

Intervention dans le cadre d'un accident de fonte de source orpheline dans une industrie sidérurgique

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Point de depart

12 septembre 2011 : Détection de Radioactivité

RECYTECH - Fouquières les Lens (F)



C.E.A.R.

30 $\mu\text{Sv/h}$

Réaction(s)

Appel téléphonique < Security, Safety & Health Dpt :

Premières mesures chez DUFERCO (B):

Filtres: 0.2 –1.3 $\mu\text{Sv/h}$

Silo : 4.5 $\mu\text{Sv/h}$

Sol : 1 $\mu\text{Sv/h}$

Standard background +/- 0.2 $\mu\text{Sv/h}$

Origine ?

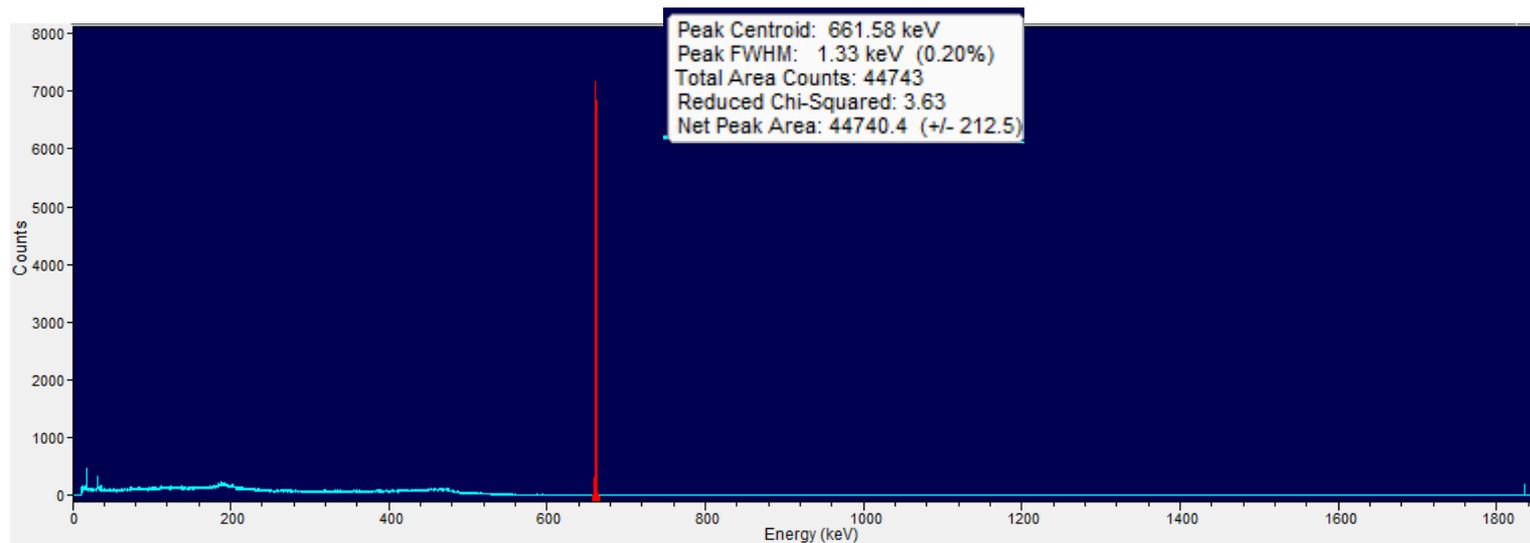
=> Prise d'un échantillon sous le silo

Confirmation

13 september 2011 : Résultat de l'analyse gammaspectrométrique

Poussière sous le silo => Cs-137 : 20 Bq/g

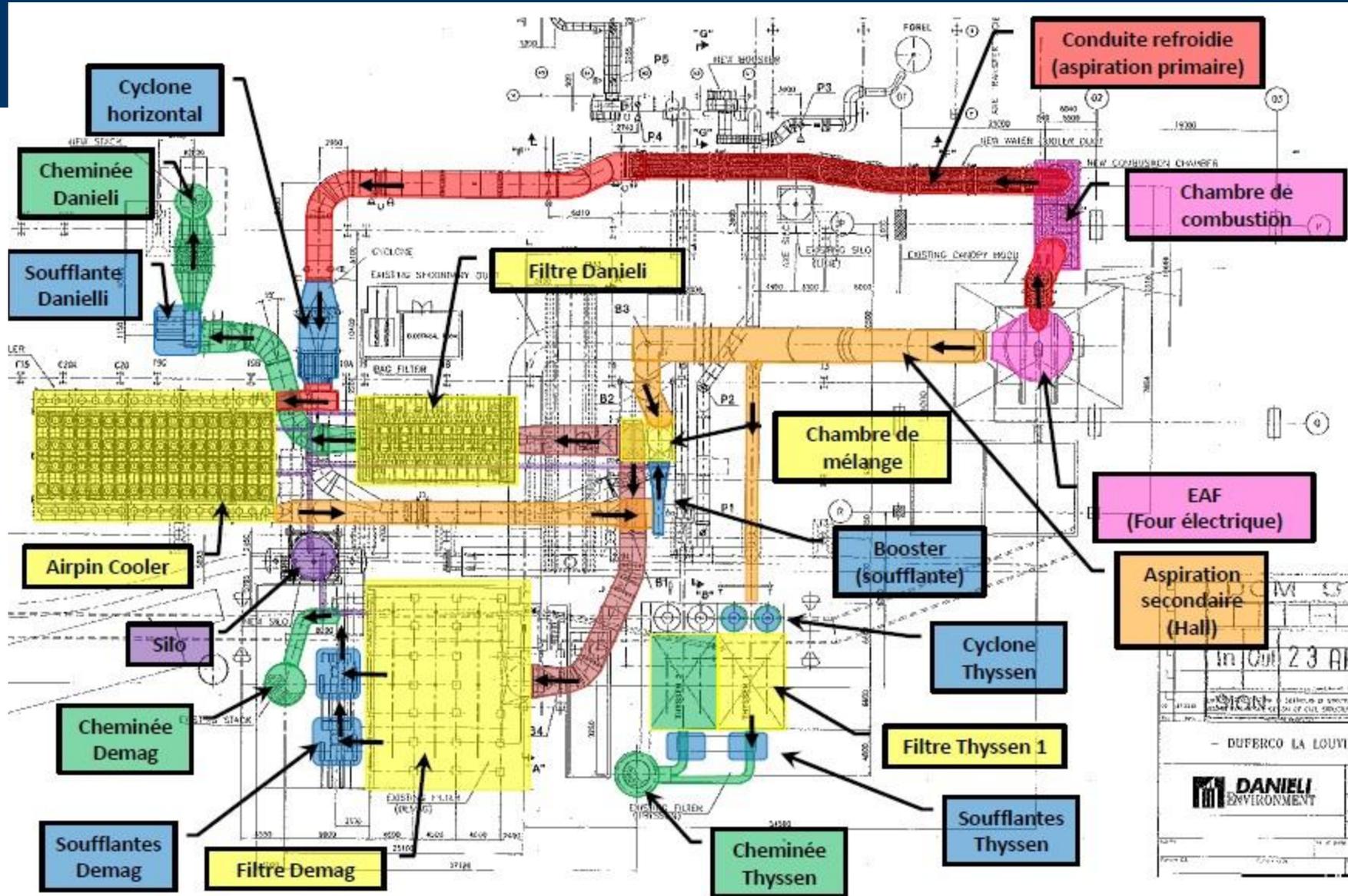
Clearance level (IAEA) 1 Bq/g



Hypothèse



Nuclide	Physical properties	Phase distribution
Co 60 Cobalt	Density : 8.90 g·cm ⁻³ Melting point: 1495 °C Boiling point: 2927 °C Half-live: 5.3 y	98 % in steel 1 % in slag 1 % in dust
Cs 137 Caesium	Density : 1.93 g·cm ⁻³ Melting point: 28.4 °C Boiling point: 671 °C Half-live: 30.2 y	0 % in steel 0 % in slag 100 % in dust
Ir 192 Iridium	Density : 22.56 g·cm ⁻³ Melting point: 2466 °C Boiling point: 4428 °C Half-live: 74 d	98 % in steel in inclusion 1 % in slag 1 % in dust
Ra 226 Radium	Density : 5,5 g·cm ⁻³ Melting point: 700 °C Boiling point: 1737 °C Half-live: 1602 y	0 % in steel 99 % in slag 1 % in dust
Am 241 Americium	Density : 12 g·cm ⁻³ Melting point: 1176 °C Boiling point: 2607 °C Half-live: 432 y	0 % in steel 99 % in slag 1 % in dust



