OMUTA RIVER PROBLEM – DIOXIN CONTAMINATED CASE –

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Introduction

The comprehensive survey of dioxin was conducted by the Ministry of Environment in 1999. 2.4 pg-TEQ/L of dioxin was detected in the sea water at the monitoring point St-6 off the coast of Omuta city. This is 2.4 times higher than the Japanese regulation for dioxin in environmental water. Omuta is an industrial city in the southern part of Fukuoka prefecture in Japan. We suspected that the water of the Omuta River was contaminated by dioxin. Therefore, the dioxin level of the sea water was expected to be high. We investigated conditions in the Omuta River in order to clarify the cause of the high dioxin level. In this investigation, we found that dark black oil droplets had seeped through the concrete joint at the bottom of the river.
In this paper, we investigate the contamination level of dioxin in the Omuta River and clarify the cause of the high dioxin level.

Materials and Methods

Figure 1 shows a map of Omuta city. The Omuta River flows through the central part of the city. There is a huge chemical factory in this area. Figure 2 shows a map of the central part of Omuta city. The numbers from 1 to 8 and the letters Y and Z stand for the sampling points used in the initial investigation. River water samples were collected for dioxin analysis at each point. The letters from U to Z and the number 5 are the sampling points used in the detailed investigation. St-6 and St-10 are monitoring points where the level of dioxin in the sea water was monitored. The letter V represents the location where dark black oil droplets were found.
The dioxin in the water samples was analyzed according to Japanese industrial standard. All HRGC-HRMS analysis was conducted on a 6890 series GC (Agilent Technology, USA) equipped with Autospec-Ultima (Micromass, UK).

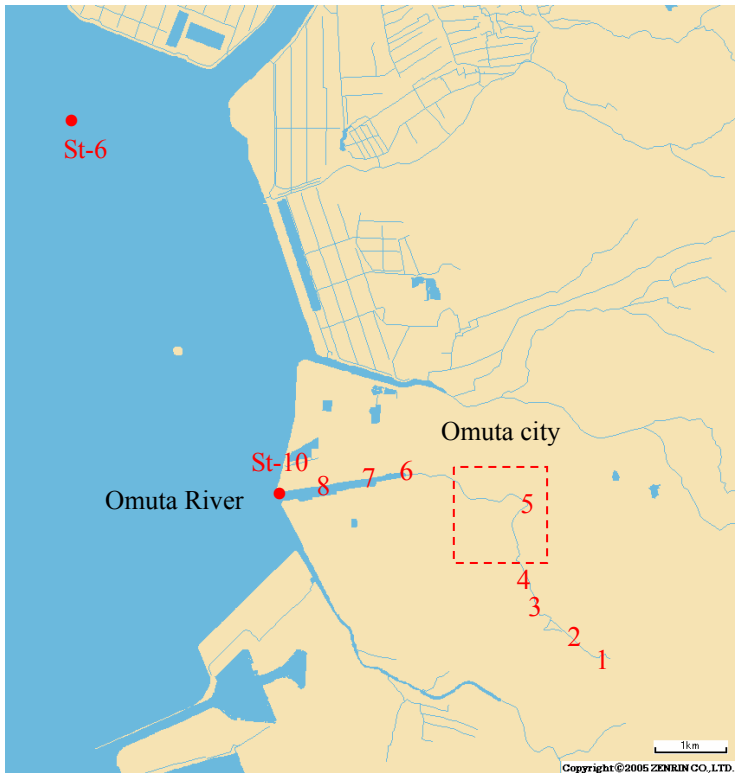

Figure 1 A map of Omuta city

Results and Discussion

Initial investigation of the Omuta River

Table 1 shows the dioxin concentrations in the river water samples. Two samples satisfied the Japanese regulation for dioxin in environmental water, 1 pg-TEQ/L, but others exceeded this level. The maximum dioxin concentration was 93 pg-TEQ/L at the point Z. It was found that the dioxin concentrations became higher along the river flow. Specifically, the dioxin concentrations at the points Y and Z were quite high. Further downstream of Y and Z, the dioxin

concentrations dropped to the same level observed upstream in the river. It is suspected that there were sources of contamination between the sampling points Y and 5. We decided that reinvestigation was necessary to confirm a pollutant source.

