Dioxin Countermeasures and Effects on Environment in Japan

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Contents

History of Countermeasures for Dioxin

Time	Details of Contents
November 1983	It was reported that dioxin had been detected from ash of a garbage incineration facility.
From 1985	Research on generation mechanism of dioxins in the course of waste disposal
January 1997	Guideline for Dioxin Emission Control in connection with Waste Disposal (New Guideline)
August 1997	Governmental and ministerial ordinance regarding "Waste Management and Public Cleansing Law" were amended. Enforcement ordinance, etc. regarding "Air Pollution Control Act" were amended.
1998	Urgent Simultaneous Nationwide Dioxin Survey
March 1999	"Basic Guidelines of Japan for the Promotion of Measures against Dioxins" was formulated.
January 2000	"Law Concerning Special Measures against Dioxins (The Dioxins Law)" was entered into force.
September 2000	"Government Plan to Reduce Dioxin Levels Resulting from Business Activities in Japan" was formulated.
June 2001	"Measurement Act" was amended. "Specified Measurement Laboratory Accreditation Program" was introduced.

Contents

Guideline for Dioxin Emission Control in connection with Waste Disposal (January 1997)

Outline

Emergency countermeasures

- Setting emission concentration standard of refuse incineration facilities to less than 80ng-TEQ/Nm^3
- Considering and implementing concrete measures urgently for the facilities which don't meet above criteria

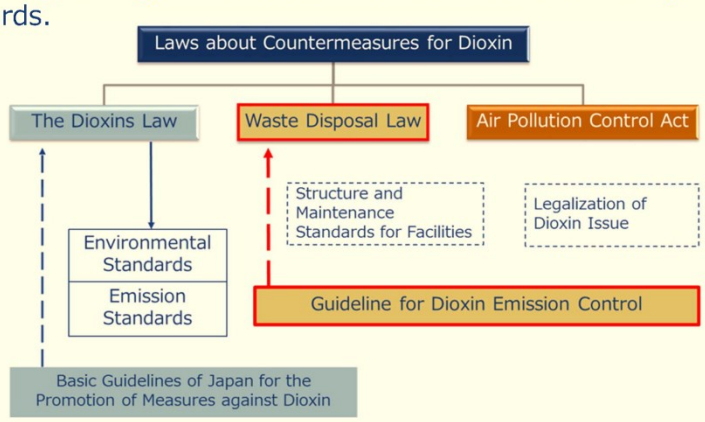
Long-term countermeasures

- Waste disposal facilities : Reviewing and improving the old guideline (structure and maintenance management)
- Newly-installed furnaces : In principle, the emission standard for all continuous furnaces shall be under 0.1ng-TEQ/Nm^3
- Existing furnaces : Emission standard shall be under 0.5~5ng-TEQ/Nm^3 (values depending on each type of furnace)
- Reducing waste disposal and promoting recycle
- Measuring emission concentration of dioxins once a year
- Making waste disposal area widen etc.

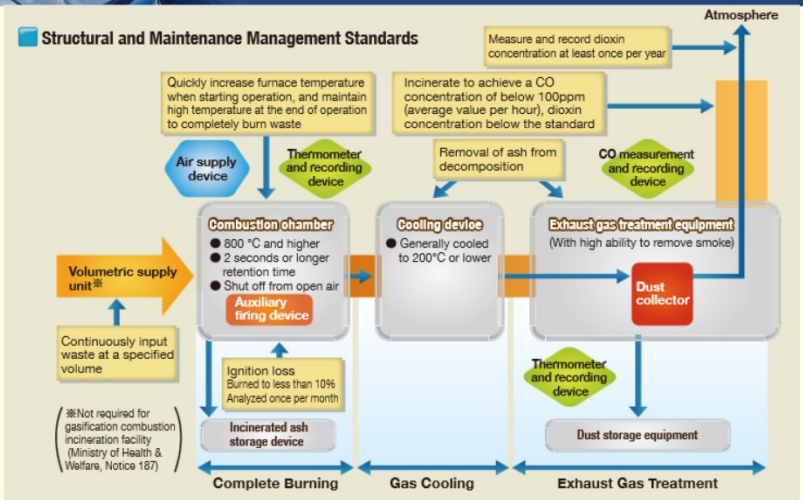
Waste Management and Public Cleansing Law December 1997

Outline

1. Strengthening of incinerator structure standards.
2. Strengthening of incinerator maintenance and management standards.



Structural and Maintenance Management Standards



Source: Ministry of the Environment, *Solid Waste Management and Recycling Technology of Japan*, 2013, p.8.

Waste Management and Public Cleansing Law December 1997

Emission Standard for Incinerator after Amendment

(Unit: ng-TEQ/ m^3 N)

Capacity of Combustion Chamber	Standard for New Incinerator	Standard for Existing Incinerator		
		1997.12.1～1998.11.30	1998.12.1～2002.11.30	after 2002.12.1
over 4 t/h	0.1	grace period	8 0	1
2 t/h ~ 4 t/h	1			5
under 2 t/h	5			1 0

Urgent Simultaneous Nationwide Dioxin Survey in 1998

1997 Pilot Survey
1998 In order to understand the dioxin pollution status nationwide, the survey to determine the current status of pollution of environmental media, including air, water, soil and bottom sediment, etc., was carried out by using uniform methods.

The measurements are conducted at approximately 400 sites throughout Japan (the number varied according to the medium studied), including the vicinity of generation sources, large cities, medium/small cities, and background.

- Air
- Soot/Dust
- Public Waters
- Groundwater

- Bottom Sediment of Public Water
- Soil
- Aquatic Organisms

Source : "Regarding the Results of the Urgent Simultaneous Nationwide Survey of Dioxins (Conducted in 1998)" published by Ministry of the Environment.
(https://www.env.go.jp/en/chemi/dioxins/urgent_Nation-wide_survey.pdf)

Law Concerning Special Measures against Dioxins [The Dioxins Law] (January 2000)

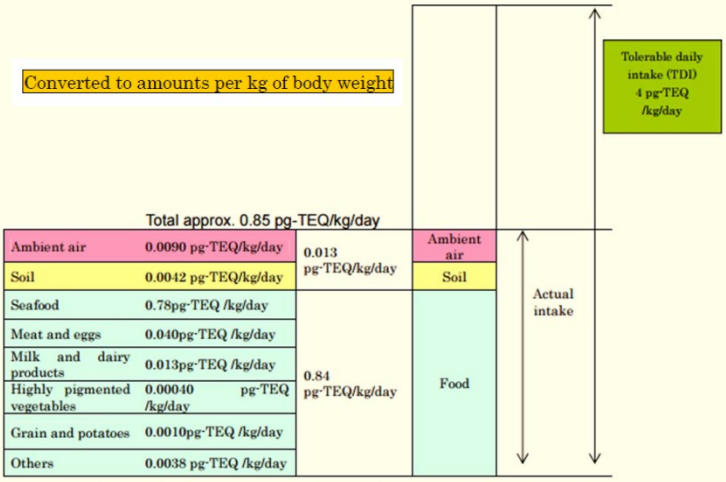
Purpose

The purpose of this law is to protect the health of citizens, by providing basic standards for the measures concerning dioxins as well as necessary regulations or measures against polluted soil in order to prevent or remove environmental pollution caused by dioxins.

Outline of the Law

1. Basic standards for formulating policies on dioxins
2. Regulations for emission gas and effluent relating to dioxins
3. Disposal of ash and dust relating to waste incinerators, etc.
4. Measures against soil contamination by dioxins
5. Governmental plan for the reduction of dioxins emissions
6. Obligations for monitoring and surveillance of the level of pollution caused by dioxins

Daily Intake of Dioxins in Japan Fiscal Year 2009, TEF-WHO (2006)



Source: Ministry of the Environment, *Information Brochure Dioxins,* 2012, p.12.

Basic Standards for the Measures Concerning Dioxins

Environmental Quality Standards	
ambient air	annual average : not more than 0.6pg-TEQ/m^3
water	annual average : not more than 1pg-TEQ/L
bottom sediment	not more than 150pg-TEQ/g
soil	not more than 1,000pg-TEQ/g

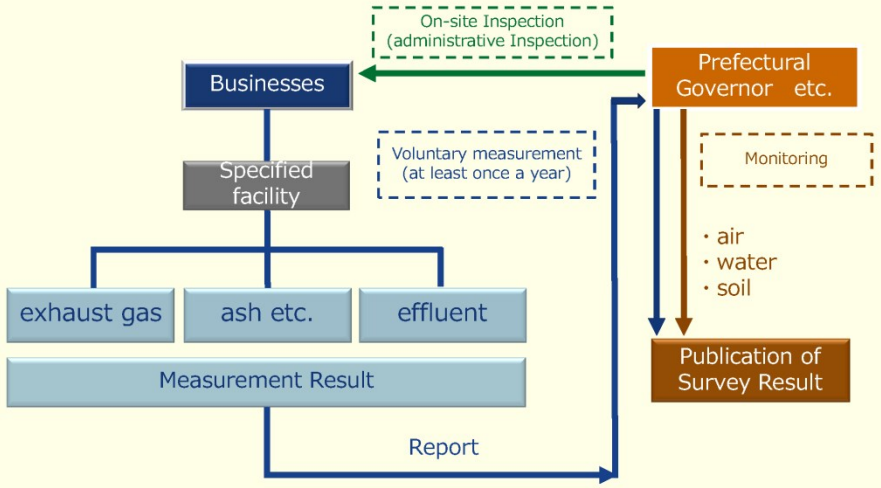
Regulations for Emission Gas and Effluent Water Relating to Dioxins

Type of Specified Facilities (Unit: ng-TEQ/m^3 N)	Scale of Facilities (Capacity of Incineration)	Standards for New Facility	Standards for existing facility
Waste incinerators (hearth area is more than 0.5m^2 or capacity of incineration is more than 50kg/h)	More than 4t/h	0.1	1
	2t/h - 4t/h	1	5
	less than 2t/h	5	10
Electric Steel-making Furnaces		0.5	5
Sintering furnaces for iron and steel industry		0.1	1
Facilities for Recovering Zinc		1	10
Facilities for Manufacturing Aluminum Base Alloy		1	5

Type of Specified Facilities (Unit: pg-TEQ/L)	Standard
・Cleansing facilities, wet dust collecting facilities, and ash storing facilities which are related to waste incinerators (hearth area is more than 0.5m^2 or capacity of incineration is more than 50kg/h) and discharge sewage or waste solution ・etc	10

Flow of Measurement and Monitoring by Businesses

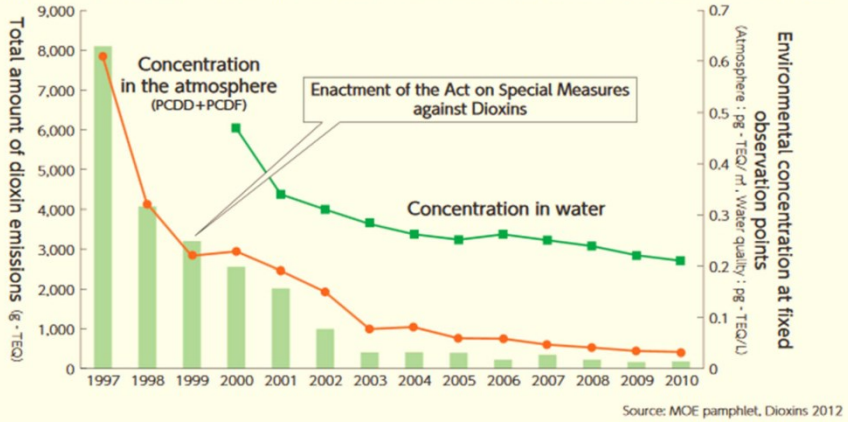
6.Obligation to Survey and Measure the Level of Pollution



Contents

National Dioxin Emissions and Environmental Levels in Air and Water

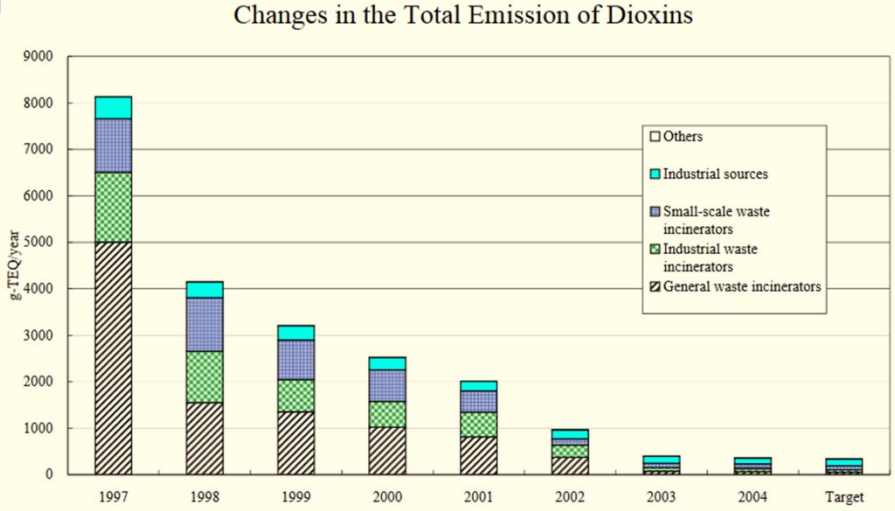
■Changes in the total amount of dioxin emissions and dioxin concentrations in the atmosphere and water



Source: MOE pamphlet, Dioxins 2012

Source: Ministry of the Environment, *History and Current State of Waste Management in Japan*, 2014, p.16.

