Acceptance Test of the Controlled Detonation Chamber (CDC) at Poelkapelle

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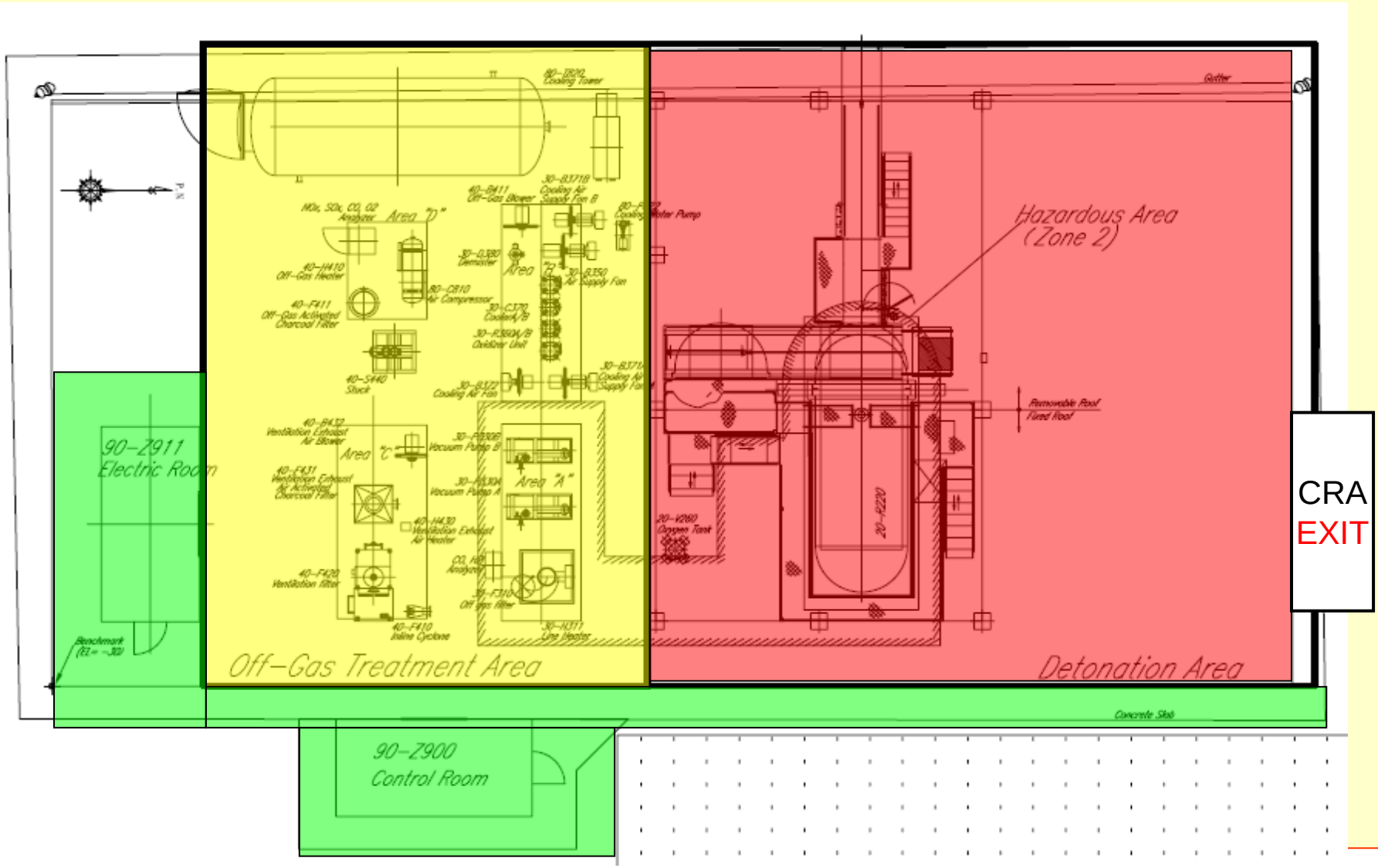
Contents

- Introduction
- Analytical procedure
  - Nature of samples taken
  - Sample treatment
- Analytical results
  - Values
  - Exposure limits
- Conclusions

site organisation – CDC open



- loading of chamber by EOD technicians
- calibres treated and loading of chamber

was as follows:

