

농촌지역의 건설폐기물 중간처리 사업장 주변 환경 영향 평가 및 개선방안 연구

A Study on Environmental Impact Assessment and Improvement Measures Around Construction Waste Intermediate Processing Sites in Rural Areas

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Kim, Byung-Yun

Abstract

In order to analyze the impact of fine dust generated from a construction waste intermediate processing site on the surrounding areas, diverse types of samples were collected from inside the site and surrounding areas. The impact analysis results of samples are as follows. (1) Compared to the air quality management standards by the Ministry of Environment, the concentration of fine dust within the site was 30 to 46% for PM10 and 14 to 42% for PM2.5, which was not much different from the general air quality level. (2) It was found that PM10 within the site may have a partial effect on the air quality, but when the blocking facilities in the site, wheel washing facilities at vehicle entry and exit route, and sprinkler during working were maintained, the impact on the nearby area was not high. (3) In the case of PM2.5, its concentration was influenced more by the exhaust fumes from work vehicles than fine dust generated during construction waste processing. Since the PM2.5 concentrations in the site and surrounding area were not much different from the general air quality, there was little correlation with the work impact of construction waste intermediate processing sites. (4) Pb, an indicator of heavy metal components, was within 50ng/m³ in all three sites, which was 10% of the domestic management standard and equivalent to the general air quality level. The complaints from residents in nearby areas were filed using indicators based on visual and experiential information in their daily lives, so even if the survey results of environmental impact by the construction intermediate waste processing site are lower than the standard, nearby residents can feel it better than such numerical information. Therefore, specific activities to reduce find dusts should be continuously continued.

Keywords : Construction Waste, Intermediate Treatment, Fine Dust, Heavy Metal, Environmental Impact

1. 1988년 건설폐기물 발생량(천톤)은 약 10만톤에 불과했으나, IMF 외환위기(1997년)를 기점으로 급증하기 시작하였다. 특히 2017년 기준 140만톤에 달하는 건설폐기물이 발생하고 있다. 이는 1988년 대비 14배 증가한 수치이다.

2017 19, 1988

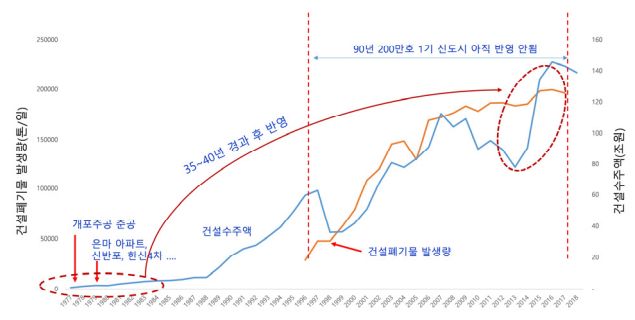


Fig. 1. Status of increase in construction waste generation

* 가
 ** 가
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가

3

. <Table 1> 가

2.2

3

가

($\mu\text{g}/\text{m}^3$)

가

1~2

2. 가

가

2.1

가

562

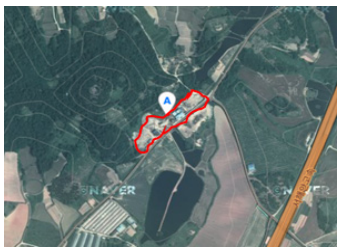


가

가

가

가

Table 1. Location and characteristics of the subject sites for evaluation

(Basic Type)		<ul style="list-style-type: none"> 가 가
(Typical Type)		<ul style="list-style-type: none"> () 가 가 가 가 가
(Complex Type)		<ul style="list-style-type: none"> 가가 가 가 가

가
AREMOD

2.5

(Cr), (Cu), (Fe), (Mn), (Ni), (As), (Pb), (Cd),
8
3 2
가 24
(KTL)
PERKINELMER OPTIMA8300 ICP-OES
. <Fig. 2(b)>

DT-9881M

가

2.3

ES 01115() ES 01605.2()
(PM10)), ES 01606.1()
(PM2.5))
<Fig. 2(a)>

2.6 SEM - EDX

SEM-EDX

가

가

가

가

SEM-EDX

. <Fig. 3>

SEM-EDX



(a) Collection device

(b) Heavy metal analysis equipment

Fig. 2. Measurement equipment

2.4

가

가

가

가

가

가 가

가

가

“

”

3.