Changes in the Total Emission of Dioxins



Source :Ministry of the Environment, Dioxin Emission Inventory 2004, November 25, 2005 Press Release.(https://www.env.go.jp/en/press/2005/1125a-03.pdf)

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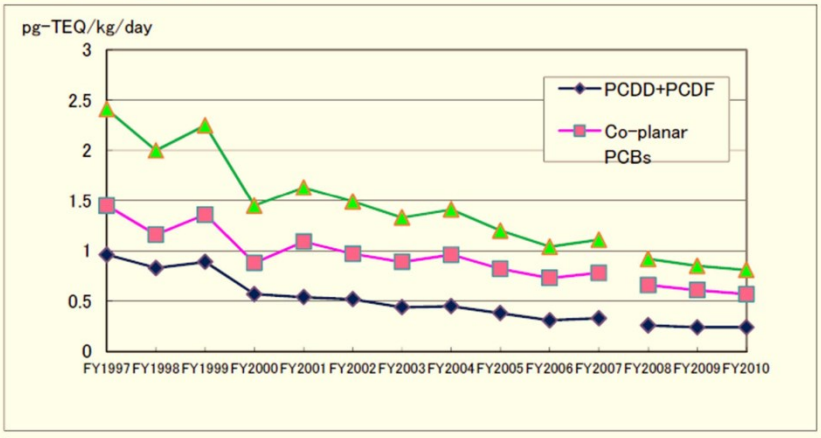
Chronological Change in Daily Intake of Dioxins from Food



(Toxic Equivalency Factors (TFEs) used to calculate the figures in the table have been changed since FY 2008.)
Source: Ministry of Health, Labour and Welfare: Total Diet Study for Dioxins.

Source: Ministry of the Environment, *Information Brochure Dioxins*, 2012, p.13.

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Dioxins Levels in the Environment

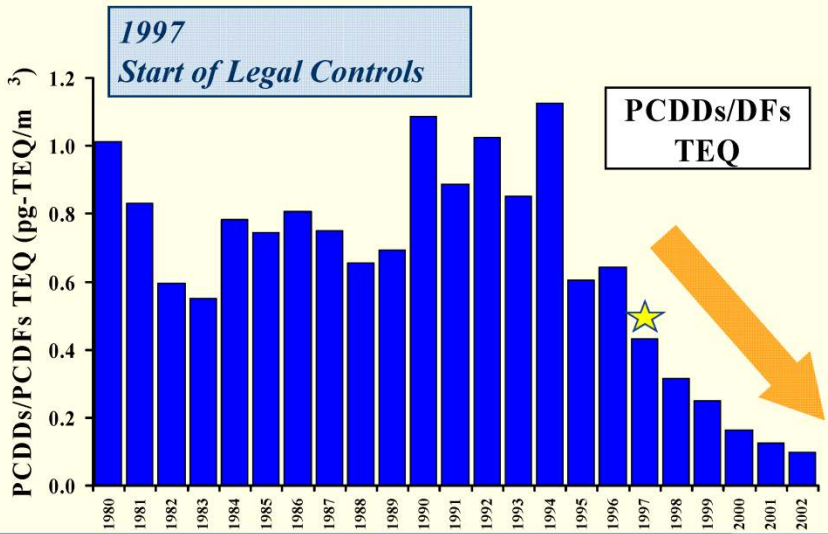
		FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	FY 2006	FY 2007
Ambient air	Average	0.55	0.23	0.18	0.15	0.13	0.093	0.068	0.059	0.052	0.050	0.041
	Range	0.010 ~ 1.4	0.0 ~ 0.96	0.0065 ~ 1.1	0.0073 ~ 1.0	0.0090 ~ 1.7	0.0066 ~ 0.84	0.0066 ~ 0.72	0.0083 ~ 0.55	0.0039 ~ 0.61	0.0053 ~ 0.40	0.0042 ~ 0.58
	No. of sites	68	458	463	920	979	966	913	892	825	763	740
Public water bodies Water	Average	–	0.50	0.24	0.31	0.25	0.24	0.24	0.22	0.21	0.21	0.21
	Range	–	0.065 ~ 13	0.054 ~ 14	0.012 ~ 48	0.0028 ~ 27	0.010 ~ 2.7	0.020 ~ 11	0.0069 ~ 4.6	0.0070 ~ 5.6	0.014 ~ 3.2	0.0097 ~ 3.0
	No. of sites	–	204	568	2,116	2,213	2,207	2,126	2,057	1,912	1,870	1,818
Public water bodies Sediment	Average	–	8.3	5.4	9.6	8.5	9.8	7.4	7.5	6.4	6.7	7.4
	Range	–	0.10 ~ 260	0.066 ~ 230	0.0011 ~ 1,400	0.012 ~ 540	0.0087 ~ 640	0.057 ~ 420	0.050 ~ 1,300	0.045 ~ 510	0.056 ~ 750	0.044 ~ 290
	No. of sites	–	205	542	1,836	1,813	1,784	1,825	1,740	1,623	1,548	1,505
Groundwater	Average	–	0.17	0.096	0.092	0.074	0.066	0.059	0.063	0.047	0.056	0.055
	Range	–	0.046 ~ 5.5	0.062 ~ 0.55	0.00081 ~ 0.89	0.00020 ~ 0.92	0.011 ~ 2.0	0.00032 ~ 0.67	0.0079 ~ 3.2	0.0088 ~ 0.72	0.013 ~ 2.2	0.0076 ~ 2.4
	No. of sites	–	188	296	1,479	1,473	1,310	1,200	1,101	922	878	759
Soil	Average	–	6.5	–	6.9	6.2	3.8	4.4	3.1	5.9	2.6	3.1
	Range	–	0.0015 ~ 61	–	0 ~ 1,200	0 ~ 4,600	0 ~ 250	0 ~ 1,400	0 ~ 250	0 ~ 2,800	0 ~ 330	0 ~ 170
	No. of sites	–	286	–	3,031	3,735	3,300	3,059	2,618	1,782	1,505	1,285

(Note) Unit of Average and Range: Air pg-TEQ/m³, Water pg-TEQ/L,Bottom Sediment pg-TEQ/g, Soil pg-TEQ/g

(Air)
I-TEF(1988) had been used for the calculation of toxicity equivalent until FY 1998 and WHO-TEF(1998) has been used since FY 1999.
(Water quality of public waters, groundwater and Soil)
WHO-TEF (1998) is used for the calculation of toxicity equivalent.

Source: Ministry of the Environment, *Information Brochure Dioxins,* 2009, p.9.

Concentration of PCDDs/PCDFs in Ambient Air (Tokyo) Over the Past 20 Years



Contents

Precision Management System concerning Dioxins Analysis

Regarding the measurement and analysis of dioxins, analyzers need to separate ultratrace substance into a lot of homologues and isomers and identify them. In addition, quite complicated procedure like pretreatment and advanced technology including high resolution mass spectrometer are required. So the precision management of measurement and analysis has become quite important subject.

Accreditation System	ISO/IEC 17025
	Eligibility of Analytical Institutions for Contractual Research which Contains the Environment Measurement of Dioxin Implemented by Ministry of the Environment
	Specified Measurement Laboratory Accreditation Program (MLAP)
Proficiency Testing	MLAP
	The Japan Society for Analytical Chemistry
	Research Group on Ultra Trace Analysis (UTA)

Number of Double-focusing Magnetic Sector High Resolution Mass Spectrometer in Japan

Eligibility of Analytical Institutions for Contractual Research which Contains the Environment Measurement of Dioxin Implemented by Ministry of the Environment

For contractual research involving environmental measures of dioxins, the MOE has conducted an evaluation of the eligibility of analytical institutions and permitted eligible institutions to participate in competitive bids, etc., which was started in 2001.

- Ministry of the Environment
  - Basic Guidelines of Japan for the Promotion of Measures against Dioxin
    - Guidelines for Quality Assurance and Quality Control of the Environmental Measurement of Dioxins
      - GC/MS method
      - Bioassay
      - GC/MS method (Simple Measurement Method)

Eligibility is valid for 3 years.

Measurement Laboratory Accreditation Program (MLAP)

Specified Measurement Laboratory Accreditation Program (MLAP) is an accreditation system that was newly introduced with the amendment of Measurement Law of Japan in June, 2001 in order to enhance the reliability of certified measurement data of micro existent substances such as dioxins.

Classification of Approval

Classification of Approval		Measuring Method
Major classification	Minor classification (medium)	
Air	exhaust gas	JIS K 0311 (2008)
	Ambient air	Manual on Determination of Dioxins in Ambient Air(Environmental Management Bureau, Ministry of the Environment, 2008)
water or soil	Environmental water	JIS K 0312 (2008)
	effluent	JIS K 0312 (2008)
	Soil	Manual on Determination of Dioxins in Soil (Environmental Management Bureau, Ministry of the Environment, 2009)
	Bottom segment	Manual on Determination of Dioxins in Bottom segment(Environmental Management Bureau, Ministry of the Environment, 2009)

Contents

Case Example by Local Government in Japan (Yokkaichi-city : refuse disposal facility)

In Yokkaichi-city where Tokai Techono is located, "Yokkaichi-city Clean Center", a general refuse disposal facility with incineration facility and crushing facility, has started working from April, 2016.
The facility ensures safety and security first of all. And in order to create sustainable society, it not only disposes refuse but also utilizes the energy generated by refuse-burning and recycles the resources, trying to minimize the environmental load.

