fukaya Office

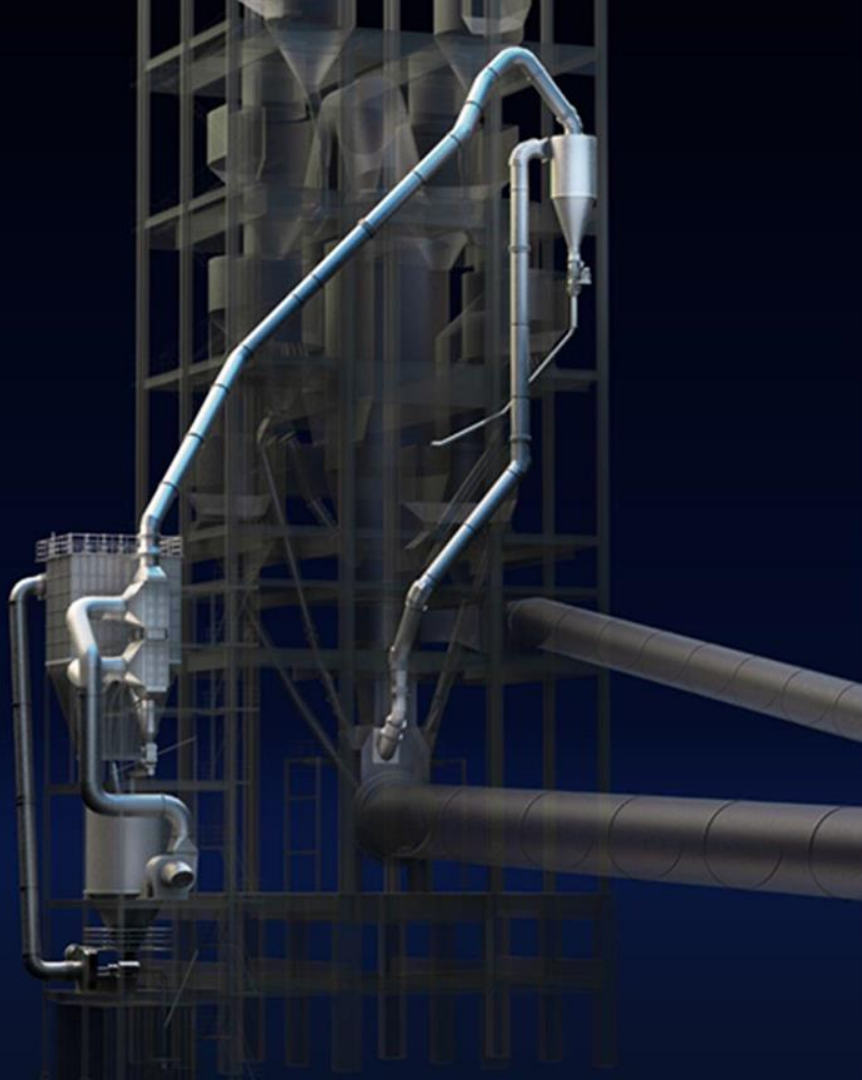
2000+

projects delivered in over 80 countries around the world



TEC uniqueness





The leading solution you can trust.

Taiheiyo Engineering has set standards in the sustainable combustion operations. We are confident in solving your problems using our competitive edge in efficient factory apparatus.