POLLUTION CONDITION - CESIUM 137 - EAF HALLS CONCERNED – Sept. 2011



Duferco Belgium
Société à responsabilité limitée



VINÇOTTE
CONTROLATOM

POLLUTION CONDITION - CESIUM 137 - EAF HALLS CONCERNED – Sept. 2011



Duferco Belgium



Actions

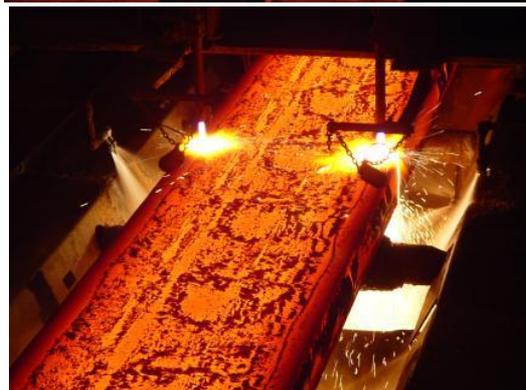
Prise d'échantillons:

Gaine refroidie	53.7 Bq/g (Cs 137)
AirPinCooler	16.4
Danieli	67.7
Demag	34.6

=> Cs 137 dispersé dans l'ensemble du système

Actions

Mesure des produits



Actions

Mesure des co-produits



Scories



Réfractaires

Autorités

14 september 2011 :

ASN + Controlatom => AFCN

1ère inspection AFCN => arrêté:

Article 1er :

La suspension des activités d'exploitation du four électrique et du système d'extraction des poussières du four jusqu'à nouvel ordre.

Art.2.

Les activités pourront reprendre sur nouvelle décision de l'Agence moyennant la réalisation des actions suivantes :

- a) décontamination des circuits et composants essentiels, tel que définit lors de l'inspection du 14-09-2011 et consigné dans le rapport d'inspection ayant pour référence 4-1-GH-2011-09-14 ;
- b) après rédaction d'un PV entièrement favorable de l'Organisme agréé AIB Vinçotte Controlatom qui confirme que ces contaminations ont été enlevées.



Melting of Orphan Source Posted on: 19 September 2011

Event Date: 13 September 2011 Event Type: Radiation Source
Event Location: Belgium, Duferco - la Louvière INES Rating: 1 (Final)