3.1

가

(1)

가

가

3

가

가

0.5~

3.3m/sec

가 가

<Table 3> <Table 4>

가

1 가

가

가

가

, 2

, 3

가

1

PM10 가 <Table 2> 30~46 $\mu\text{g}/\text{m}^3$
 , PM2.5 5~15 $\mu\text{g}/\text{m}^3$. PM2.5 가 가
 PM10 PM2.5

, PM10 60 $\mu\text{g}/\text{m}^3$,
 100m 50 $\mu\text{g}/\text{m}^3$
 가 10~20 $\mu\text{g}/\text{m}^3$
 PM2.5 30 $\mu\text{g}/\text{m}^3$, 100m 가
 20 $\mu\text{g}/\text{m}^3$
 4~7 $\mu\text{g}/\text{m}^3$
 80~100m

Table 2. Measurement results within the workplace (unit : $\mu\text{g}/\text{m}^3$)

	PM10	PM2.5	
	30(30%)	7(20%)	()
	46(46%)	15(42%)	
	35(35%)	5(14%)	

, 가 가 가
 가
 가
 가 , PM2.5

, 가 가
 가 2.5km
 24
 PM10 PM 2.5

PM10

PM10 30~46%, PM2.5 14~42%
 가

P3, P5
 80m

(2)

가

가

가

80m

가

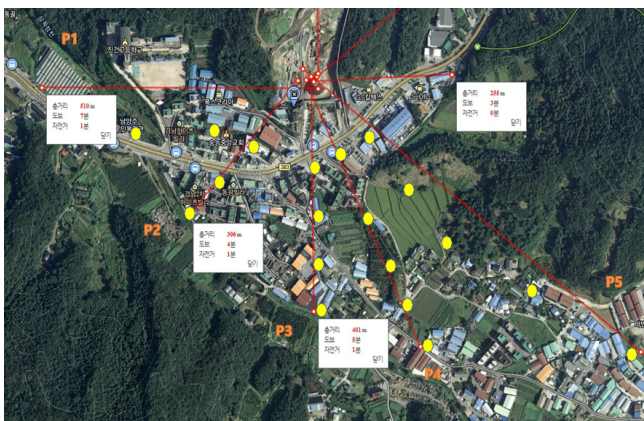


Fig. 4. Measuring points at the workplace



Fig. 5. Measuring points at the workplace

Table 3. Fine dust measurement result (workplace)

		($\mu\text{g}/\text{m}^3$)	($\mu\text{g}/\text{m}^3$)	($\mu\text{g}/\text{m}^3$)	가 ($\mu\text{g}/\text{m}^3$)	($\mu\text{g}/\text{m}^3$)		(m/sec)	()	(%)
1st	PM10	30~60	30-39-41	54-85-109	46	50~60	NW	0.5~1.5 (1.87)	21~23	29~35
	PM2.5	16~20	11-13-14	23-28-33	15	20~30				
2nd	PM10	38~74	22-37-76	86-128-159	-	40~60	S	0.8~2.5	16~19	22~36
	PM2.5	20~35	8-13-20	37-47~52	-	10~18				
3rd	PM10	6~11	12-30-49	20-47-78	17	10~30	N	1.5~3.5 (6.8)	14~17	42~58
	PM2.5	4~10	4-7-10	2-10-22	3	2~8				
		-	-	-	-	100~900m				

Table 4. Fine dust measurement result (workplace)

		($\mu\text{g}/\text{m}^3$)	($\mu\text{g}/\text{m}^3$)	($\mu\text{g}/\text{m}^3$)	가 ($\mu\text{g}/\text{m}^3$)	($\mu\text{g}/\text{m}^3$)		(m/sec)	()	(%)
1st	PM10	52~62	30-50-88	49-89-160	39	32~93	W	2.0~2.5	23~26	26~39
	PM2.5	28~29	21-26-37	23-28-30	2	18~30				
2nd	PM10	36~63	34-57-96	27-64-120	7	20~40	W	1.0~3.5	19~23	40~64
	PM2.5	13~21	22-26-34	18-40-78	14	10~25				
3rd	PM10	43~52	-	50-95-190	-	20~40	N	0.8~1.75	13~17	48~64
	PM2.5	16~30	-	19-38-71	-	2~8				
		-	-	-	-	100~900m				

PM2.5 가 가 $\mu\text{g}/\text{m}^3$. 213m T PM10 가
 . PM2.5 , 가 15.01 $\mu\text{g}/\text{m}^3$ 가 가
 . 가
 가 , PM10 24
 PM2.5 15% , PM2.5 24 6%
 가 가
 가 24 PM10 가 30~50 $\mu\text{g}/\text{m}^3$ 가
 . 가