Courtesy of Life Environment Section, Yokkaich Municipal Government

Incineration Facility Outline	
Target for processing	Garbage (we include abolished plastic) to burn,flammable oversized garbage
Processing capacity	336 t / day (112t / day × 3 furnaces)
Processing method	Gasification scorifier (shaft type)
Use of residual heat	Steam turbine generator 9000kW

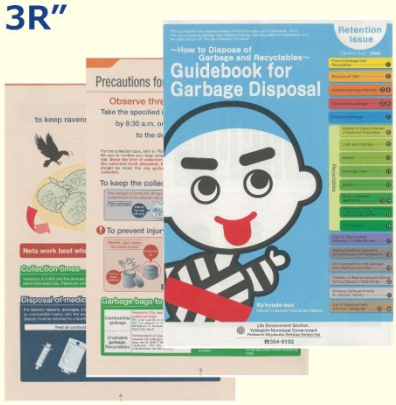
Source : This table was created by Tokai Techno Co., Ltd. based on following site.
(http://www5.city.yokkaichi.mie.jp.e.rt.hp.transer.com/menu73728.html)

Case Example by Local Government in Japan (Yokkaichi-city : Promoting 3R)

Basic Concept "Promoting 3R"

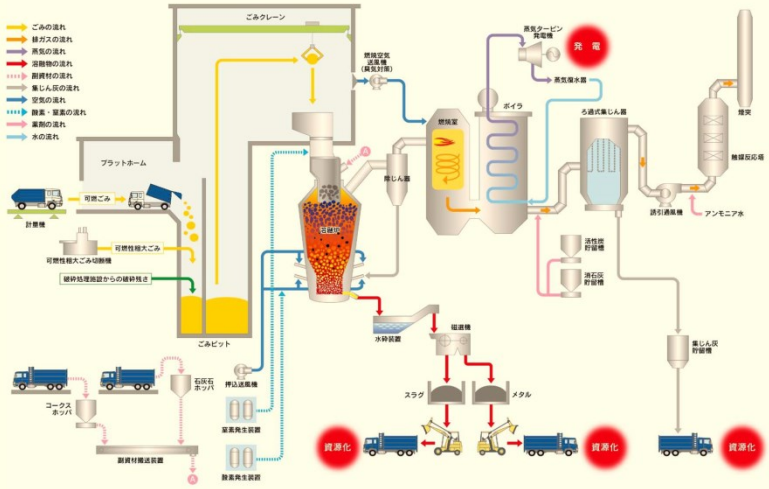
Reduce
Reuse
Recycle

- Reducing the amount of garbage discharge
- Reducing the amount of final disposal
- Increasing the recycling ratio



Source: Yokkaichi Municipal Government, *Guidebook for Garbage Disposal.*

Flow of Process at Incineration Facility (Yokkaichi-city Clean Center)



Courtesy of Life Environment Section, Yokkaich Municipal Government

References

Ministry of the Environment

Waste Management and Recycling Technology of Japan
～Toward a Sustainable Society～

References

Ministry of the Environment, Government of Japan

○Information Brochure Dioxins 2012
http://www.env.go.jp/en/chemi/dioxins/brochure2012.pdf

○Solid Waste Management and Recycling Technology of Japan
http://www.env.go.jp/recycle/circul/venous_industry/en/brochure.pdf

○Video
https://www.youtube.com/watch?v=kwTl2wy4UcM&feature=relmfu

National Institute of Technology and Evaluation

○Measurement Laboratory Accreditation Program (MLAP)
http://www.nite.go.jp/en/iajapan/mlap/index.html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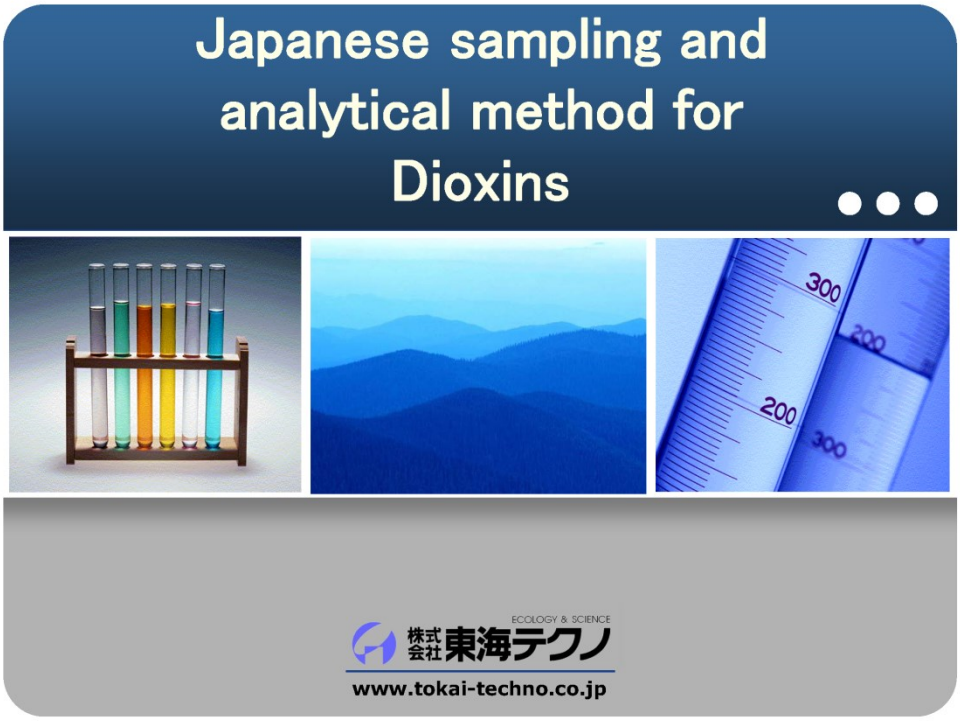
Japanese sampling and analytical method for Dioxins
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Dioxin Measuring Method in Japan

Official Method

exhaust gas:JIS K0311 (Method for determination of tetra-through octachlorodibenzo-p-dioxins, tetrathrough octachlorodibenzofurans and dioxin-like polychlorinatedbiphenyls in stationary source emissions)

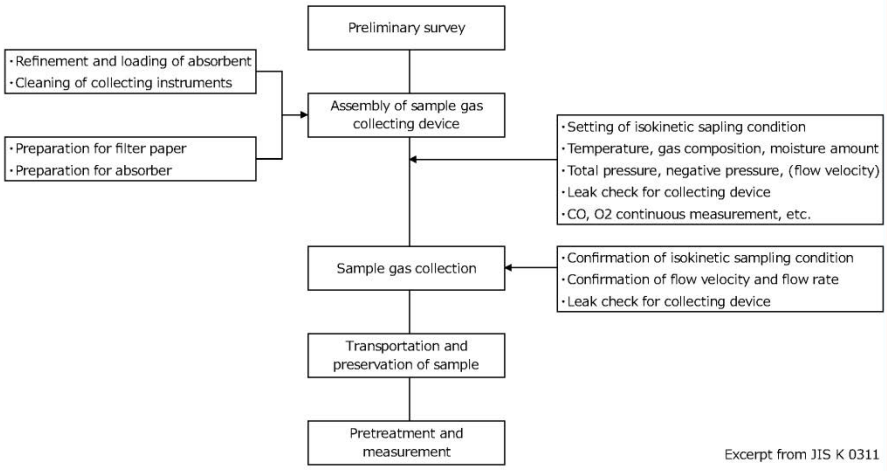
effluent:JIS K0312 (Method for determination of tetra-through octachlorodibenzo-p-dioxins, tetra-through octachlorodibenzofurans and dioxin-likepolychlorinatedbiphenyls in industrial water and waste water)

ambient air:Manual on Determination of Dioxins in Ambient Air

soil:Manual on Determination of Dioxins in Soil

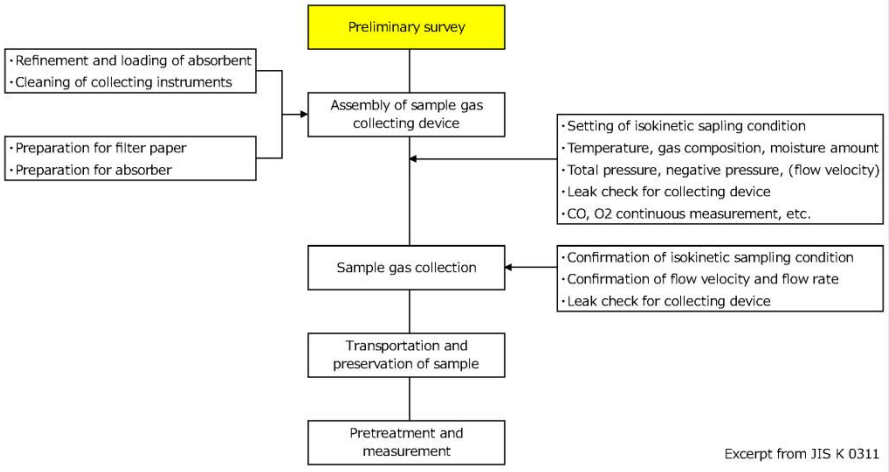
bottom sediment:Manual on Determination of Dioxins in Bottom Sediment

Outline of Exhaust Gas Sample Collecting by JIS



Excerpt from JIS K 0311

Outline of Exhaust Gas Sample Collecting by JIS



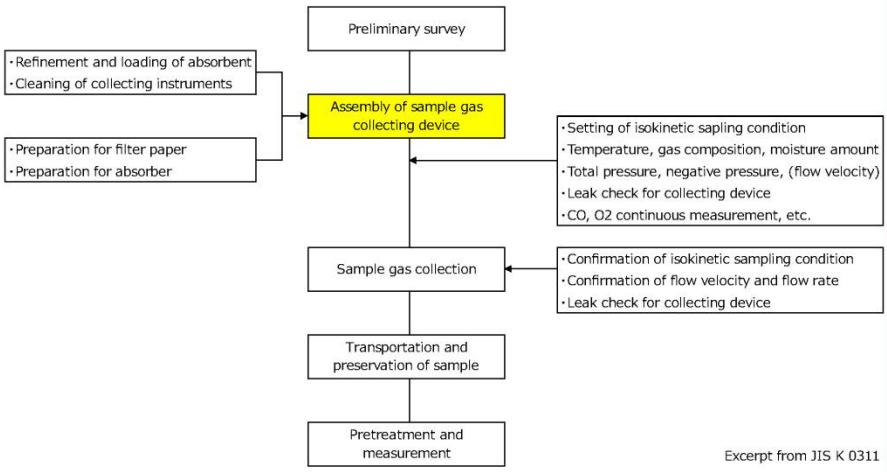
Excerpt from JIS K 0311

Outline of Exhaust Gas Sample Collecting by JIS

Preliminary Survey

1) Properties of Exhaust Gas (gas temperature, flow velocity, composition etc.)
2) Measurement Position(height from ground, condition of measurement hole etc.)
3) Duct(shape, size etc.)
4) Safety for Working(area of measuring stage, ladder condition etc.)
5) Power Source(battery volume, socket position etc.)
6) Water Supply(water cock availability, position etc.)
7) Review of Facility measured(scale, operation status etc.)

Outline of Exhaust Gas Sample Collecting by JIS



Excerpt from JIS K 0311

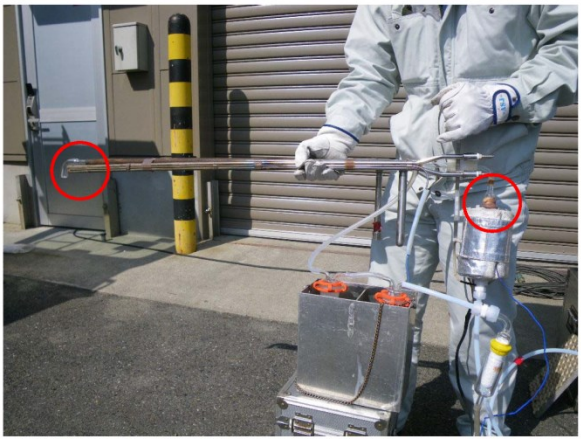
Outline of Exhaust Gas Sample Collecting by JIS

Sample gas collecting device

- sampling tube
- collecting device
- suction pump
- gas meter
- continuous gas analyzer
- manometer
- pitot tube
- thermocouple

Outline of Exhaust Gas Sample Collecting by JIS

Outline of Exhaust Gas Sample Collecting by JIS



Outline of Exhaust Gas Sample Collecting by JIS

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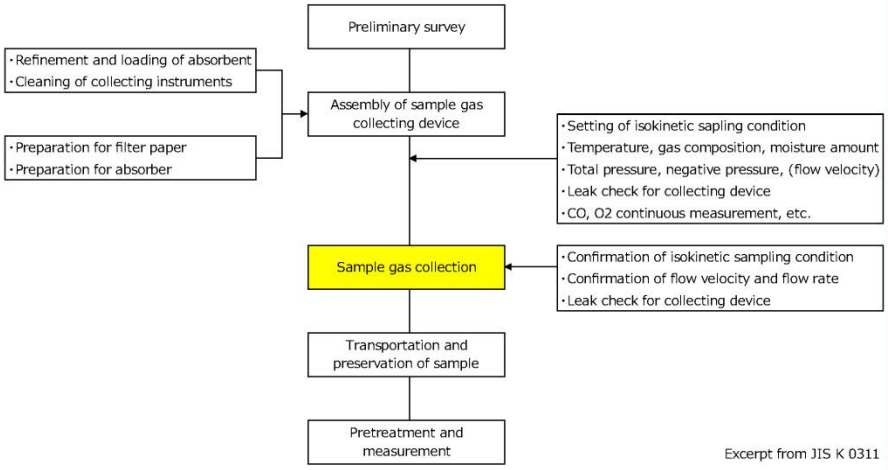
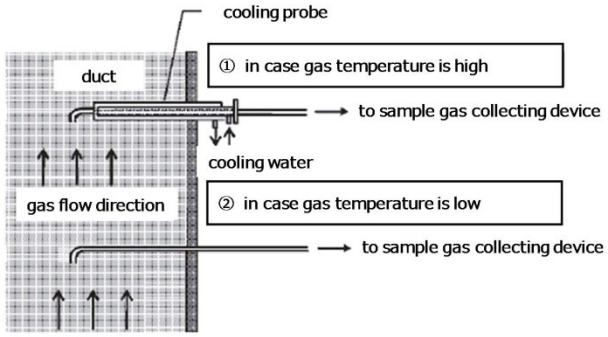