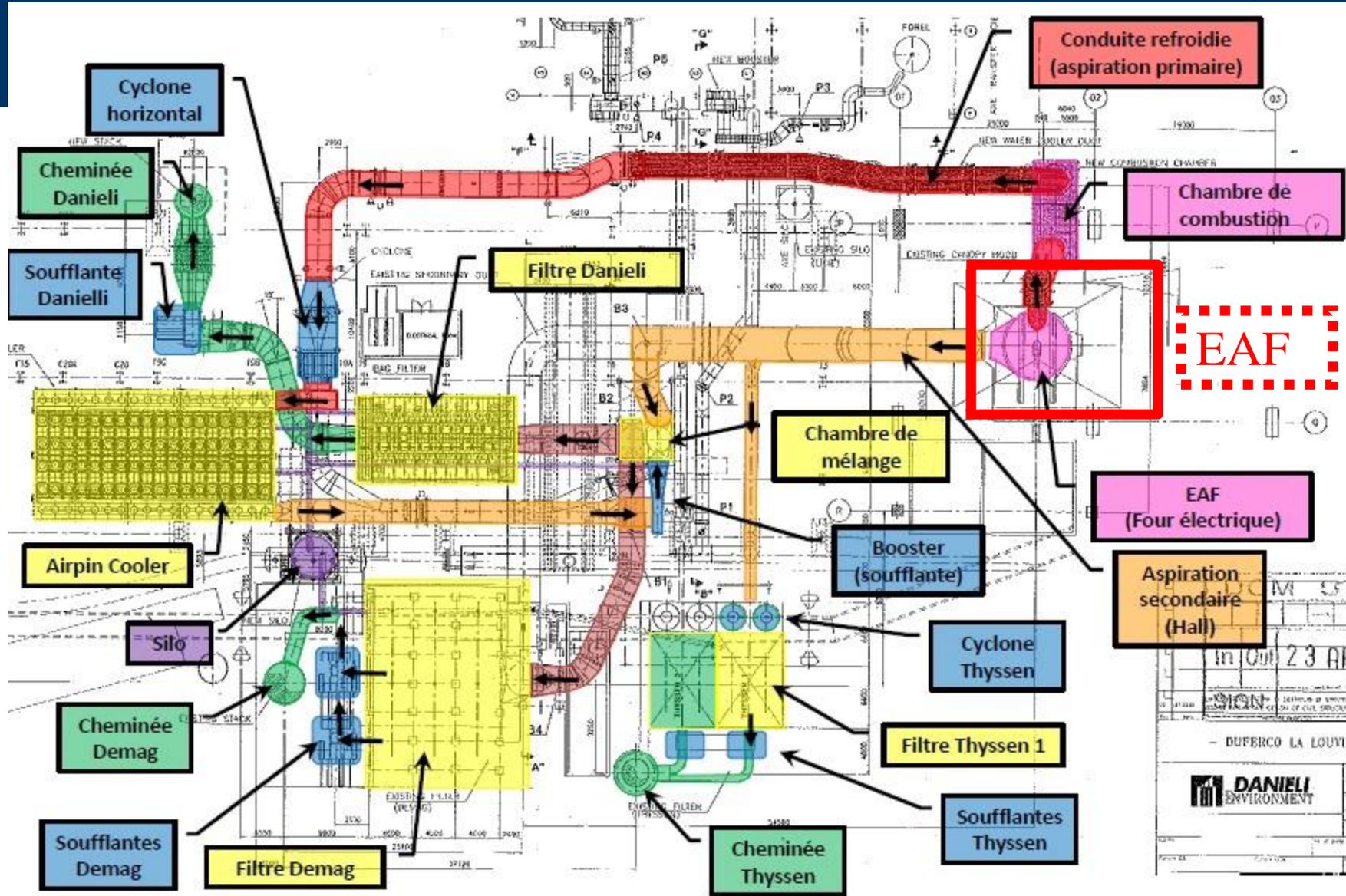
Tuesday 13 September 2011 in the evening, the FANC was informed that a radiation portal monitor for the measurement of radioactivity in a French facility indicated the presence of radioactive material in the load of a truck coming from Duferco La Louvière Produits Longs, located in La Louvière, Belgium.

Immediately after the event had been reported, the FANC went to the site of Duferco La Louvière Produits Longs, accompanied by experts of the recognised control organisation AIB Vinçotte Controlatom in order to investigate the circumstances of the event and to take the necessary measures for managing the event.

This event was caused by the inadvertent introduction of a cesium-137 source (~1.5 GB, according to first measurements and conservative calculations) in the electric furnace of Duferco La Louvière Produits Longs, despite the presence of portal monitors at the entrance of the site. This is how the radioactive source was melted and was scattered, mainly in the dust remaining after the production, but also in the system for the extraction of dust from the furnace. Consequently, the FANC was able to conclude that part of the equipment of the installation was contaminated.

The first on-site measurements gave no indication that the workers or the environment have been contaminated. However, as a precautionary measure, the FANC has demanded additional check-ups of the workers that might have been in contact with the installation or the contaminated products. The results of these investigations showed no contamination of the workers up to now.

Under these circumstances, the FANC decided to suspend the production activities of Duferco La Louvière Produits Longs awaiting the decontamination of the contaminated equipment.



EAF

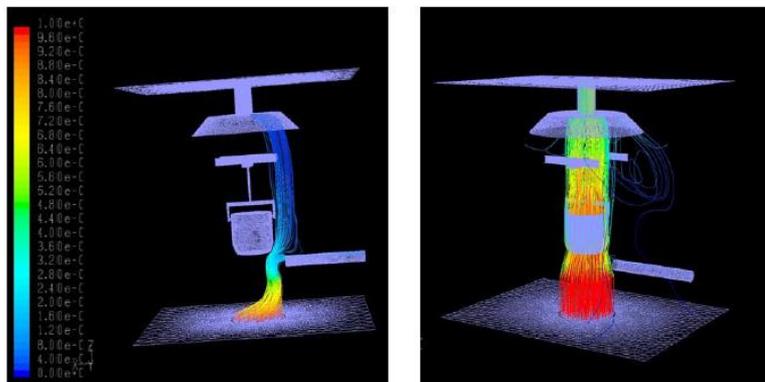


Figure 4. Pathlines coloured by mass fraction of fumes just before dropping the scrap and 15 seconds later



EAF (Four électrique)