Calibre type	N° shells/shot	Total amount
77 mm	6	102
105 mm	6	48
150 mm	1	17
210 mm	1	10

- toxic agent: Clark I/ Clark II

Aim of sampling

- Determine the level of exposure of (un)protected workers
- Determine level of exposure of environment
- Estimate destruction efficiency

Type of samples taken

- **Tenax sorbent tubes**
- **Nitrocellulose particle filters**
- **Solid samples**
  (dust and scrap recovered after detonation)

SAMPLE TREATMENT

Sample treatment of NC filters

Filters are cut in 2:

- Complete microwave digestion in $HCl/HNO_3/H_2O_2$
- GFAAS quantitative analysis

- Extraction with ACN
- Addition IS ~ quantitation
- GC/MS - liquid injection

Sample treatment of TENAX tubes

- spiking the tubes with internal standard (IS)
- thermal desorption: 10 min – 300°C, He flow (20 ml/min)
- cold trapping at -30°C
- injection of sample on GC column at 300°C

Sample treatment of solid samples (dust, scrap)

Samples divided in two parts :

- Complete microwave digestion in $HCl/HNO_3/H_2O_2$
- GFAAS quantitative analysis

- Extraction with CH_2Cl_2
- GC/MS - liquid injection

ANALYTICAL RESULTS

Airborne concentrations

Analysis of { Tenax tubes => total Clark content
NC filters => total As

↓

Information about

A. Exposure of protected workers
active sampling of air
protection = protective suit + breathing apparatus

B. Exposure of unprotected workers
active sampling at control room
dress room

C. Emission at stack

Results and detection limit

		DLAP
GC/MS	Liquid injection	**1.8 ng**
	Tenax desorption	**3.3 ng**
		DL(=3S/N)
GFAAS		**2 ppb**

A. Exposure of protected workers

Values in μg/m³

A1. Active sampling of operators (sampling restricted to time of loading)

77 mm		17-1-2008		18-1-2008		19-1-2008	
		Clark	As	Clark	As	Clark	As
Team 1	**operator 1**	**6.6**	**nq**	**nq**	**nq**	**1.6**	**nq**
	operator 2	**4.9**	**nq**	**1.4**	**nq**	**nq**	**nq**
Team 2	**operator 1**	**9.7**	**nq**	**nq**	**nq**	**nq**	**nq**
	operator 2	**9.9**	**-**	**2.9**	**40**	**nq**	**nq**
Team 3	**operator 1**	**4.3**	**nq**	**0.8**	**nq**	**nq**	**nq**
	operator 2	**28.7**	**-**	**2.1**	**nq**	**2.3**	**nq**

22/01
23/01
24/01

All values < DLAP or DL

Values in μg/m³

105 mm	25-1-2008		28-1-2008		30-1-2008	
	Clark	As	Clark	As	Clark	As
Team 1/1	nq	nq	nq	19	nq	3
1/2	12.4	nq	nq	16	nq	3
Team 2/1	0.9	13	0.6	180	nq	103
2/2	1.0	nq		485	nq	394
Team 3/1	0.3	31	nq	nq	nq	
3/2	0.3	325	nq	169	2.2	
Team 4/1					nq	125
4/2					nq	173

Values in μg/m³

150 mm	31/1		1/2		4/2		5/2	
	Clark	As	Clark	As	Clark	As	Clark	As
Team 1/1	nq	4	nq	nq	nq	nq	nq	nq
1/2	nq	nq	nq	18	nq	nq	nq	nq
Team 2/1	nq	12	nq	48	nq	10	nq	25
2/2	nq	53	nq	112	nq	21	nq	44
Team 3/1			0,68	27	nq	13	nq	155
3/2			nq	195	nq	2	nq	27

Values in µg/m³

150 mm (cont'd)	6/2		7/2		8/2	
	Clark	As	Clark	As	Clark	As
Team 1/1	nq	15	2.2	35	nq	25
1/2	nq	3	nq	109	-	39
Team 2/1	1.1	26	nq	17	nq	43
2/2	nq	527	nq	nq	nq	257
Team 3/1	0.5	4	nq	20	1.8	225
3/2	1.7	940	nq	439	-	-