Excerpt from JIS K 0311

Outline of Exhaust Gas Sample Collecting by JIS

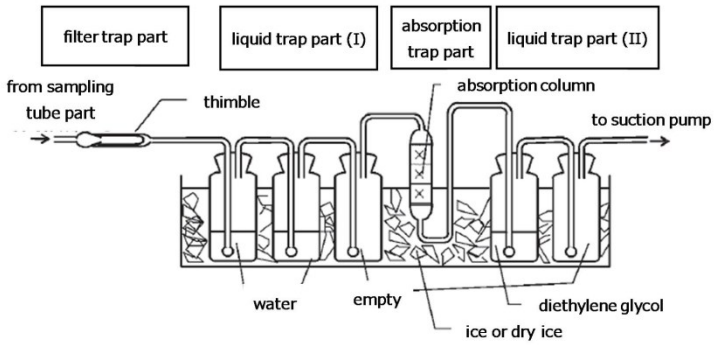
Schematic Chart of Sampling Tube Part



Excerpt from JIS K 0311

Outline of Exhaust Gas Sample Collecting by JIS

Schematic Chart of JIS I type Collecting Device



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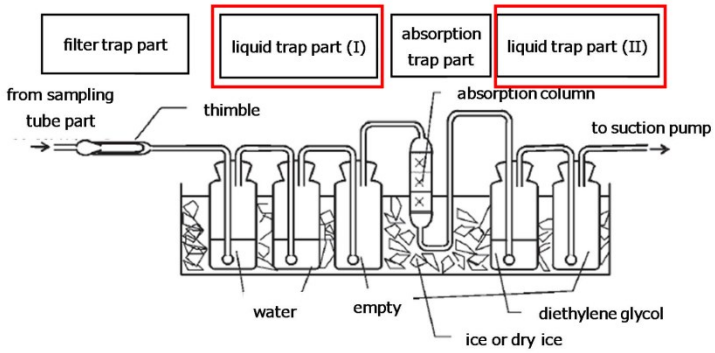

Excerpt from JIS K 0311

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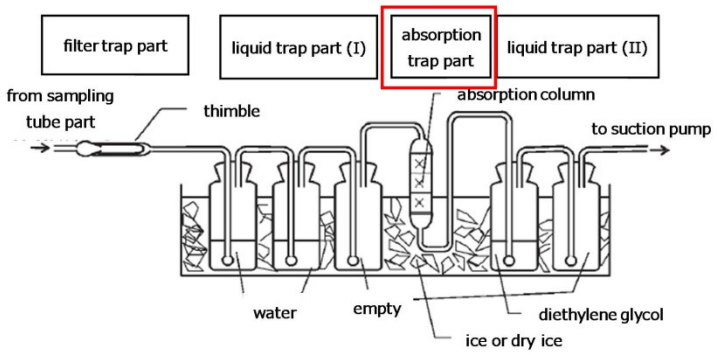
Outline of Exhaust Gas Sample Collecting by JIS

Schematic Chart of JIS I type Collecting Device



Excerpt from JIS K 0311

Outline of Exhaust Gas Sample Collecting by JIS

Points of exhaust gas sampling

- To remove the dioxin pollution of reagents or instruments, etc. used for collecting device as much as possible, and to confirm the pollution level. (grasp and confirmation of blank value)
- To use instruments made of materials which don't absorb dioxins easily
- To collect representative samples
- To sample isokinetically
- To make sure that there's no leaking in collecting device
- To prevent secondary production of dioxins in collecting device

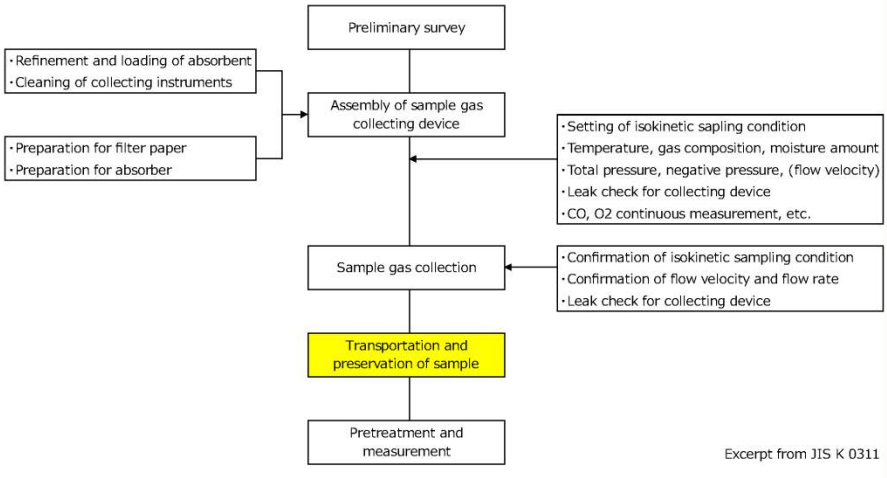
Outline of Exhaust Gas Sample Collecting by JIS

Points of exhaust gas sampling

- To manage the temperature of dust collecting part (less than 120 degrees centigrade)
- To sufficiently cool absorption part like liquid collecting part and XAD-2.
- To prevent loss from sampling system and recover analysis target components appropriately

(recovery rate of sampling spike shall be 70 ~ 130%)

Outline of Exhaust Gas Sample Collecting by JIS



Excerpt from JIS K 0311

Outline of Pretreatment Method for Dioxins

Caution points for arranging samples

・reagent

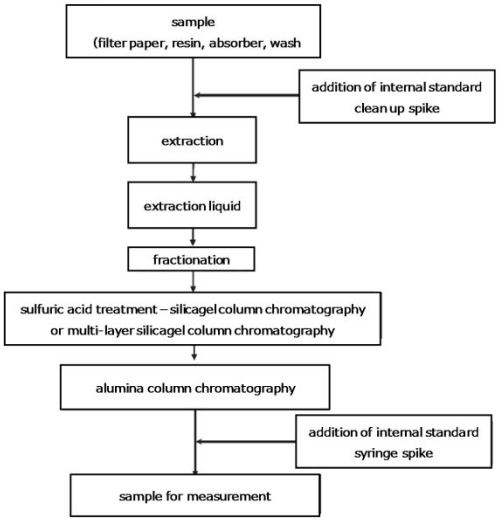
To confirm in advance that it isn't polluted by dioxins and there's no interference substance included by blank test or so.

・instruments and apparatus

To clean instruments and apparatus used for analysis sufficiently, and to confirm by blank test beforehand that they are not polluted by dioxins and they don't interfere with measurement.

It's desirable to distinguish between instruments for high-concentration samples and those for low-concentration samples, and to record use history for management.

Outline of Pretreatment Method for Dioxins



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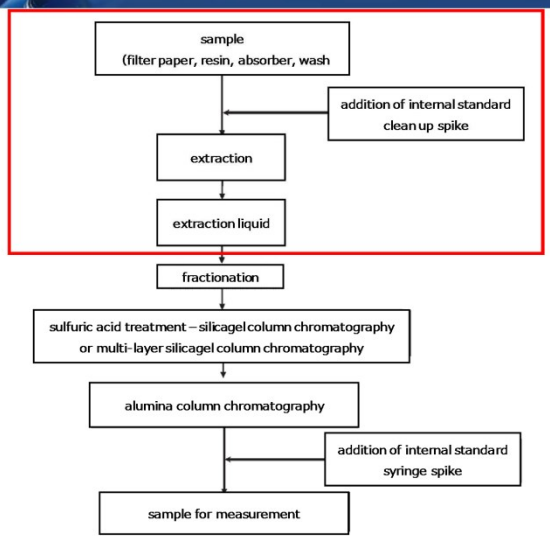
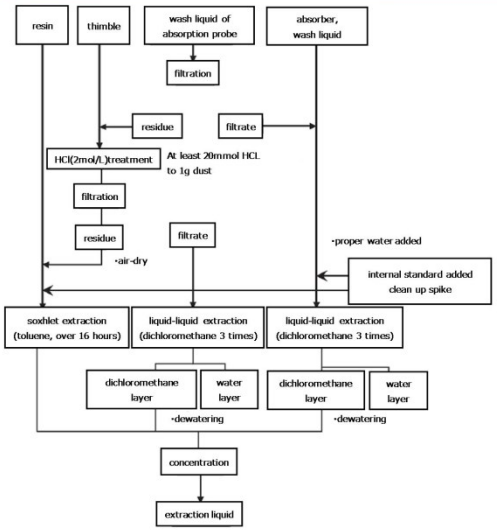
Outline of Pretreatment Method for Dioxins



Outline of Pretreatment Method for Dioxins



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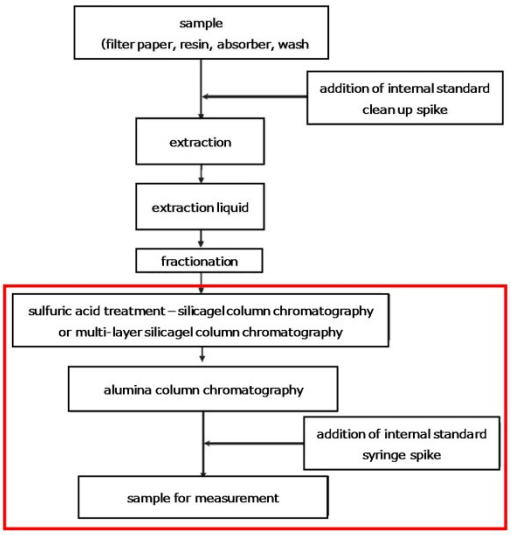


Outline of Pretreatment Method for Dioxins

example of clean up method	main purpose
DMSO treatment	Selective extraction of aromatic compound from oily sample, and removal of oil. Removal of aliphatic hydrocarbon and alicyclic hydrocarbon.
sulfate treatment	Decomposition and Removal of most part of matrix. Removal of colored substance, PAHs, unsaturated hydrocarbon, phthalic estel, and part of organic chlorine compound.
alkali treatment	Removal of phenol, acidic substances, lipid, and protein.
silver nitrate/silica gel silver oxide/silica gel activated copper	Removal of DDE and aliphatic higher hydrocarbons.
almina (or florisil) column chromatography	Removal of low polar substance, PCB, PCN, and organochlorine pesticide.
activated carbon column chromatography	Removal of chlorinated diphenyl ether, component derived from organism, and many interference component.
HPLC (normal phase, reversed phase, GPC) porous graphitized activated carbon (PGC)	High-precision clean up and fractionation.