THANK YOU

 <https://www.taiheiyo-eng.co.jp/en/>

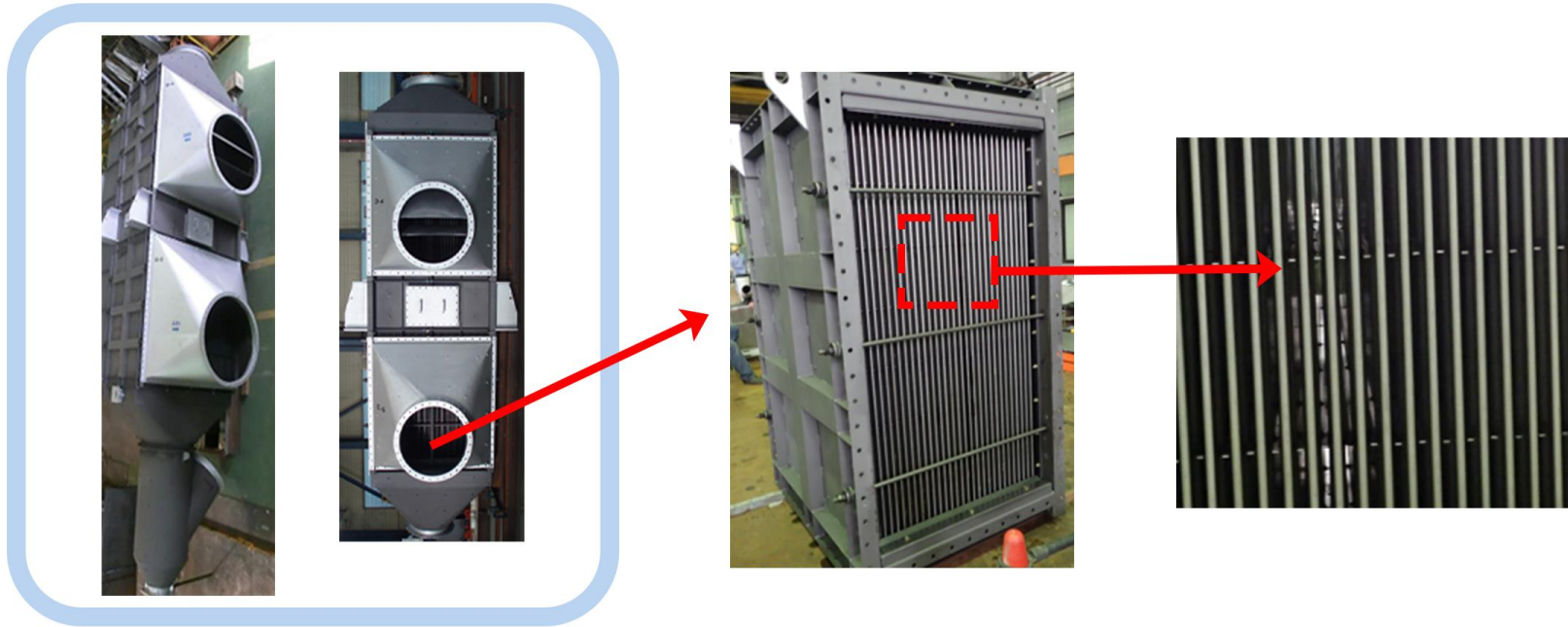
 overseas_sales@taiheiyo-eng.co.jp





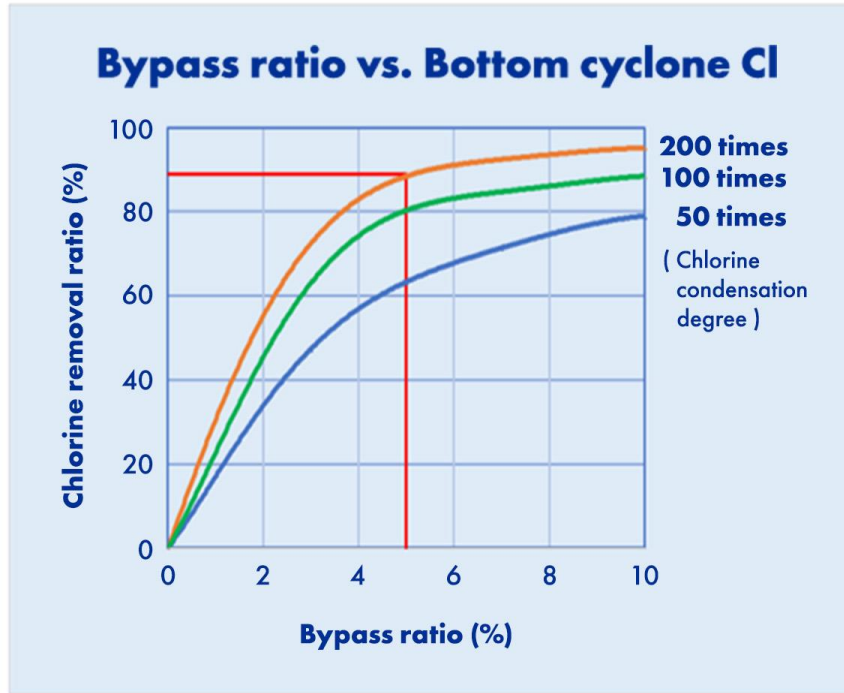
TAIHEIYO CHLORINE BYPASS GAS COOLER

COMPACT GAS-AIR TYPE GAS COOLER

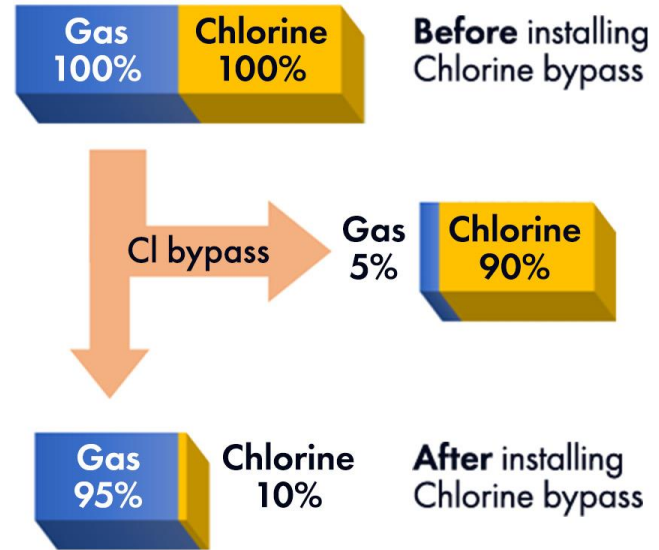


HIGH CHLORINE REMOVAL

