



The Optimum Process for Nutrient Removal from Sludge Liquor at a Centralized Sludge Treatment Plant in Yokohama City, Japan

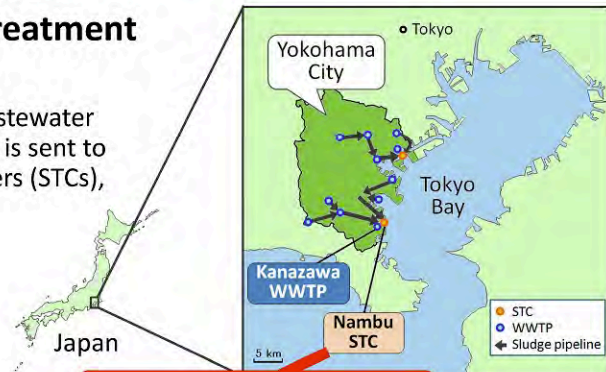
Akira Yoshida*, Takayuki Motohashi*, Mariko Inukai* * Environmental Planning Bureau, City of Yokohama

1. BACKGROUND

Centralized sludge treatment in Yokohama, Japan

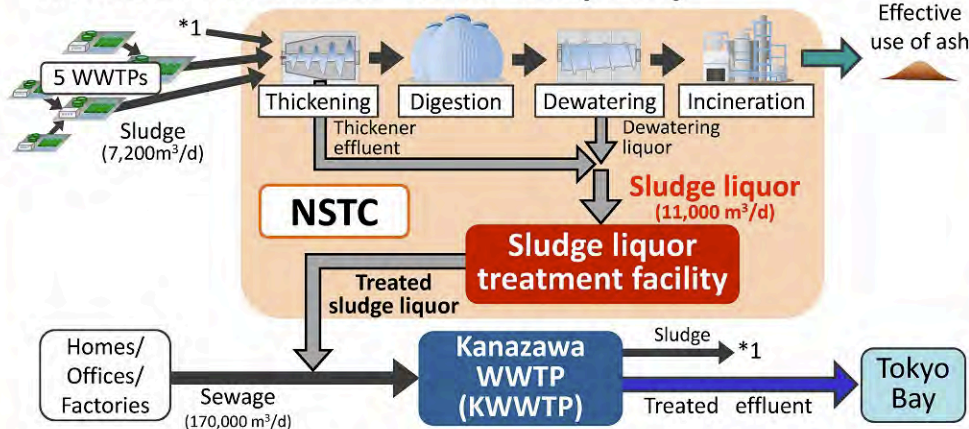
Sludge, generated at 11 wastewater treatment plants (WWTPs), is sent to two sludge treatment centers (STCs), and treated.

Yokohama City	
Population	3.7 million
Area	435 km ²
Volume of treated effluent	1.6 million m ³ /d



Focus on the Nambu STC

Treatment flow at the Nambu STC (NSTC)



- Merit: Sludge is treated effectively and utilized as biomass resources.
- Problem: The treatment process generates 11,000 m³/d of sludge liquor which contains **high concentrations of nitrogen and phosphorus**.

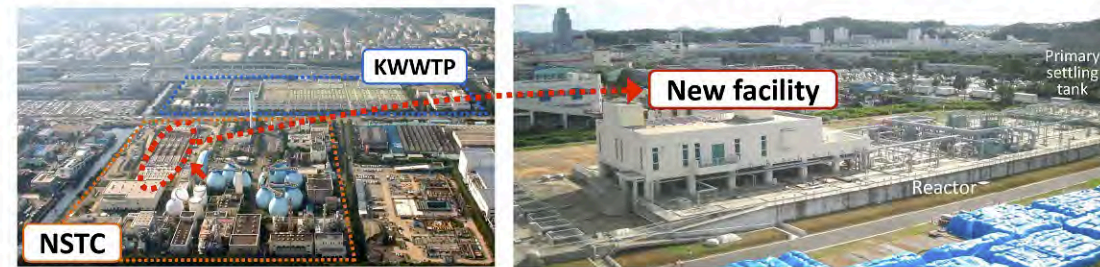
Need to pretreat sludge liquor

From 1990 to 2010, sludge liquor was treated at the old facility using a recycled nitrification/denitrification process.

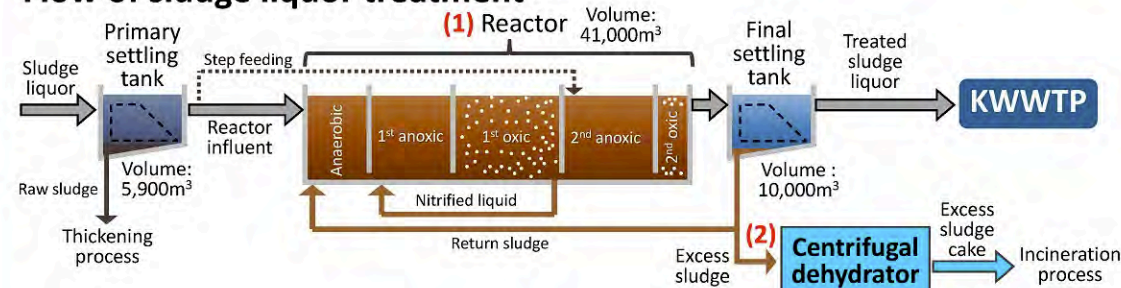
Need to reduce nutrient loads to KWWTP as a measure against eutrophication of Tokyo Bay

In 2010, the new facility began operation.