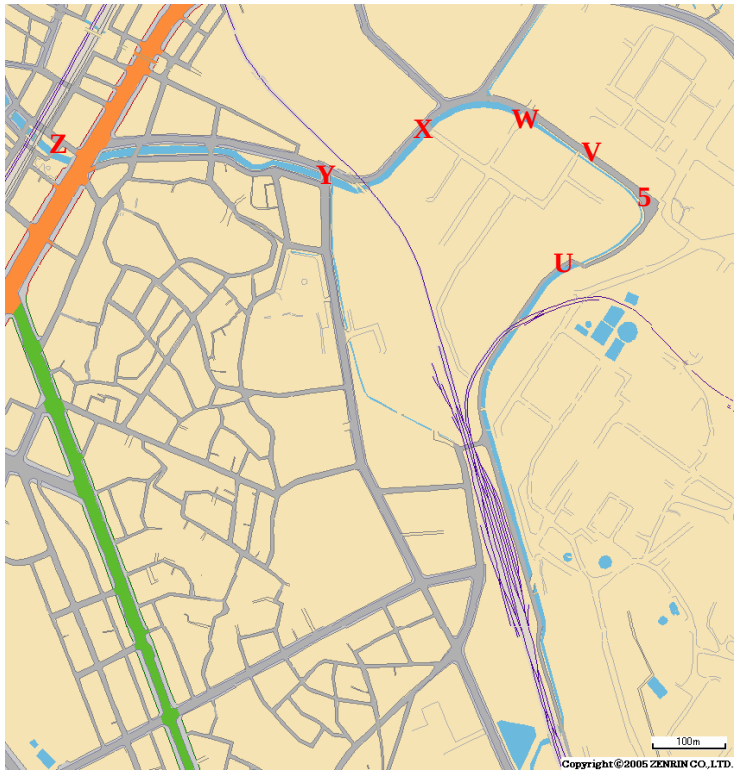

Figure 2 A map of the central part of Omuta city

Detailed investigation of the Omuta River

Table 2 shows the dioxin concentrations in the Omuta River water samples according to the detailed investigation. We surveyed the river water carefully. It was found that dark black oil droplets had seeped through the concrete joint on the bottom of the river. These oil droplets were collected carefully and analyzed. These droplets contained dioxin at a concentration of 390,000 pg-TEQ/g. Also, 350 pg-TEQ/L of dioxin was detected in the river water at sampling point V. It is presumed that these oil droplets were the cause of the high level of dioxin in the water.

Measures for dioxin control

The concrete joints on the bottom of the river were sealed in order to keep the oil droplets from entering the river. Table 3 shows a comparison of the dioxin concentrations in the river before and after the concrete joints were sealed. It is clear that the sealing of the concrete joints was effective in decreasing the dioxin level in the river water. Since this investigation, the dioxin levels in the river and the sea have been continuously monitored.

Table 1 The dioxin concentrations in the Omuta River water samples on the initial investigation

(pg-TEQ/L)

Sampling point	Dioxin	Sampling point	Dioxin
1	0.21	Y	39
2	0.62	Z	93
3	2.8	6	1.3
4	1.6	7	1.1
5	4.1	8	1.9

Table 2 The dioxin concentrations in the Omuta River water samples on the detailed investigation

(pg-TEQ/L)

Sampling point	Dioxin	Sampling point	Dioxin
U	2.7	X	51
5	3.2	Y	37
V	350	Z	79
W	18		

The Omuta River monitoring

The dioxin concentrations at the monitoring points St-6, St-10, Y and Z are summarized in Table 4. The dioxin

levels in the sea water at St-6 and St-10 satisfied the Japanese regulation for dioxin in environmental water. The dioxin level in the Omuta River water at the points Y and Z decreased to a relatively low level. Continuous monitoring of the Omuta River is needed.

Table 3 Comparison of the dioxin concentrations in the river before and after sealing of the joints

(pg-TEQ/L)

Sampling point	V	Y	Z
Before sealed (Jun., 2000)	350	37	79
After sealed (Sep., 2000)	1.3	1.7	3.3

Table 4 The dioxin concentrations on the Omuta River monitoring

(pg-TEQ/L)

Monitoring point	St-6	St-10	Y	Z
Apr. - May, 2000 (Before sealing)	0.35	0.35	39	93
Jun. - Jul., 2001	0.63	-	2.9	7
Sep. - Oct., 2001	0.46	0.82	2.0	1.5
Dec. - Jan., 2002	0.36	-	0.97	0.37
Mar., 2002	0.16	-	3.3	0.44
Jul., 2002	-	-	0.58	0.83
Aug., 2002	0.30	1.0	2.7	2.8
Sep. - Oct., 2002	-	0.63	0.43	0.20
Feb., 2003	-	0.16	0.40	0.66
May, 2003	-	0.18	0.36	0.52
Jun., 2003	-	0.26	1.1	1.6
Sep. - Oct., 2003	0.28	-	0.34	0.61
Dec. - Jan., 2004	-	0.20	0.30	0.36
Mar., 2004	-	-	0.32	0.34
Jul., 2004	0.15	0.81	1.1	1.4
Sep., 2004	-	-	0.88	0.79
Dec. - Jan, 2005	0.25	0.45	0.23	0.21
Feb. - Mar., 2005	0.17	0.27	0.30	0.33

Conclusion

We can conclude that the Omuta River was contaminated with dioxin due to the seeping of dark black oil droplets through the concrete joint on the bottom of the river. After the joints were sealed, the dioxin level in the Omuta River dropped to a low level.

References

Japanese Industrial Standard K 0312 (1999) "Method for determination of tetra- through octa-chlorodibenzo-p-dioxins, tetra- through octa- chlorodibenzofurans and coplanar polychlorobiphenyls in industrial water and waste water"