Outline of Pretreatment Method for Dioxins

Caution point for sample clean up

- To prevent contamination caused by reagent or instrument, and to conduct blank test
- To select reliable and effective clean up method
- To confirm elution condition of column clean up
- To clean up sample until it has no color and volatile components are not confirmed visually
- To understand interference components which can be included in samples.
- To confirm that recovery rate of clean up spike is valid (recovery rate : 50 ~120 %)

Type and Role of Internal Standard Substance

Usage examples of internal standard substance

Internal Standard Substance	example 1			example 2		
	sampling spike	clean up spike	syringe spike	sampling spike	clean up spike	syringe spike
$^{13}C_{12}$ -1,2,7,8-TeCDF				○		
$^{13}C_{12}$ -2,3,7,8-TeCDF		○			○	
$^{13}C_{12}$ -1,2,3,4-TeCDD			○			○
$^{13}C_{12}$ -2,3,7,8-TeCDD		○			○	
$^{37}Cl_4$ -2,3,7,8-TeCDD						
$^{13}C_{12}$ -1,2,3,7,8-PeCDF	○				○	
$^{13}C_{12}$ -2,3,4,7,8-PeCDF		○				
$^{13}C_{12}$ -1,2,3,7,8-PeCDD		○			○	
$^{13}C_{12}$ -1,2,3,4,7,8-HxCDF		○				
$^{13}C_{12}$ -1,2,3,6,7,8-HxCDF		○			○	
$^{13}C_{12}$ -1,2,3,7,8,9-HxCDF	○					
$^{13}C_{12}$ -2,3,4,6,7,8-HxCDF		○				
$^{13}C_{12}$ -1,2,3,4,7,8-HxCDD		○				
$^{13}C_{12}$ -1,2,3,6,7,8-HxCDD		○			○	
$^{13}C_{12}$ -1,2,3,7,8,9-HxCDD			○			○
$^{13}C_{12}$ -1,2,3,4,6,7,8-HpCDF		○			○	
$^{13}C_{12}$ -1,2,3,4,7,8,9-HpCDF	○			○		
$^{13}C_{12}$ -1,2,3,4,6,7,8-HpCDD		○			○	
$^{13}C_{12}$ -1,2,3,4,6,7,8,9-OCDF		○				
$^{13}C_{12}$ -1,2,3,4,6,7,8,9-OCDD		○			○	

Excerpt from JIS K 0311

Estimation of Pollution Source

Manual on Determination of Dioxins in Ambient Air

- If necessary (for example, to judge the origin of pollution), concentration of homologue and isomer such as "1,3,6,8-TeCDD", "1,3,7,9-TeCDD", "1,2,7,8-TeCDF" shall be determined quantitatively and indicated.

調査開始年月日	OO年OO月OO日	実施主体	OO県					
調査終了年月日	OO年OO月OO日	媒体名	大気					
都道府県	OO県	Total (PCDDs+PCDFs)	0.047	(pg-TEQ/m³)				
市町村名	OO市	Total Co-PCBs	0.19	(pg-TEQ/m³)				
測定地点名	OO公民館	Total (PCDDs+PCDFs+Co-PCBs)	0.24	(pg-TEQ/m³)				

		実測濃度 (pg/m³)	定量下限値 (pg/m³)	検出下限値 (pg/m³)	回収率 (%)	重なって定量されている異性体名称	毒性等価係数 TEF	毒性等量(TEQ) (pg-TEQ/m³)
PCDDs	1,3,6,8-TeCDD	0.060	0.01	0.003	—		—	—
	1,3,7,9-TeCDD	0.040	0.01	0.003	—		—	—
	2,3,7,8-TeCDD	<0.003	0.01	0.003	88		1	0.0015
	1,2,3,7,8-PeCDD	0.010	0.01	0.003	87		1	0.01
	1,2,3,4,7,8-HxCDD	(0.010)	0.02	0.007	89		0.1	0.001
	1,2,3,6,7,8-HxCDD	0.020	0.02	0.007	85		0.1	0.002
	1,2,3,7,8,9-HxCDD	0.020	0.02	0.007	87		0.1	0.002
	1,2,3,4,6,7,8-HpCDD	0.14	0.02	0.007	88		0.01	0.0014
	OCDD	0.60	0.04	0.01	91		0.0003	0.00018
PCDFs	1,2,7,8-TeCDF	0.040	0.01	0.003	—		—	—
	2,3,7,8-TeCDF	0.010	0.01	0.003	86		0.1	0.001
	1,2,3,7,8-PeCDF	0.040	0.01	0.003	93	1,2,3,4,7,8-HxCDF	0.01	0.0013
	2,3,4,7,8-PeCDF	0.040	0.01	0.003	92		0.3	0.012
	1,2,3,4,7,8-HxCDF	0.040	0.02	0.007	90	1,2,3,4,7,9-HxCDF	0.1	0.004
	1,2,3,6,7,8-HxCDF	0.040	0.02	0.007	89		0.1	0.004
	1,2,3,7,8,9-HxCDF	<0.007	0.02	0.007	92		0.1	0.00035
	2,3,4,6,7,8-HxCDF	0.050	0.02	0.007	89		0.1	0.005

Excerpt from Manual on Determination of Dioxins in Ambient Air

Estimation of Pollution Source

origin	PCDDs	PCDFs
CNP (agrochemical)	1,3,6,8-TeCDD 1,3,7,9-TeCDD 1,2,4,6,8/1,2,4,7,9-PeCDD 1,2,3,6,8-PeCDD 1,2,3,7,9-PeCDD	2,4,6,8-TeCDF 1,2,4,6,8-PeCDF 2,3,4,6,8-PeCDF
PCP (agrochemical)	1,2,3,6,7,9/1,2,3,6,8,9-HxCDD 1,2,3,6,7,8-HxCDD 1,2,3,4,6,7,9-HpCDD 1,2,3,4,6,7,8-HpCDD OCDD	1,2,4,6,7,8-HxCDF 1,2,4,6,8,9-HxCDF 1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,8,9-HpCDF OCDF
chlorine bleaching chlorine treatment		1,2,7,8-TeCDF 2,3,7,8-TeCDF 1,2,8,9-TeCDF 1,2,4,6,7/1,2,4,7,8/1,3,4,6,7/1,3,4,7,8-PeCDF 1,2,3,7,8-TeCDF 1,2,4,8,9/2,3,4,6,7-PeCDF 1,2,4,6,8,9-HxCDF 1,2,3,4,7,8-HxCDF 1,2,3,7,8,9-HxCDF 1,2,3,4,6,7,8-HpCDF 1,2,3,4,6,8,9-HpCDF 1,2,3,4,7,8,9-HpCDF

Estimation of Pollution Source

Behavior in Environment

- Dioxins have different isomer pattern according to generation mechanisms, so isomer pattern can be clue for specifying generation source.
- Usually, isomer pattern of dioxins emitted as a result of incineration is similar to that of air in cities, so the origin of dioxins in air is considered to be incineration.
- Agrochemical, PCB, or electrolyzing factory sludge indicate unique isomer pattern.
- Dioxins in landfill waste or river bottom sediment is considered to be the mixture of dioxins from incineration and that from agrochemical.

Summary

1) Manual of official method in Japan is prescribed for each subjected environmental media.

2) It is necessary to conduct preliminary survey before measuring.

3) As for exhaust gas sampling, temperature control for collecting device is required when measuring.

Summary

4) It is important to select reliable and effective method for refinement operation.

5) Higher analytical precision is ensured by adopting internal standard method.

6) Estimation of pollution source is possible by analyzing distribution pattern of isomer.

Thank you all for your attention.

ECOLOGY & SCIENCE
株式会社東海テクノ
www.tokai-techno.co.jp

Correspondence to Stockholm Convention on Persistent Organic Pollutants by Japanese Government

Activity of Ministry of the Environment Japan

IDEA Consultants, Inc. Tomohisa KUME

Background

It was recognized that actions on POPs (Persistent Organic Pollutants) such as PCB,DDT, PCDD,PCDF, etc. as POPs by only a limited number of countries are insufficient for the worldwide elimination and reduction of POPs. Therefore, the Stockholm Convention was adopted at the Conference of Plenipotentiaries held in Stockholm in May, 2001.

Purpose

Mindful of the precautionary approach as set forth in Principle 15 of the Rio Declaration on Environment and Development, the objective of this Convention is to protect human health and the environment from persistent organic pollutants.

We must take measures

- [1] Eliminate releases from intentional production and use (aldrin, hexachlorocyclohexane(alpha-, Beta-, Lindane), Chlordane, Chlordecone, Dieldrin, Endrin, Heptachlor, Hexabromobiphenyl, Hexabromodiphenyl ether, and heptabromodiphenyl ether, Hexachlorobenzene, Mirex, Pentachlorobenzene, Polychlorinated biphenyls(PCB), Tetrabromodiphenyl ether, and pentabromodiphenyl ether, Toxaphene, Technical endosulfan and its related isomers, Hexabromocyclododecane, and Restriction (DDT, Perfluorooctane sulfonic acid(PFOS))
- [2] Reduce of Unintentional production (Hexachlorobenzene (HCB) , Pentachlorobenzene (PeCB), Polychlorinated biphenyls (PCB), Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF))
- [3] Measures to reduce or eliminate releases from stockpiles and wastes
- [4] Implementation plans
- [5] Prohibit and/or take the legal and administrative measures necessary to eliminate
- [6] Public information, research, development and monitoring, awareness and education
- [7] Technical assistance

Effect and the conclusion of the Stockholm Convention

- Stockholm Convention became effective by having concluded by 50 countries on May 17, 2004.
- As of January, 2015 , 151 countries and European Union (EU) have signed, and 178 countries including Japan and EU have concluded.

Correspondence of the Convention in Japan

- Japan joined the First Intergovernmental Negotiating Committee (Inc1) for an international legally binding instrument for implementing international action on certain Persistent Organic Pollutants, and concluded on August 30, 2002.

Domestic correspond-ence

- The enforcement of the measures on POPs

Regulation on Manufacture, Use, and Import/Export

Substances recognized by the Convention is prohibited or virtually prohibited.

- Chemical Substances Control Law
- Agricultural Chemicals Regulation Law
- Pharmaceutical Affairs Law
- Foreign Exchange and Foreign Control Trade Law

"Export Trade Control Order" and "Import Trade Control Order"

Regulation of releases from unintentionally produced substances

- Based on the dioxin law of Japan, PCDDs, PCDFs and coplanar PCBs are defined as dioxins and comprehensive discharge reduction measures are promoted.
  - Environmental standards
  - Tolerable daily intake
  - Effluent standard for discharge water and exhaust gas of specific facilities
  - Development of implementation plans for dioxin discharge reduction
- Because the types of sources and generation processes of PCBs and HCBs are similar to dioxins, according to the current knowledge, the discharge reduction is conducted together with dioxins countermeasures.
- Dioxins and PCBs are subject to PRTR system by the law.

Regulation of releases from stockpiles and wastes

(Pesticides)

- The sale and use of pesticides that are assumed to be in conjunction pesticide use with 15 active ingredients substances are prohibited. The pesticide manufacturers must collect these pesticides and severely perform safekeeping or detoxification.
- The underground burial disposal is undertaken for organochlorine-based pesticides (Aldrin, etc.) including POPs. Approximately 4,000 tons of POPs among 4400 tons of total pesticides have been detoxified by underground burial disposal in 168 sites (as of February, 2011).

Regulation of releases from stockpiles and wastes

(Others)

- Appropriate disposal of waste including dioxins

"The Act on Special Measures Concerning Dioxins"

"Waste Management and Public Cleaning Law"

- Disposal of waste including PCBs

" The Act on Special Measures Concerning PCB"

"Guidelines about the processing on a very small amount of PCB pollution abolished electric apparatuses"

"Collection transportation guidelines on a very small amount of PCB pollution abolished electric apparatuses"

- The discharge of the POPs waste or development of the processing standard

"Technical notice of the disposal POPs including abolished pesticides"

"Technical notice of the disposal PFOS for waste"

Environmental monitoring

【Purpose】

Temporal long-term monitoring of general environmental pollution on state of persistence of substances. From FY2002, the effect of the countermeasures on abolition and the reduction of POPs substances are being monitored.

【Chemical substances】

- FY1978～ Environmental monitoring of biota
- FY1986～ Environmental monitoring of water and sediment

The continuity and accumulation of the data by the same sampling and analytical technique and/or methods are taken into account.