3.2 가

AREMOD 700m ,
 가 , PM10 24 가 0.52~12.04 $\mu\text{g}/\text{m}^3$,
 , PM2.5 24
 PM10, 가 0.07~1.54 $\mu\text{g}/\text{m}^3$,
 가 0.08~1.81 $\mu\text{g}/\text{m}^3$, 가 0.01~0.23 $\mu\text{g}/\text{m}^3$
 “ 가 ”, 160m K
 14 PM10 가 가 12.04 $\mu\text{g}/\text{m}^3$ 가 가
 . 가
 , PM10 24
 5% , PM2.5 24
 (1) 가 3% .
 3 가

1,000m . ,
 <Table 5> PM10 24 가 0.26~ 가 ,
 15.01 $\mu\text{g}/\text{m}^3$, 가 0.11~3.14 $\mu\text{g}/\text{m}^3$, PM2.5
 24 가 0.04~2.25 $\mu\text{g}/\text{m}^3$, 가 0.002~0.47 .

Table 5. Predicted weighted concentration of fine dust in nearby areas for each site (unit: $\mu\text{g}/\text{m}^3$)

	가			가			가		
	(m)	PM10	PM2.5	(m)	PM10	PM2.5	(m)	PM10	PM2.5
24	650	1.69	0.25	700	0.52	0.08	785	0.55	0.08
	770	5.55	0.83	170	6.11	0.92	888	8.13	1.22
	213	15.01	2.25	160	12.04	1.81	490	4.90	0.74
	330	9.67	1.45	198	6.53	0.98	839	14.41	2.16
	965	0.26	0.04	117	6.56	0.98	246	5.33	0.80
	570	0.58	0.09	500	1.14	0.17	695	2.17	0.33
	650	0.08	0.01	700	0.07	0.01	785	0.03	0.01
	770	0.24	0.04	170	1.11	0.17	888	0.42	0.06
	213	3.13	0.47	160	1.54	0.23	490	0.34	0.05
	330	1.64	0.25	198	0.70	0.10	839	0.20	0.03
	965	0.11	0.00	117	0.71	0.11	246	0.42	0.06
	570	0.03	0.00	500	0.21	0.03	695	0.21	0.03

1,000m
 PM10 24 가 0.55~14.41 $\mu\text{g}/\text{m}^3$,
 가 0.03~0.42 $\mu\text{g}/\text{m}^3$, PM2.5 24 가
 0.08~2.16 $\mu\text{g}/\text{m}^3$, 가 0.01~0.06 $\mu\text{g}/\text{m}^3$

3.3 24
 24
 PM10 PM2.5
 가
 24

839m PM10 가
 가 14.41 $\mu\text{g}/\text{m}^3$ 가 가
 PM10 24 5% ,
 PM2.5 24 2%

2 (가 24 , 24)
 가 가
 가
 <Table 6>

Table 6. 24 hour measurement results (unit: $\mu\text{g}/\text{m}^3$)

	PM10			PM2.5		
	A	B	C	A	B	C
가	96	69	70	81	65	64
	96			47		
	86	74	79	77	68	73
	115			58		
가	89	80	88	63	68	60
	92			60		
	76	87	75	50	65	50
	86			60		
가	129	100	104	89	91	79
	90			82		
	92	108	111	77	96	93
	105			104		

PM10 가 PM2.5
 PM10 0.6

PM10, PM2.5 가

가
가
PM10 가
, PM2.5
3~10%
PM10
PM2.5
PM10
, PM2.5
가 PM10 가
25µg/m³
, PM2.5
5~10%
PM2.5
3.4
Mn, Fe
가 Pb 3 50ng/m³
500ng/m³ 10%
(cd) 0~
3ng/m³
(WHO) 5ng/m³ 3

Table 7. Analysis result of heavy metal content of fine dust

			(ng/m³)							
			Pb	Cd	As	Mn	Cr	Fe	Ni	Cu
PM 10	A-1	a	14	1	N.D	23	N.D	577	N.D	N.D
		b	26	1	N.D	19	N.D	478	N.D	N.D
	A-2	a	18	1	N.D	21	N.D	428	N.D	N.D
		b	25	1	N.D	16	N.D	314	N.D	N.D
PM 2.5	B-1	a	12	1	N.D	16	N.D	275	N.D	N.D
		b	25	1	N.D	13	N.D	230	N.D	N.D
	B-2	a	28	N.D	N.D	15	N.D	174	N.D	N.D
		b	25	1	N.D	12	N.D	167	N.D	N.D