Pont
roulant

Rotating
Frame

Voutain



Four

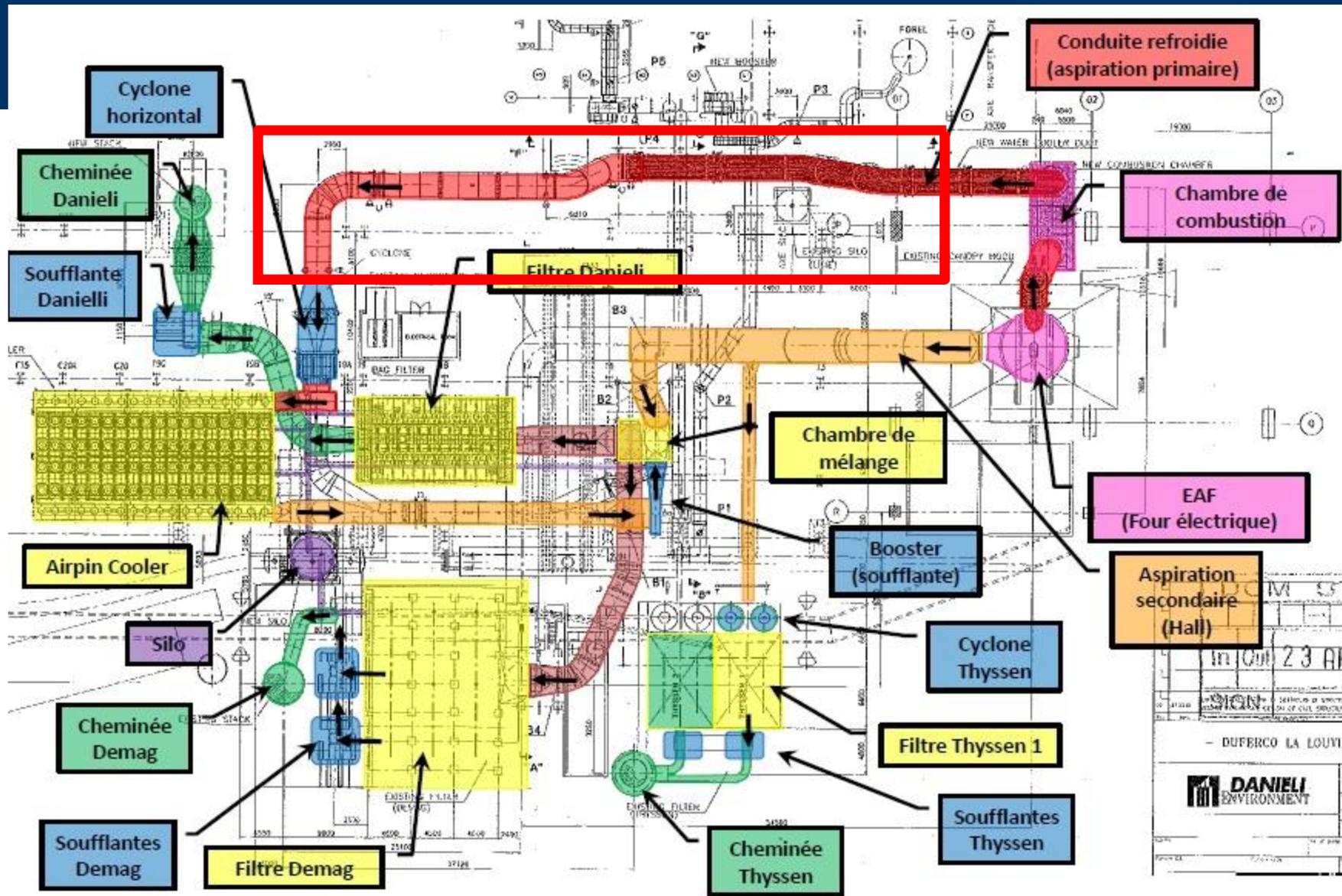
Chambre de Combustion