Values in µg/m³

210 mm	12/2		13/2		14/2		15/2	
	Clark	As	Clark	As	Clark	As	Clark	As
Team 1/1			nq		2.5	nq	5.9	52
1/2	nq		nq	20	nq	16	7.4	321
Team 2/1	1.2		8.2	20	5.5	4	12.5	54
2/2	2.9	6	nq	212	1.6	10	29.9	176
Team 3/1	nq	nq	0.7	121	1.9	6	8.9	1173
3/2	nq	nq	7.5		6.9	72	17.9	1099
Team 4/1	11.1	474	7.1	21	13.6	109		
4/2	1.9	853	nq	58	12.3	872		

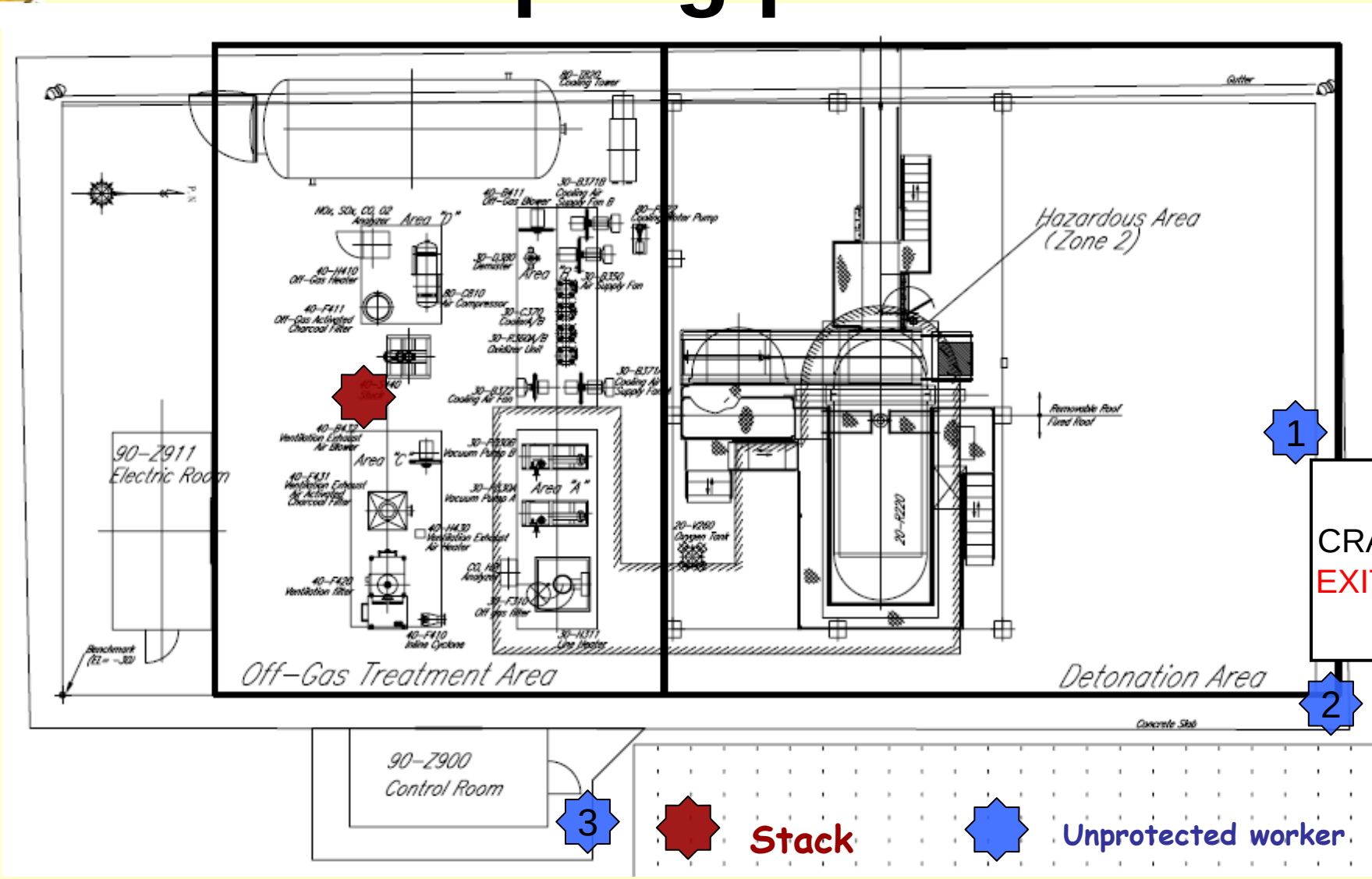
A2. Airborne concentrations at the door (Values in µg/m³) (sampling restricted to time door is open)