			(ng/m³)							
			Pb	Cd	As	Mn	Cr	Fe	Ni	Cu
c			10~40	ND~3	ND~3	ND~40	ND~3	150~800	ND~3	3~120
PM 10	A-1	a	27	1	N.D	28	N.D	702	N.D	15.79
		b	30	1	N.D	29	N.D	682	N.D	N.D
	A-2	a	33	1	N.D	33	N.D	744	N.D	N.D
		b	26	1	N.D	26	N.D	625	N.D	N.D
PM 2.5	A-1	a	40	2	N.D	25	N.D	227	N.D	N.D
		b	39	N.D	N.D	18	N.D	207	N.D	N.D
	A-2	a	29	1	N.D	20	N.D	186	N.D	N.D
		b	31	1	N.D	14	N.D	147	N.D	N.D
c			10~40	ND~3	ND~3	ND~40	ND~3	150~800	ND~3	3~120
PM 10	A-1	a	36	1	N.D	26	N.D	446	N.D	N.D
		b	39	1	N.D	22	N.D	356	N.D	N.D
	A-2	a	48	1	N.D	69	N.D	211	N.D	N.D
		b	28	1	N.D	16	N.D	144	N.D	N.D
PM 2.5	A-1	a	7	N.D	N.D	2	N.D	239	N.D	N.D
		b	39	2	N.D	17	N.D	175	N.D	N.D
	A-2	a	46	2	N.D	71	N.D	227	N.D	N.D
		b	36	2	N.D	21	N.D	221	N.D	N.D
c			10~40	ND~3	ND~3	ND~40	ND~3	150~800	ND~3	3~120
d			500	5		150				

a: 가, b: , c: , d: (WHO)

3.5 SEM - EDX

SEM-EDX PM10 PM2.5 가 가

<Table 8>, <Table 9>

(1) PM10

PM10

가 PM10 가 가

EDX

Si가 42~43%
11~12% 가
SiO₂
C CaCO₃
NaO, Al₂O₃, CaO
가 SiO₂
Ca(OH)₂, CaCO₃ 가

Table 8. Inorganic component content in PM10(%)

	C	O	Na	Mg	Al	Si	S	Cl	K	Ca	Fe	Total
가	11.08	40.60	0.43	-	0.35	44.80	1.60	-	-	0.65	-	100
가	12.86	43.39	0.45	-	-	41.34	1.95	-	-	-	-	100
가	11.70	43.45	0.56	-	0.17	42.00	1.46	-	-	0.63	-	100
가	12.09	42.97	0.55	-	-	43.03	-	-	0.40	0.96	-	100
가	11.08	40.60	0.43	-	0.35	44.80	1.60	-	-	0.65	-	100
가	12.86	43.39	0.45	-	-	41.34	1.95	-	-	-	-	100

(2) PM2.5

PM2.5
PM10
가
가
가
가
가

PM2.5 PM10 SiO₂
SO₂, SO₃
Cl K가
PM2.5 S, Cl, K
가
가 PM2.5
PM2.5

Table 9. Inorganic component content in PM2.5(%)

	C	O	Na	Mg	Al	Si	S	Cl	K	Ca	Fe	Total
가	-	70.88	-	-	-	5.84	17.18	6.09	-	-	-	100
가	-	64.60	1.38	-	-	1.60	24.00	5.91	2.51	-	-	100
가	-	66.30	-	-	-	1.96	18.77	7.39	5.58	-	-	100
가	-	60.83	-	-	-	4.31	19.58	8.54	6.74	-	-	100
가	-	70.88	-	-	-	5.84	17.18	6.09	-	-	-	100
가	-	64.60	1.38	-	-	1.60	24.00	5.91	2.51	-	-	100

4.

가

(1)

PM10 30~46%, PM2.5 14~42%
가

(2)

PM10

(3) PM2.5

가

가

(4)

m³

가 Pb 3 50ng/
10%

가

가

가

가

가

- 가 , 2018.
- , , , , 39(2), 2019.
- , <http://www.windy.com>
- , , , , 2017.
- , , , , 가 가 가, 22(5), 2013.
- , , PM10 PM2.5 가, 35(3), 2019.
- , , , , 25(4), 2023.
- , , , , 23(1), 2021.
- , , , , 2017.

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: 2024. 05. 08
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