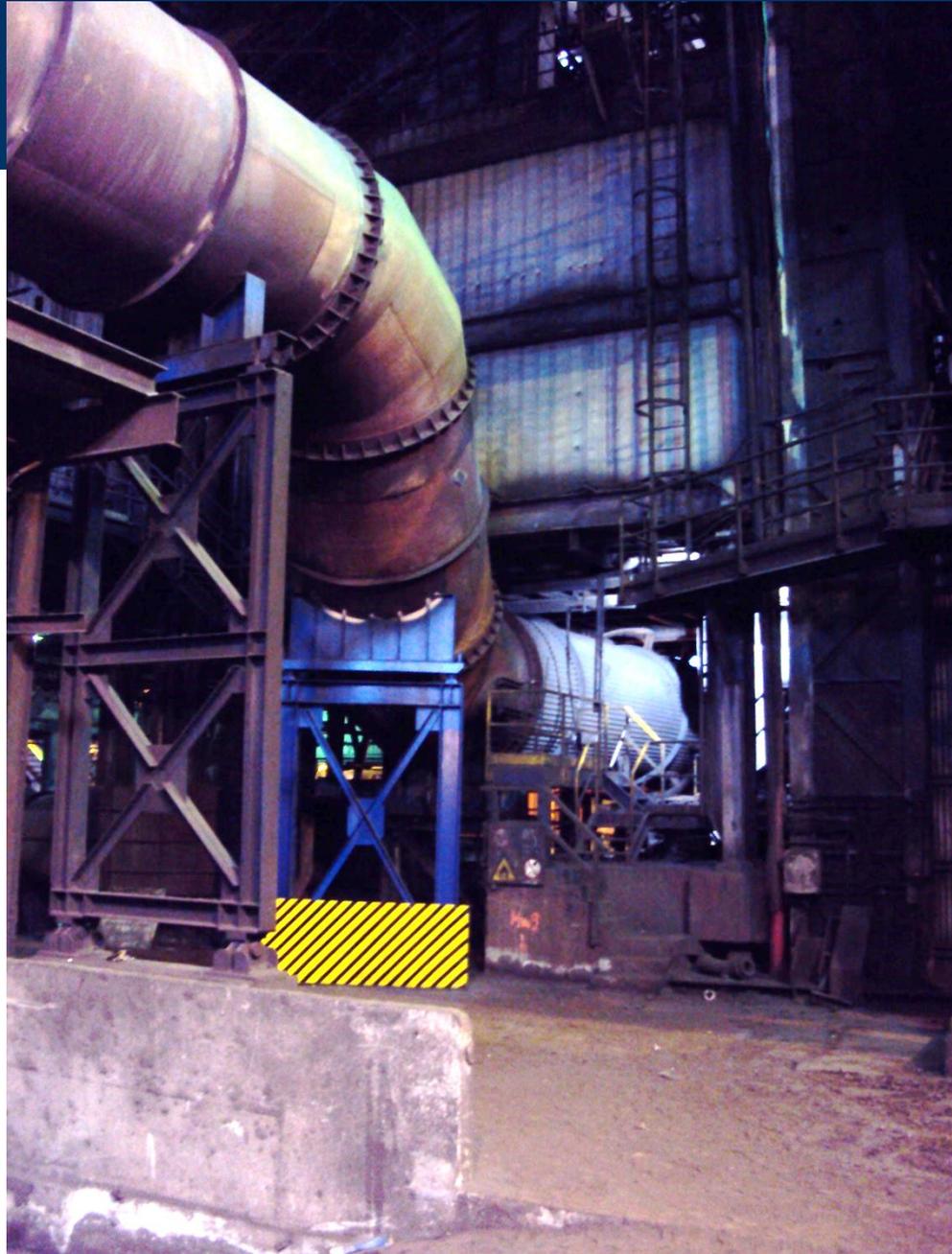


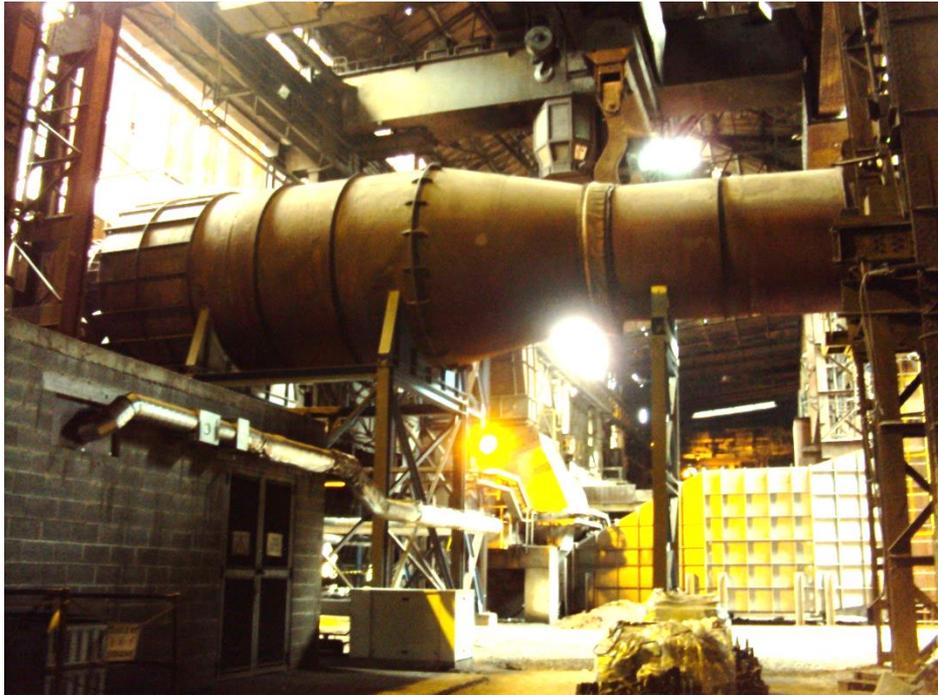