	77 mm	105 mm		
	17/01	25/01	28/01	30/01
As	nq	nq	40	73

	150 mm						
	31/01	1/02	4/02	5/02	6/02	7/02	8/02
As	nq	218	nq	nq	48	22	nq

	210 mm			
	12/02	13/02	14/02	15/02
As	92	22	19	136

Sampling points



B. Exposure of unprotected workers

B1. Airborne concentrations at the dress room

	Total Clark	Total As
77 mm	**nq**	**nq**
105 mm	**nq**	**nq**
150 mm	**nq**	**nq**
210 mm	**nq**	**(4 – 10)**

B2. Airborne concentrations at the control room

	Total Clark	Total As
77 mm	**nq**	**nq**
105 mm	**nq**	**nq**
150 mm	**nq**	**(0.1 – 1)**
210 mm	**nq**	**(0.1 – 1)**

Values in $\mu g/m^3$

C. Emission at stack

(sampling during full working day)

77 mm	Clark	Total As
17-1-2008	0,25	nq
18-1-2008	nq	nq
21-1-2008	0,27	7
22-1-2008	nq	2
23-1-2008	nq	nq
24-1-2008	nq	nq

105 mm	Clark	Total As
25-1-2008	nq	24
28-1-2008	nq	nq
30-1-2008	nq	2

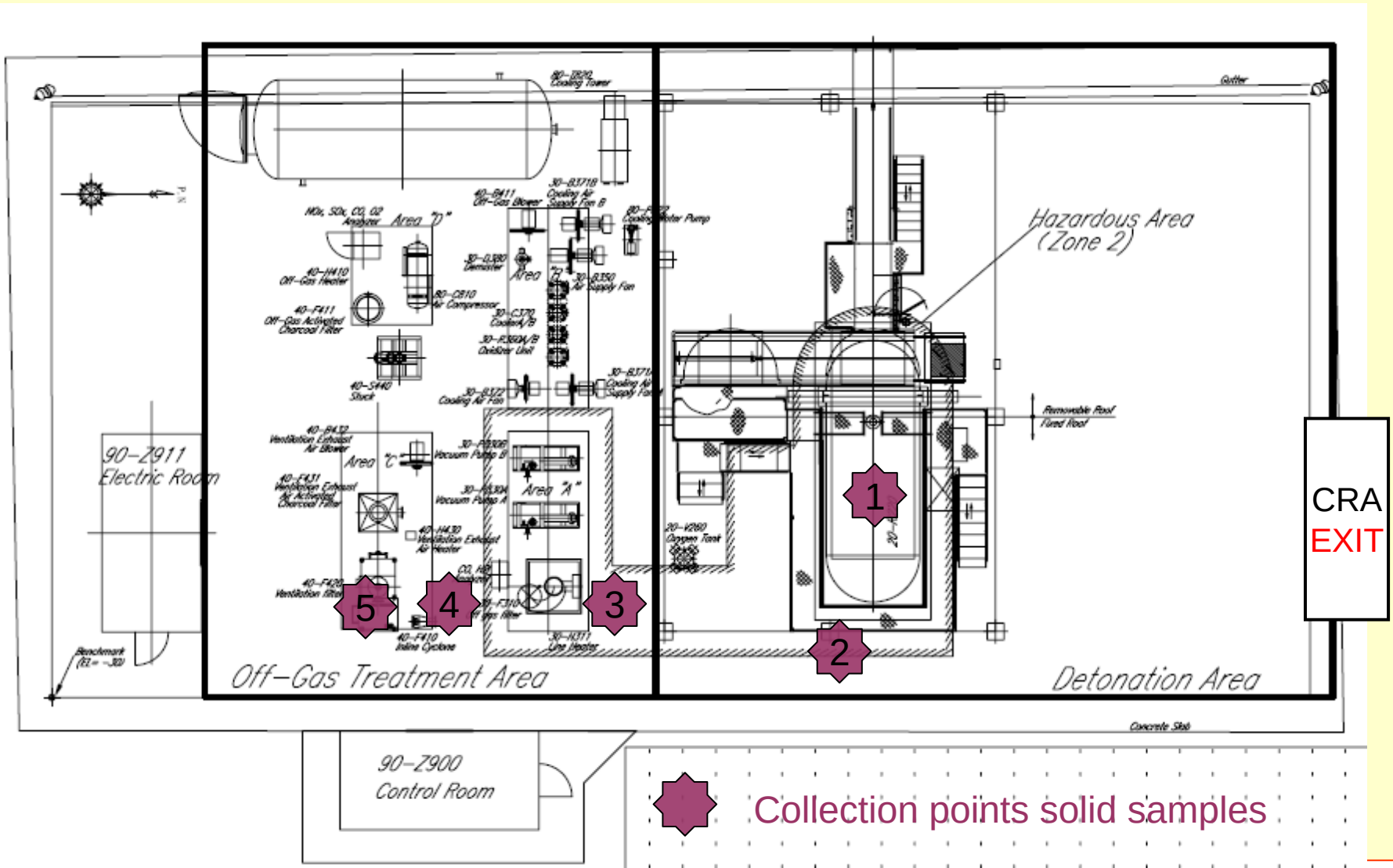
Values in $\mu g/m^3$

150 mm	Clark	Total As
31-1-2008	nq	nq
1-2-2008	nq	6
4-2-2008	nq	1
5-2-2005	nq	nq
6-2-2008	-	2
7-2-2008	nq	nq
8-2-2008	nq	nq

210 mm	Clark	Total As
12-2-2008	nq	4
13-2-2008	0,04	4
14-2-2008	nq	4
15-2-2008	nq	4

Values in $\mu g/m^3$

Organisation site: sampling points solid samples



Collection points solid samples

Point F310

Point F410/F420

Solid samples
(scraps + dust)
A. Total As CONTENT

	77mm		105 mm		150 mm		210 mm	
	17-1	24-1	25-1	30-1	31-1	11-2	12-2	15-2
SCRAP 1	2		6		10		25	
SCRAP 2	3		6		17		64	
SCRAP 3	3		11		20		125	
F310		50	63	53	39	181	244	230
F410		18		22		18		63