with low bypass ratio



< If installing TCBS with bypass ratio 5% >

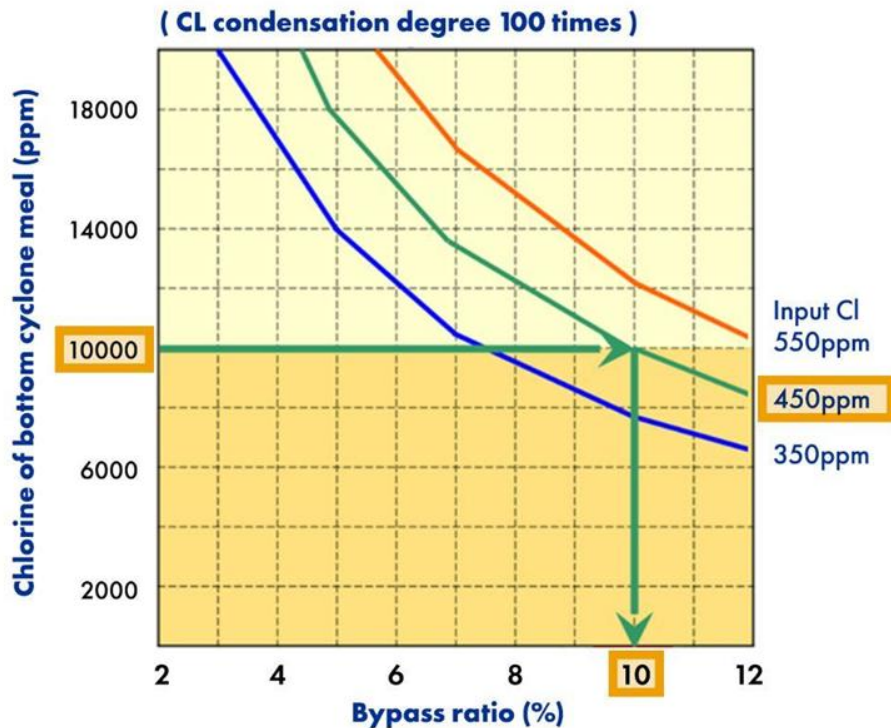


HIGH CHLORINE REMOVAL

with low bypass ratio

**Bypass ratio
vs.
Bottom cyclone Cl**

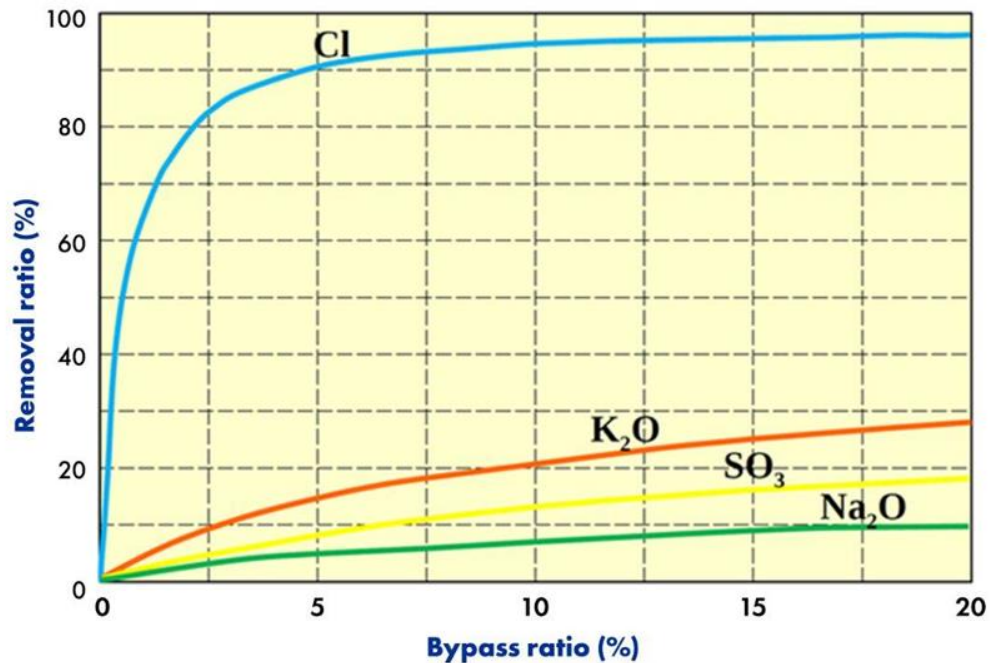
Bypass ratio is set up
by target of Bottom cyclone Cl