【PCDD,PCDF / PCB】

- FY1985～ National environmental monitoring of water, sediment & aquatic environment (river, lake & sea)
- FY1986～ Ambient air environmental monitoring
- FY1998～ National surveys conducted, adding soil as subject media
- FY2000～ Large-scale regular monitoring implemented by local governments

State of General Environment 1

(PCDD,PCDF)

【Air】

- FY1986～ National environmental monitoring
- FY1997～ National survey implemented based on Air Pollution Control Law
- FY2000～ Large-scale regular monitoring implemented by local governments
- In FY2010, 746 sites, 2,427 samples were surveyed. The mean concentration of 691 sites satisfied the atmosphere environmental standard. The mean concentration was 0.032 pg-TEQ/m3, in the range of 0.0054-0.32 pg -TEQ/m3. No site exceeded the atmosphere environmental standard.
- For PCDDs/Fs, the mean concentration of 33 continuous monitoring sites was 0.034 pg-TEQ/m3, largely decreasing from that of FY 1997, 0.61 pg-TEQ/m3.

State of General Environment 2

(PCDD,PCDF)

【Water】

- FY1998～ National environmental monitoring
- FY2000～ Large-scale regular monitoring implemented by local governments
- In FY2010, 1,610 sites were surveyed. The mean concentration was 0.19 pg-TEQ/L, in the range of 0.010～2.1 pg-TEQ/L. Among these sites, 26 sites exceeded the water environmental standard (annual average <1 pg-TEQ/L; exceeding ratio 1.6%).
- For the 784 continuation survey sites, the mean concentration decreased from 0.47 pg-TEQ/L of FY 2000 to 0.21 pg-TEQ/L.

State of General Environment 3

(PCDD,PCDF)

【Sediment】

- FY1985～ National environmental monitoring
- FY2000～ Large-scale regular monitoring implemented by local governments
- In FY2010, 1,328 sites were surveyed. The mean concentration was 6.9 pg-TEQ/g-dry, in the range of 0.054～320 pg-TEQ/g-dry. Among these sites, 6 sites exceeded the sediment environmental standard (< 150 pg-TEQ/g) (exceeding ratio 0.5%).
- In the 495 continuous survey sites, the mean concentration decreased from 17pg-TEQ/g of FY 2000 to 9.8pg-TEQ/g.

State of General Environment 4

(PCDD,PCDF)

【Underground water】

- FY1998～ National environmental monitoring
- FY2000～ Large-scale regular monitoring implemented by local governments
- FY2010, 590 sites were surveyed. The mean concentration was 0.048 pg-TEQ/L, in the range of 0.0098～0.44 pg-TEQ/L. No site exceeded the water environmental standard (annual average < 1 pg-TEQ/L).

State of General Environment 5

(PCDD,PCDF)

【Soil】

- FY1998～ National environmental monitoring
- FY2000～ Large-scale regular monitoring implemented by local governments
- FY2010 survey, 998 sites were surveyed. The mean concentration was 3.0 pg-TEQ/g-dry, in the range of 0～94 pg-TEQ/g-dry. No site exceeded the ground environmental standard v (annual average < 1,000pg-TEQ/g-dry) .
- For the 714 general environmental survey sites, the concentration mean was 2.1 pg-TEQ/g-dry, in the range of 0.000032～61 pg-TEQ/g-dry. For the 284 sites near emission sources, the concentration mean was 5.4 pg-TEQ/g-dry, in the range 0～94 pg-TEQ/g-dry.

State of General Environment 6

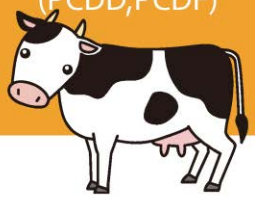
(PCDD,PCDF)

【Aquatic Organisms】

- FY1985～FY1999 surveyed
- In FY1999, 2,832 samples of fishes, crustaceans, and mollusks were surveyed at 543 sites. The mean concentration was 1.4 pg-TEQ/g-wet, in the range 0.032～33 pg-TEQ/g-wet. The mean concentration was slightly lower, and the density range was approximately at the same level, in comparison with FY1998 survey results (mean concentration 2.1 pg-TEQ/g-wet; range 0.0022～30 pg-TEQ/g-wet).

State of General Environment 7

(PCDD,PCDF)



【Wildlife】

- FY1997～FY2007 surveyed
- In FY2007, 41 samples of birds, aquatic mammals, and landed mammals were investigated. No concentrations were recognized to be higher than the existing findings. As for the temporal trend, mean concentration was somewhat higher, but no clear increasing or decreasing trend was observed.
- Though dioxin emitted into environment have reduced due to emission countermeasures, it was suggested that its effect on the state of accumulation is slow or little in wildlife.

State of General Environment 8

(PCDD,PCDF)

【Human】

- Fy2002～ Survey was started
- In FY2010, the mean dioxin concentration in the blood of 174 people was 14 pg-TEQ/g-fat, in the range 0.10～82 pg-EQ/g-fat, within the range of past findings.
- In the past 9 years, the mean dioxin concentration in the blood of 2,264 people was 19 pg-TEQ/g-fat, the in the range of 0.10～130 pg-TEQ/g-fat. **A statistical differences were observed for concentrations by areas, districts, ages, nursings, the delivery situations, and occupations.**

Effectiveness of the measures and issues

【Effectiveness of the measures and issues】

- 1990 Development of waste incinerator guidelines
- 1992 Enforcement of the instruction of paper pulp factory discharge restraint measures
- 1997 Implementation of the effluent control of the electric furnace for waste incinerator and steel manufacture, based on the Air Pollution Control Act.
- 1999 Comprehensive countermeasures implemented according to laws concerning dioxins.
- In regards to the Second Reduction Plan Program developed in 2005, the dioxins emission of FY2010 was 158-160 g-TEQ, decreasing by approximately 59% in comparison with 2003, satisfying the reduction target. This result is equivalent to approximately 98% reduction from 1997, when the regulation had begun.
- The environmental pollution status has also improved progressively in recent years. The achievement rate of the environmental standard becomes approximately 100% for all mediums. In 2012, the Third Reduction Plan was revised to carry out precise emission reduction countermeasures, on the basis not to deteriorate the improved environment.

Environment Standards

(PCDD,PCDF)

【Environmental Standards Relating to PCDD, PCDF】

Media	Standard
Ambient Air	<= 0.6 pg-TEQ/m3
Water	<= 1 pg-TEQ/L
Sediment	<= 150 pg-TEQ/g
Soil	<= 1,000 pg-TEQ/g

Note 1 : Standards are in TEQ, calculated by 2,3,7,8-TeCDD toxicity

Note 2 : Standards for ambient air and water (excluding sediment) are annual mean.

Total National Emission Reduction

(PCDD,PCDF)

【Strategy to propel gross weight emission reduction】

1. Implementation of Reduction Plan
2. BAT/BEP

International Contributions

(PCDD,PCDF)

【International Contributions】

Transferring experiences and techniques on dioxins and waste countermeasures of Japan, in response to the request made by counterparts.

National Implementation Plans (NIP)

(PCDD,PCDF)

【Review and Update of Implementation Plans】

Based on the changes dioxins emission, the enforcement situation of the Implementation Plan is evaluated every five years and revised as needed.

【Schedule of Implementation Plans】

Emission reduction measures are continuously carried out, without deteriorating the present environment.

Laws of Japan and National Implementation Plan (NIP)

【Law】
http://www.japaneselawtranslation.go.jp/?re=02

【NIP】
http://www.env.go.jp/chemi/pops/plan/en_full-re.pdf

Environmental Survey Technique (reference)

POPs Air Sampler

2016. May. 10,11

Questionnaire regarding environmental measurement business

We are Tokai techno Co., Ltd. JAPAN.

We are sending this questionnaire regarding environmental businesses in cooperation with Ministry of the Environment and Forest of Indian Government, in order to improve the environment in India.

You do not need to answer the question that you cannot answer.

Thank you in advance for your kind cooperation.

1. Information of Your ORGANIZATION

Organization name:
Full name of Representative Director:
Address:
TEL:
FAX:
E-mail:
URL:
The class and the number of the shares:
Others:

2. Bussiness Scale

Capital:
Number of employees:
Types of businesses/ classes of works:

Customers / Clients:

3. Qualification / Certification

Possession qualification and/or certification (Organization):

Number of the qualified and/or certified engineer; qualification / certification name (Personnel):

4. Technique

Does your organization conduct field sampling on by your own? Y / N
Field: air, land, river, lake, sea, chimney, etc.

What kind of ordinary chemical analysis (pH, DO, BOD, COD, etc.) does your organization conduct?
Analytical item:

Target media:
General environment (air, water, sediment, solid, etc.)
Pollution (emission gas, drainage, waste, etc.)
Working environment, food, DNA, biotechnology, nanotechnology, etc.

Does your organization accept orders for POPs investigations (PCDD, PCDF, PCB, PFOS, etc.) ?
Y / N
Target POPs items:
Original POPs (PCDD, PCDF, PCBs, HCH, etc.)
New POPs (Endosulfan, PFOS, PBDEs, etc.)
Other candidates
Target media for POPs:
General environment (air, water, sediment, solid)
Pollution (emission gas, drainage, waste)
Others

Customers / Clients:

5. Analytical / Investigation Methods

What are the analytical and investigation methods that you use in your organization for POPs?
Are those methods you use public / official methods in India?

6. Price

Please show some examples of the unit price or the set sales price of the general analysis items such as pH, BOD, COD, SS, turbidity, total-nitrogen, total phosphorus, DDT, HCH etc.
Sample attachment is possible

7. Management / Reporting

How are the above techniques and methods managed (i.e. precision management, validity confirmation, back grounds)?
+ Quality control

+ International Standard Operation

Does your organization have any format to report to your customers / clients?
Sample attachment is possible

8. Donation

Do you have any POPs (including dioxin) projects receiving the help or donation from other countries or other groups like World Bank or UNEP?
Name of Project
Total Price
Name of donation group

Sample attachment is possible

9. Other remarks

Please enter any other matters worthy of special remarks or mention in this column. Or Or, if you have any other comments or opinions that you may wish to share with us, please describe in this column as well. We will read this carefully.
Thank you very much.

In conformity with information protection, we will not use this information other than our duties. We greatly appreciate your kind understanding and cooperation in advance.

別添資料 14. 関心表明書（Copy）

SCHOOL OF ENVIRONMENTAL SCIENCES
जवाहरलाल नेहरू विश्वविद्यालय
JAWAHARLAL NEHRU UNIVERSITY
New Delhi-110067, INDIA

Prof. Indu Shekhar Thakur
FNASc, FBRS, FNESA
Professor & Dean

Letter of Intent

Date: 28th April 2016

Mr. Junichi Ichida
President & CEO
Tokai-techno Co., Ltd.
Japan

Subject: Verification Survey with Private Sector for Disseminating Japanese Technologies for "**Verification Survey for Chemical Analysis for Stockholm Convention on Persistent organic Pollutants in India**"

Dear Sir/madam,

In consideration of the meeting held on 28th April 2016, we would like to inform you of our acceptance of the Verification Survey for Chemical Analysis for Stockholm Convention on Persistent organic Pollutants in India"

Sincerely yours

Dr. Indu Shekhar Thakur
Dean
School of Environmental Sciences
Jawaharlal Nehru University
New Delhi
India

Phone : +91-11-26741538, 26704302, 26704321, 26742370 (R) , Fax : +91-11-26741502
E-mail: isthakur@hotmail.com ; isthakur@mail.jnu.ac.in ;indushekhart@gmail.com

英 文 要 約

Feasibility Survey with the Private Sector for Utilizing Japanese Technologies in ODA Projects "Feasibility Survey for Chemical Analysis for the Stockholm Convention on Persistent Organic Pollutants in India"

Final Report

India

October, 2016

Tokai Techno Co., Ltd.

Contents

Summary

1 Development subject for object field of the country and area

Economy in India has been showing high-performance with the change in industrial structure. The development of its economy has been accelerated by private consumption mainly led by the middle class, which appeared along with the growth of service industry.

As the Stockholm Convention concerning POPs regulation was adopted in 2001 and come into effect in 2004, India ratified it in 2006. Around the same time, India established "National Environment Policy", setting "environment management" as one of purposes of the environment policy. And India government stressed the importance to promote "environment management" field in the environment policy.