F420		8				13		24
Flens	5	2	11	10	7	24	8	31

Values in g As/kg

Solid samples
(scraps + dust)

B. Total Clark CONTENT

77 mm
105 mm
150 mm
} No detection of Clark compounds

210 mm: detection of Clark II (major compound)

	SCRAP 1	SCRAP 2	SCRAP 3	F310	F420	Flens
12/02	3.2	3.2	3.1			
15/02				nd	nd	47

Values in mg Clark/kg

Analysis results and airborne exposure limits

(expressed in μg/m³)

(in μg/m³)	Clark I	Clark II	As
without any protection	0.03	0.008	10
FFP SAR	60	16	20000
Emission	0.03	0.008	1000

Conditions: exposure < 1 h

Protected workers

- Total Clark

	Values>exposure limit
77 mm	**-**
105 mm	**-**
150 mm	**-**
210 mm	**2/29**

- Total As

All values < exposure limit

Unprotected workers

- Total Clark

all values < DLAP

all values = 'nq'

- Total As

All values < exposure limit

Conclusions

- For red zone:
  - Wearing full protective equipment + SAR
  - Operation time less than 1 hour
- For green zone:
  - Measurements taken to avoid the spreading of the contamination were sufficient
  - The principles of leaving the contaminated zone should be respected very strictly
- Treatment of 210 mm calibres demands great care
- Emission to the environment: can be neglected

Conclusions

	Destruction efficiency
77 mm	~ 100 %
105 mm	~ 100 %
150 mm	~ 100 %
210 mm	*

* Due to the different configurations used during the Acceptance Test, more analysis should be done to have a more reliable idea of the destruction efficiency of 210 mm calibre.

Thank you for your attention!

Questions?