2. OUTLINE OF THE NEW FACILITY



Flow of sludge liquor treatment



Two characteristics of the new facility

- (1) Modified Bardenpho process
- (2) Direct dewatering of excess sludge

3. RESULTS AND DISCUSSION

Operation results of the new facility

Volume of sludge liquor	10,500 m ³ /d
HRT of the reactor	75 hours
MLSS	3,700 mg/L
Rate of nitrified liquid circulation	340%
Rate of return sludge	50%
Volume of air	290,000 Nm ³ /d
Volume of excess sludge	940 m ³ /d

Water quality of the new facility

	Planned value		Actual value	
	Reactor influent	Treated sludge liquor	Reactor influent	Treated sludge liquor
BOD ₅ (mg/L)	650	10	1,200	15
SS (mg/L)	450	20	1,200	10
T-N (mg/L)	310	30	280	16
T-P (mg/L)	60	20	46	8.2

The quantity of organic matter (BOD₅) of the reactor influent was heightened under the actual operation in order to improve the treatment of nitrogen and phosphorus.

Comparison of water quality between the old and new facilities

	Treated sludge liquor	
	Old	New
T-N (mg/L)	52	16
T-P (mg/L)	15	8.2

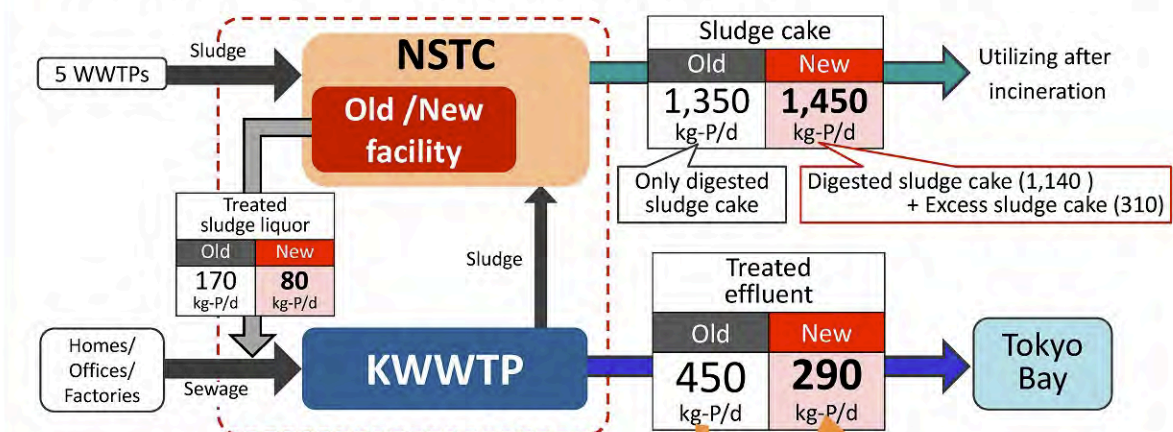
The quality of treated sludge liquor was greatly improved.

T-N: 70% reduction T-P: 45% reduction

The nutrient loads to the KWWTP were reduced by operating the new facility.

Comparison of phosphorus output between the old and the new

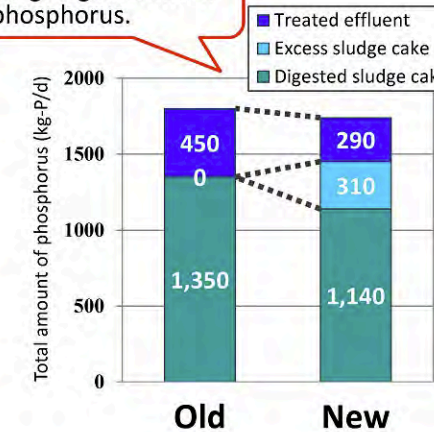
The outgoing amounts of phosphorus at the NSTC and the KWWTP were compared between a period during operating the old facility and a period during operating the new facility.



T-P: -35%

The 35% reduction of phosphorus loads to Tokyo Bay from KWWTP has led a measure against eutrophication of Tokyo Bay.

The graph shows the outgoing amount of phosphorus.



CONCLUSIONS

Sludge liquor which contained high nutrients was able to be treated by adding sufficient organic loads to the reactors at the new facility that adopted the modified Bardenpho process and direct dewatering of excess sludge.