NIP, National Implementation Plan on Stockholm Convention, established in 2011, stipulates that "India is concerned that wild animals may expose to POPs or it has effect on human health, India has to correspond to the convention early in consideration of environment management, and NIP should effectively and efficiently assist India in implementing the Stockholm Convention to enhance the immediate capacities for management of POPs chemicals at the national and state levels." However, India recognized that it lacked the capacity for measurement and analysis of POPs, so it positions the improvement of measurement and analysis technology for POPs as the immediate development subject.

For this development subject, India is conducting the installment of necessary institutions and equipment in MoEFCC and Ministry of Science and Technology such as POPs laboratory. Based on the Stockholm Convention, India is required to conduct POPs survey, measurement, and analysis on their own frequently and regularly, however, it has not been able to correspond to the convention sufficiently and appropriately because of the lack of technology and human resources for the measurement and analysis.

2 The use possibilities for technology of proposing company and future outlook of business operation

The purpose of this survey is to confirm the subject to improve the capacity of survey, measurement and analysis for "Persistent Organic Pollutants" (hereinafter referred to POPs), and to consider the possibility to make use of technology of Tokai Techno co., ltd. (hereinafter referred to Tokai Techno) for the development of developing countries through seminars introducing case example in Japan and countermeasures against POPs, and workshops teaching technology regarding POPs survey, measurement and analysis.

2-1 The feature of products and technology of proposing company.

The products are concentration measurement certification data obtained with comprehensive technology concerning POPs measurement and analysis which requires very complicated and various processes.

For the measurement and analysis of POPs, which is ultratrace substance, complicated and various processes are required in the pretreatment process and the like. Tokai Techno has, in particular regarding measurement and analysis of dioxins, very advanced technology of survey, measurement and analysis with HRGC/HRMS. And its main product is concentration measurement certification data obtained with comprehensive technology concerning POPs measurement and analysis

Tokai Techno is categorized as major company in terms of scale in POPs analysis industry in Japan, and has many experiences (for 16 years). The technical level of measurement in Japan in the field of POPs analysis is pioneering and overwhelming in the world. So it can be expected to conduct business operations dominantly by the quality of measurement data. Also, As the corporate organization of "International Center for Environmental Technology Transfer" (ICETT), Tokai Techno engages in regulation, standard, seminar and training. In particular, as the group company of material recycle company, Tokai Techno has the ability to provide the comprehensive education and training such as training for the appropriate material management of POPs pollutants.

The concrete contents of cooperation of Tokai Techno are to support the basic of manual preparation for survey and analysis method and to transfer the beginning part of technology necessary for survey and analysis. Therefore, it will grasp the situation concerning POPs in India through the hearing there and the like, and understand the real state of collaborators and share the information of both countries through POPs seminars. Also, it will propose the introduction of materials and equipment necessary for actual works and support the conduction of seminars.

2-2 The position of overseas expansion for business development of proposing company

Tokai Techno is considering gaining overseas share as environment analysis market in Japan is shrinking. And it has decided to focus on India, which has not formed POPs measurement analysis market sufficiently and is now in appropriate economic condition for introducing POPs technology. And expanding policy is as follows;

1) To enter the market with advanced analysis technology for POPs which Tokai Techno has advantage of.

2) To establish a joint-venture company with a local partner to address the issues such as securing of human resources, regulations and rules, and investment risk.
3) To expect private company and Japanese company in India as customers.

2-3 The expected contribution to regional economy in Japan with the overseas expansion of proposing company

After ODA project, creation of new employment from POPs related business will be expected. Also, the support regarding environmental measurement field by Japanese company in India, the spread to educational training of environmental technology by governments, and securing of excellent human resources as creating employment market for students from India by forming joint-platform with ASEAN will be also expected.

3 Investigation result of survey and use possibility for the products and technology expected to be used in ODA project

The customers subjected to this survey are not only government organization related to environmental policy (such as CPCB, NEERI, or CRIS), regional government and SPCB, and Indian private companies which have institutions under the emission standards, but all the business operators including Japanese companies. The technology expected to be utilized is excellent Japanese survey and analysis technology for POPs, and the survey result of the usability is as follows.

3-1 Preliminary survey for latest POPs situation, current condition of POPs analysis technology in India, and request about POPs technology

It was made clear that CPCB, which was the candidate for C/P, didn't have enough survey and analysis technology for POPs, but it had abundant human resources and it was expecting capacity building.

The issues for improving survey and measurement analysis capability of POPs in India were heard from MoEFCC and NEERI, and the seminar to introduce the POPs countermeasures through activities in Japan was held. And the meeting after the seminar revealed that India lacked technique and knowledge and was in the pressing situation for implementation of the Stockholm convention.

3-2 The survey on business environment such as market formation for ODA project

Basic information about POPs were widely disseminated to relevant administration in India. And consultation about conduction of a seminar focusing on public relations

for business operation after the project was held with CPCB and NEERI.

It was made clear that NEERI had equipment for measurement and analysis of POPs but had not arranged analysis system sufficiently so had been considering to obtain information about the policy, current technology level, and survey result in Japan.

It was revealed that MoEFCC was considering to get information about the law and countermeasures in Japan, and JNU wanted the information about current technology and survey result.

Furthermore, JNU was intending to look for the possible contents in pilot survey for disseminating and to consider preparations such as secure of the land.

3-3 Feasibility survey for business development

(1) Verification result for local compatibility of products and technology

By using the dioxins survey and analysis technology based on Japanese method which can partially specify the emission source such as waste or combustion, and by analyzing survey results with that feature, it was assumed to be able to solve the multiple environmental problems from pollution source to exposing condition in the waste issue or air pollution issue which are in critical condition in India. We extracted technology and equipment which India lacks for conducting this proposal and did on-site training focusing on insufficient part. Then it was revealed that both CPCB and NEERI has just one HRGC/HRMS, and they are insufficient to survey, measure and analyze every sorts of environmental media. However, they are originally professional group in chemistry analysis, so basic knowledge for general chemical analysis was sufficient. Furthermore, because of the experience they have in certain survey and analysis, adaptability of the local engineers seemed to be high. And it can be said that they will be able to conduct their own survey and analysis for initial POPs relatively soon if reliable training opportunity is offered.

(2) Confirmation of demand for products and technology of the country and area

It was confirmed that as for the general environmental measurement, there were specialized equipment and exclusive staff, and they analyzed a lot of samples through a year. And we could confirm the existence of market for measurement and analysis.

On the other hand, our survey could not find out offices which had HRGC/HRMS capable of measuring and analyzing low concentration, and engineers in Indian private companies recognized that simple method made based on USEPA was enough to analyze dioxins. And it was made clear that Japanese method would be

particularly useful, and there would be sufficient scale of market in the future, supposing the market like survey business regarding the POPs sources such as disposal issue of illegally dumped waste. It is essential to collect the reliable data based on the credible environmental survey technology in order to organize the laws related to environment. And if the law making is spurred on by collection of accurate data, it can be expected that demand from private institutions which have to face regulations will increase and the markets will be expanded.

(3) Confirmation of efficacy and use possibility of products and technology for development issues of the country and area

We confirmed that the important development issue was improvement of analysis capability and performance of appropriate monitoring for the abolition and observation of POPs, and that Japanese measurement and analysis technique, which are effective to specify emission resources, are sufficiently useful for solving the environment problems in India, like improvement of the ability to correspond to the Stockholm convention or development of legal system. Also, it was turned out from this survey that the department in charge of the Stockholm convention didn't have the ability to fully conduct the measurement and analysis in a practical level, which the convention required. According to the details of legal regulations in some countries, it is necessary to get supports about the measures the country promotes from academic institutes as advisers or auditors. And JNU is suitable to it because JNU is highly interested in dioxins and the like. However, in order to inspect academically the measures and to give appropriate advice, JNU needs to have technology and knowledge equal to or greater than national research institutes. And JNU has a problem that it has not installed measurement equipment. To make JNU an academic institute which can conduct various activities in committee or something, JNU is expected to introduce HRGC/HRMS, to improve analysis technic, and to accumulate knowledge. JNU has a strong will to attend projects like seminars, facilities where HRGC/HRMS can be installed, and staff who are good at chemical analysis technique. So it can begin to develop technology just after HRGC/HRMS is installed and give advices at a committee in the time. So JNU should be appropriate C/P for this ODA.

However, in order to improve such situations and transfer the POPs measurement analysis technology to related organizations, the size of business will require several years of activities mainly focusing on human resource development.

4 Specific suggestions regarding ODA proposal

4-1 Outline of the ODA proposal

We propose “pilot survey for disseminating” as specific ODA scheme, and the name of the scheme is “Pilot Survey for Disseminating concerning Dioxins Analysis Technology correspondent to the Stockholm Convention”.

The background of this proposal is that we could confirm that compliance status to the Stockholm Convention by Indian government has been insufficient and that even governmental research institutions don’t have adequate analysis equipment, human resources, and technology.

The competent authority for the Stockholm Convention (MoEFCC) and the supervisory department for it (NEERI) have to conduct POPs survey and analysis, and guide related organizations immediately. So they want to train and secure engineers in their department, and establish the Indian standard survey and analysis manual for POPs (dioxins). In order to establish it based on Japanese method, it is necessary to get supports from academic institutions which can verify and evaluate the superiority of Japanese method and to obtain legitimate approval for survey and analysis manual (plan) from academic institutions. Therefore, with JNU as C/P, our objective is to archive the following contents.

(STEP 1)

We will develop personnel who can consider a manual plan adopting the superiority of Japanese analysis technology by introducing the equipment necessary for POPs (dioxins) survey and analysis in JNU, transferring analysis technology, and transferring it also to NEERI.

(STEP 2)

We will guide NEERI so that it proposes manual plan to MoEFCC, which is the competent authority, by establishing a working group where JNU cooperates with NEERI regarding POPs (dioxins) and by helping them create the Indian standard survey and analysis manual for POPs (dioxins).

(STEP 3)

We will hold a conference for progress report, inviting government officials such as MoEFCC and NEERI, show the manual plan’s superiority of survey and analysis for

POPs (dioxins) in India, and get a foothold for standardization or dissemination.

4-2 Specific cooperation plan and expected development effectiveness

This time, we will propose "pilot survey for disseminating" and suppose the following scheme.

- To introduce the necessary equipment and transfer the technology by teaching Japanese analysis technique
- To support the creation of Indian standard survey and analysis manual plan so that it is proposed to competent authority
- To hold a conference for progress report, show the superiority of Japanese analysis technology, and get a foothold for standardization or dissemination

With this scheme, by enhancing the specialty of NEERI which is corresponding department to the Stockholm convention for Indian government and developing experts at JNU which is academic institution, cooperation becomes possible between NEERI which conducts administrative guidance for sure and JNU which performs technical verification from an academic point of view. And with Tokai techno supporting them, it should be realized to optimize monitoring system and to vitalize industries from the interaction of industry, government, and academia. We will introduce the necessary equipment and technology and train personnel so that Japanese excellent survey and analysis method for POPs (dioxins) can be effectively utilized in India. After that they will inspect the survey and analysis method, and develop it to Indian original manual plan. And dissemination of analysis method and creation of its market can be also considered. As a result, we can expect that survey and analysis market for POPs (dioxins) will be created by promoting the policies related to POPs (dioxins) in India.

The estimated outline of pilot survey for disseminating is shown below.

4-3 The estimated outline of pilot survey for disseminating

The name of ODA scheme is "Pilot Survey for Disseminating concerning Dioxins Analysis Technology correspondent to the Stockholm Convention". The objective (purpose) is to make it possible for India to obtain survey and analysis data concerning the Stockholm Convention domestically by introducing necessary survey and analysis equipment, transferring survey and analysis technology for POPs (dioxins), and supporting the creation of rules like manual establishment. The survey period is assumed to be for about 2 years (2017 ~ 2018), and rough budget on cooperation money is estimated to be a hundred million yen. Anticipated achievement is shown

below, including human resource development by introduction of equipment and technology transfer, support of official method plan creation through working group, and dissemination inside India.