Contamination fixée

Chambre de Combustion

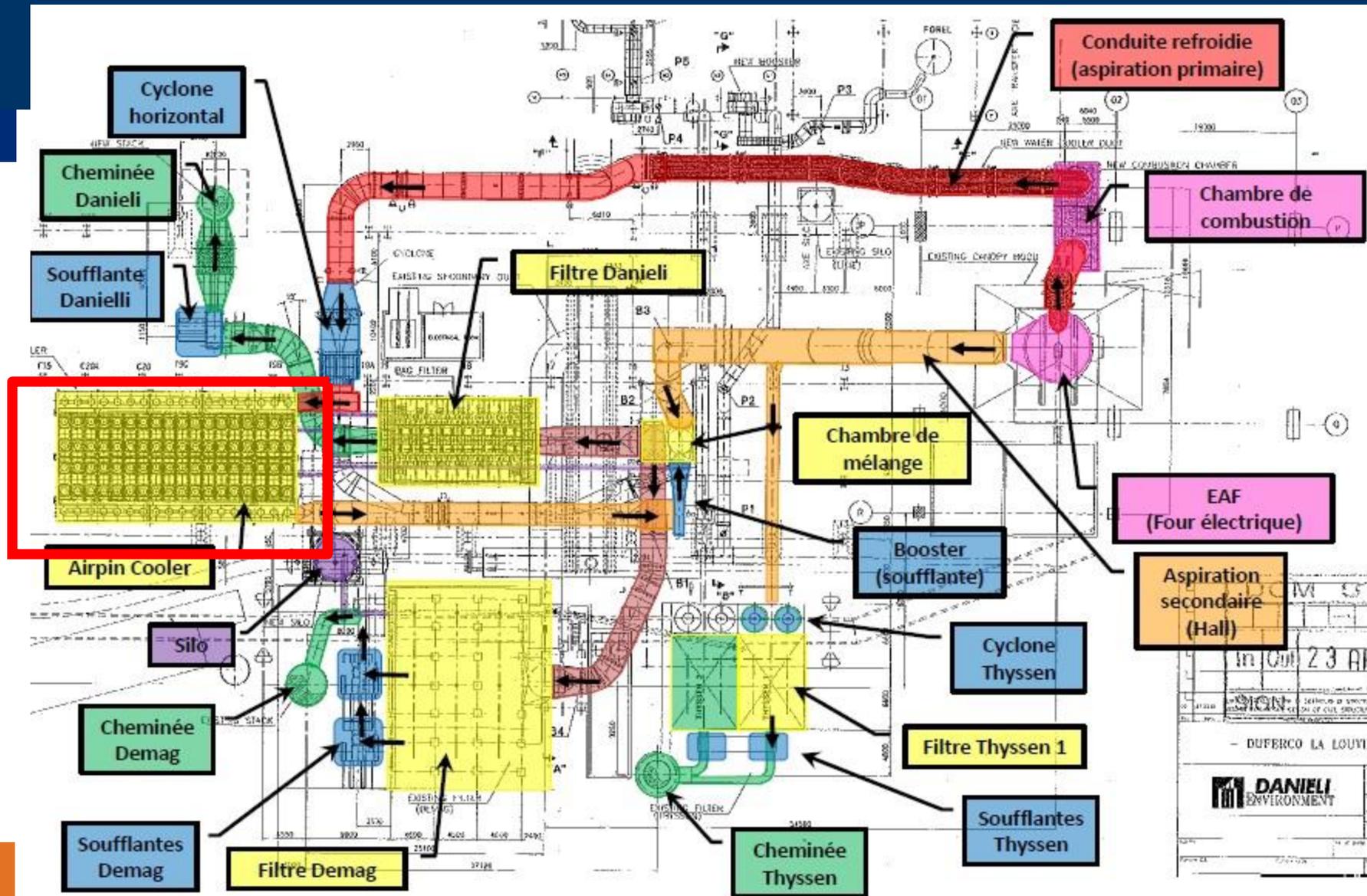