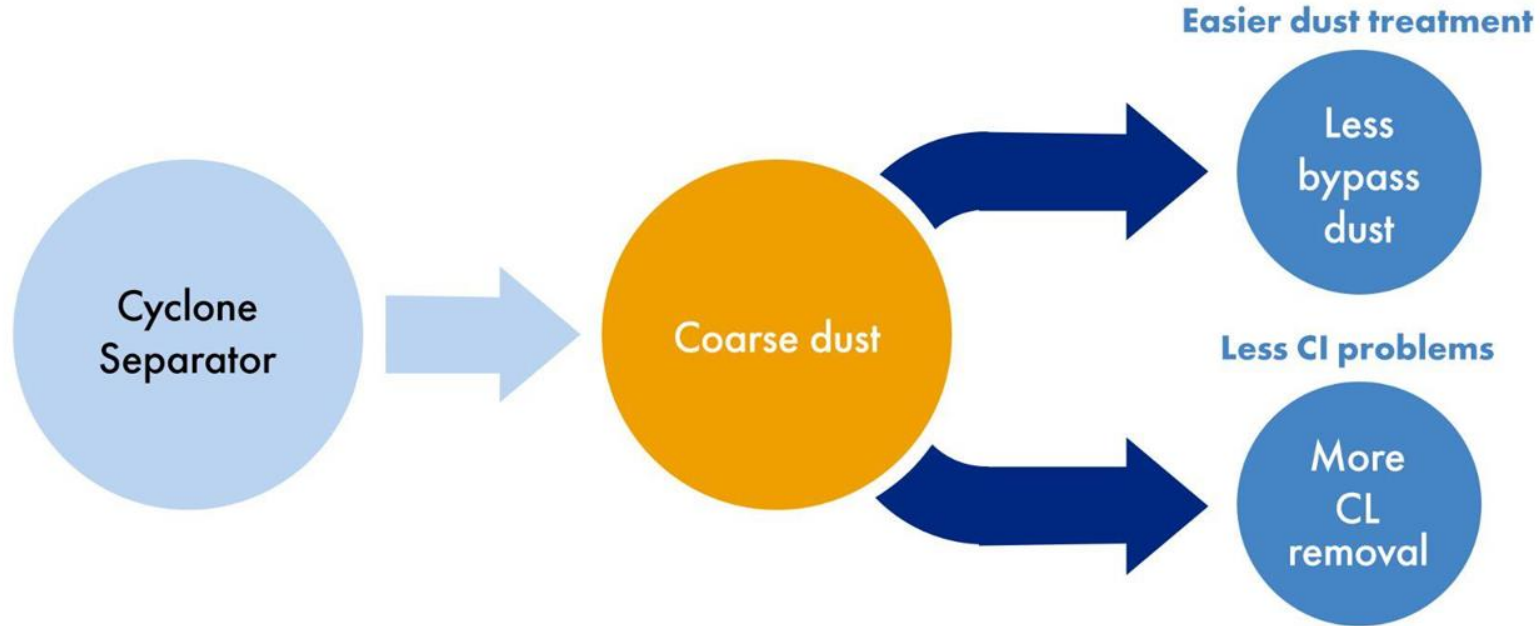
HIGH CHLORINE REMOVAL

with low bypass ratio

Removal ratio of major volatile matters



2 DUST TREATMENT MODES



TAIHEIYO CHLORINE BYPASS CYCLONE

2 DUST TREATMENT MODES

Clinker production: **5800 td** Input C1:**450ppm**

| | Coarse dust treatment | |
|--------------------------------------|-----------------------|--------------------|
| | Back to kiln | Out of kiln |
| Bypass ratio (%) | 10 | 6 |
| Discharged dust amount (t/d) | 13 - 17 | 60 - 65 |
| Chlorine content of dust (%) | 13 - 16 | 3 - 5 |
| Chlorine amount of dust (t/d) | 1.69 - 2.72 | 1.80 - 3.25 |

Small dust amount

Lower bypass ratio