【Achievement1】	To develop personnel who can create a manual plan adopting the superiority of Japanese analysis technology by introducing the equipment necessary for POPs (dioxins) survey and analysis in JNU, transferring analysis technology, and transferring it also to NEERI
【Achievement2】	To guide NEERI so that it proposes manual plan to MoEFCC, which is the competent authority, by establishing a working group where JNU cooperates with NEERI regarding POPs (dioxins) and by helping them create the Indian standard survey and analysis manual for POPs (dioxins)
【Achievement3】	To hold a conference for progress report, show the manual plan's superiority of survey and analysis of POPs (dioxins) in India, and get a foothold for standardization or dissemination

Activity contents are shown below, including equipment procurement and technology guidance, working group operation, and public relations.

【Activity1】	1-1 To procure machine and equipment necessary for survey and analysis after creating the list, and install them 1-2 To instruct how to operate them 1-3 To utilize those equipment, send engineers regarding survey and analysis, and conduct engineering guidance
【Activity2】	2-1 To support the establishment of working group where JNU cooperates with NEERI regarding POPs (dioxins) 2-2 To help them create Indian standard survey and analysis manual plan for POPs (dioxins), which basically adopts the superiority of Japanese analysis, but reflects Indian condition (such as electricity status, human resources, or quality of material available there) so that the manual is specific enough to apply appropriately 2-3 To support them so that the manual plan cited above is proposed to the competent authority
【Activity3】	To hold a conference for progress report, inviting government officials such as MoEFCC and NEERI

The implementation system and each role are as follows.

【Implementation System】

Proposing Company：Tokai Techno Co., Ltd.

Outside Human Resource：IDEA Consultants, Inc. (hereinafter referred to IDEA)

Candidate for C/P：JNU

Cooperative Organization：NEERI (the level is the same as C/P)

Other Governmental Organization：MoEFCC

【Role for Japanese Side】

1 To procure and install necessary equipment

2 To provide engineering guidance concerning POPs (dioxins) survey and analysis by sending engineers

3 To support the creation of survey and analysis manual for POPs (dioxins)

4 To inspect matters regarding quality check at the level of technical skills and to hold a conference for progress report

【Role for Indian Side】

1 To offer the place where necessary equipment is installed, and bear the fuel and light expenses to run equipment

2 To support general affairs necessary to procure equipment (for example: tax exemption)

3 To appropriately select and position Indian analysis engineers in charge of survey and analysis for POPs (dioxins)

4 To establish and chair the working group where Indian standard survey and analysis manual for POPs (dioxins) is discussed

5 To support the operation of a conference for progress report

【Discussions Status with the Candidate for C/P】

We have gotten the agreement for support (interest expression) based on the scheme of pilot survey for disseminating through several discussions. Also, we have confirmed several possible sites for equipment installation, and plan to decide specific place for it when starting the project.

4-4 Relevance between the project and business development

Utilizing the “pilot survey for disseminating”, we will introduce the necessary equipment and technology and train personnel so that Japanese excellent survey and analysis method for POPs (dioxins) can be effectively used in India. After that they will inspect the survey and analysis method, and develop it to Indian original manual

plan. And dissemination of analysis method and creation of its market can also be considered. As a result, we can expect that survey and analysis market for POPs (dioxins) will be created by promoting the policies related to POPs in India.

When the manual plan becomes the Indian official method and it is adopted as verification method for chemical substance regulations, there will be the possibility to cooperate with other ODA projects which are related to water and sewerage facility and emission gas facility or so.

4-5 Issues and measures in forming ODA project

The candidate for C/P is JNU. HRGC/HRMS, which is the most important equipment to create ODA proposal and JNU doesn't have, will be covered by introduction during pilot survey for disseminating. So JNU will be able to inspect NEERI business as an academic institution. Also, the lack of peripheral equipment such as glassware will be covered as necessary.

The verbal approval that HRGC/HRMS is to be installed in the building of environmental science faculty of JNU has been gotten from Dr. Indu Shekhar (person in charge and the dean of environmental science faculty when the third on-site survey was conducted), but there'll still be some concern regarding new negotiation with the current dean until the contract is actually singed. And we plan to handle this issue by holding detailed meeting and contracting MOU for sure.

The issue about personnel organization for C/P is that discussion with officials has not been conducted because the arrangement was insufficient. And we need to continue to contact Dr. S. K. Singh (Principal Scientist and Head, Eco-System Division, NEERI & Coordinator, SCRC India). As a countermeasure, it is necessary to hold working-level conference by the time pilot survey for disseminating begins along with the meeting and conclusion of MOU.

5 Specific plans for business development

The customers subjected to this survey are not only government organization related to environmental policy (such as CPCB, NEERI, or CRIS), regional government and SPCB, and Indian private companies which have institutions under the emission standards, but including Japanese companies.

5-1 Result of market analysis

There was a small scale survey and analysis market for POPs. However, the medium in the market didn't cover core media of the Stockholm convention. In India today,

market size is small because there's no legal regulation for POPs survey and analysis. But as it is organized and strengthened with the improvement of survey capability of government offices or academic institutions, the demand from private institutions which have emission resources will increase, and competitors conducting POPs survey and analysis will also increase. By the time several competitors appear and the market is shared by them, it can be expected for the government to provide preferential and supporting measures, and to expand initial service for improvement of environment.

5-2 Business plan and development effectiveness (assumed)

A joint-venture POPs survey and analysis company is to be established with a local environment and chemical company as soon as possible after the end of pilot survey for disseminating. The below chart shows assumed implementation system (plan) operated by industry, government and academia after business development.

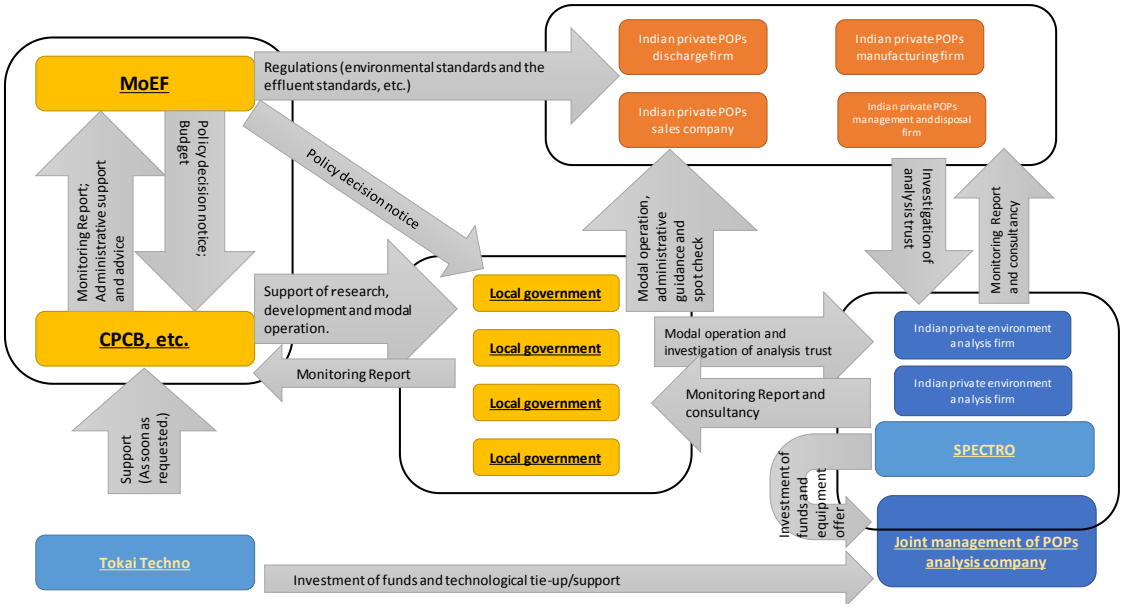


Figure: Implementation system (plan) after business development

The work to establish a local joint-venture company will begin along with pilot survey for disseminating. And objective is to register incorporation (more than 6 months are necessary from the beginning to registration) after the project. Initial investment is estimated to be about 2 hundred million yen (joint-venture, capital ratio is 50 : 50) as a capital fund. Initial investment (capital fund) is calculated with operation cost for a year including construction expenses for remodeling laboratory, initial plant

investment for measurement machine and equipment, and personnel expenses. According to the experience of IDEA in China and the like, the business will make profits in 5 years. And the market size will grow, based on an analogy from cases in Japan and China, about 10 to 20 times in 10 years. The profit coming to Japan from semi-advanced countries is basically scheduled to be the profit distribution. We show 5-year plan for development operation of POPs market in the table below based on the growth rate of market size for POPs analysis for past 15 years in Japan and past 5 years in China, and statistical data and current market in India.

	major item		year / minor item	1	2	3	4	5
conditions setting	market scale			small				large
	competitors			major companies (Shriam etc.)		mid-sized companies		
	expected demand	monitoring	wastes	△	○	○	○	○
			ambient air		△	○	○	○
			water quality		△	○	○	○
			bottom sediment			△	○	○
			soil				△	○
			living being・others					△
		consultant	governments・laboratories			△	○	○
			building material manufacturer			△	○	○
			emission resource			△	○	○
			intermediate treatment facilities			△	○	○
		training program	Japan		△	○	○	○
			abroad	○	○	○	○	○
		equipment sale	glassware		△	○	○	○
			GC column		△	○	○	○
			standard substance			△	○	○
			others			△	○	○
	legal regulation	guideline		・waste (byproduct) regulation		・ambient air regulation ・water・bottom sediment regulation	・production, sale, stockpile regulation	・soil regulation ・living being・other regulation

Figure: 5-year plan for development operation of POPs market

5-3 Relevancy to the development subject

With the ODA proposal (pilot survey for disseminating), India can conduct POPs-related operations by their own without depending on foreign countries. Therefore, as the data regarding POPs is accumulating, India will be able to establish regulations and standards domestically. Because of this, POPs operation written in NIP will get on track, contribute to development plan or environmental policies, and lead to the establishment of position in UNEP. Furthermore, after pilot survey for disseminating, the survey and analysis business concerning POPs will begin, market where data is produced being created.

5-4 Risks and measures in business development

(1) Risks regarding funding plans

It is low. C/P has enough money for the section concerning this survey. And it is

unlikely for JICA to get short of fund in the middle of the survey. Although initial cost for starting business in the future is estimated to be about 2 hundred million yen, it is usual investment risk for private companies.

(2) Risks regarding intellectual property and the like

It is unlikely that such risks arise as the risk regarding lack of legal system in developing countries like intellectual property issues, the risk regarding environment and social safeguard, or language and communication risk.

(3) New risk

(a) The fields regarding waste are not usually handled by intellectuals because of caste system. Therefore, positive business development by Indian intellectuals is hard to expect, and the expansion of market is assumed to be difficult. For the countermeasures, we will promote consulting for development of legal system regarding waste, which Tokai Techno has advantage of, and expand the market.

(b) There is a possibility of lack of preparation for survey equipment because of electric power, water supply, gas and transportation. And there is also a possibility of business delay resulting from failure handling of measurement equipment. For them, we are considering to improve the backup function.

India, Feasibility Survey for Chemical Analysis for the Stockholm Convention on Persistent Organic Pollutants

SMEs and Counterpart Organization

- Name of SME : Tokai Techno Co., Ltd.
- Location of SME : Yokkaichi, Mie Pref., Japan
- Survey Site / Counterpart Organization : Deli, India / JNU

Concerned Development Issues

- India ratified Stockholm Convention in 2006, and the importance of urgent capacity building of "persistent organic pollutants" (POPs) analysis technique was recognized. The production and use of POPs such as dioxins which is a cause of the environmental pollution is limited.
- But the level of POPs analysis and carrying out POPs environment monitoring or food inspection at local level remain as issues.

Products and Technologies of SMEs

- We have high skills and techniques on POPs surveys and analysis, particularly dioxins, using "high-resolution gas chromatograph / double-focusing mass ".
- The target of analysis includes combustion effluent gas, ash, water, the soil, food, and blood.

Proposed ODA Projects and Expected Impact

- We will establish an environmental chemical local private enterprise and joint venture and assume business development such as POPs investigation, measurement analysis, consulting, education and training for Indian government, private domestic factories and Japanese companies in India.
- In addition, we will also consider developing the market on chemical substances investigation besides POPs, and also on consulting services for chemical analysis.