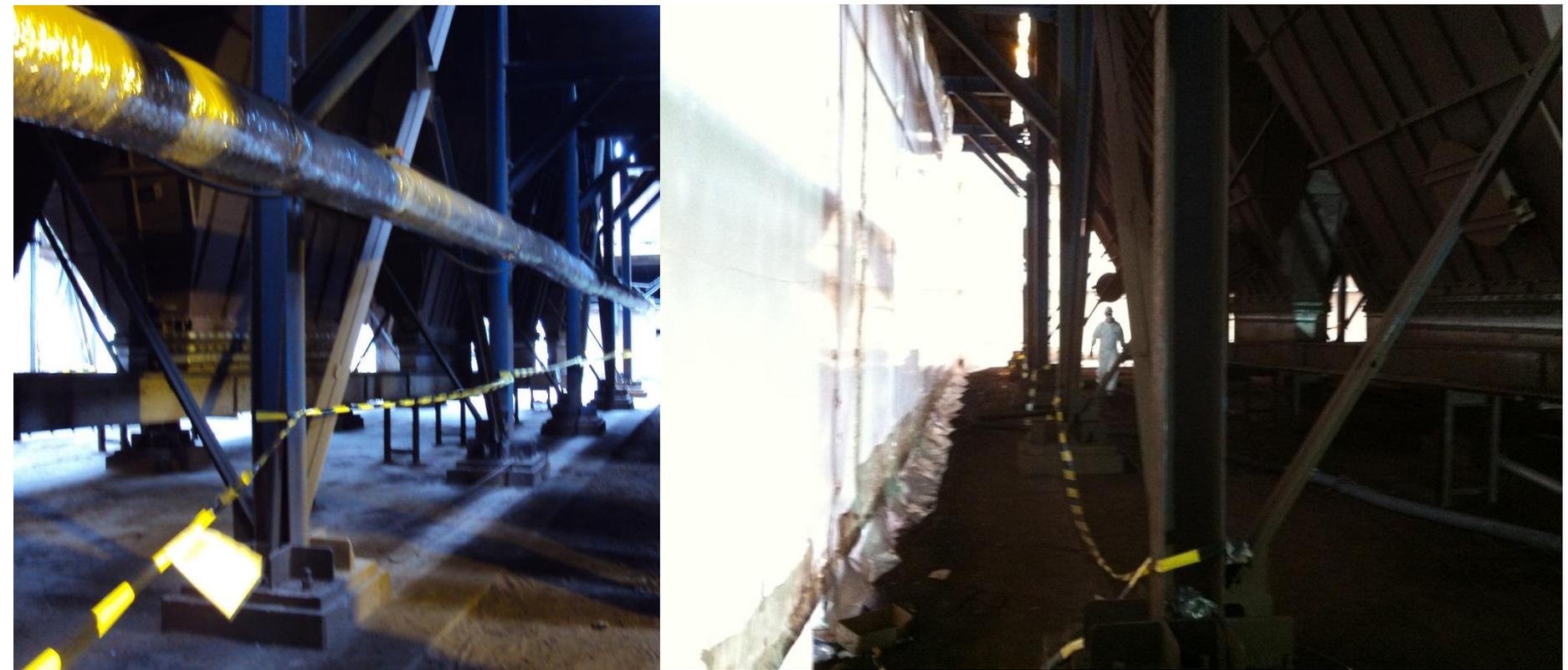
in Oct 23 AP
 - DUFERCO LA LOUVRE
 DANIELI ENVIRONMENT

Airpin Cooler



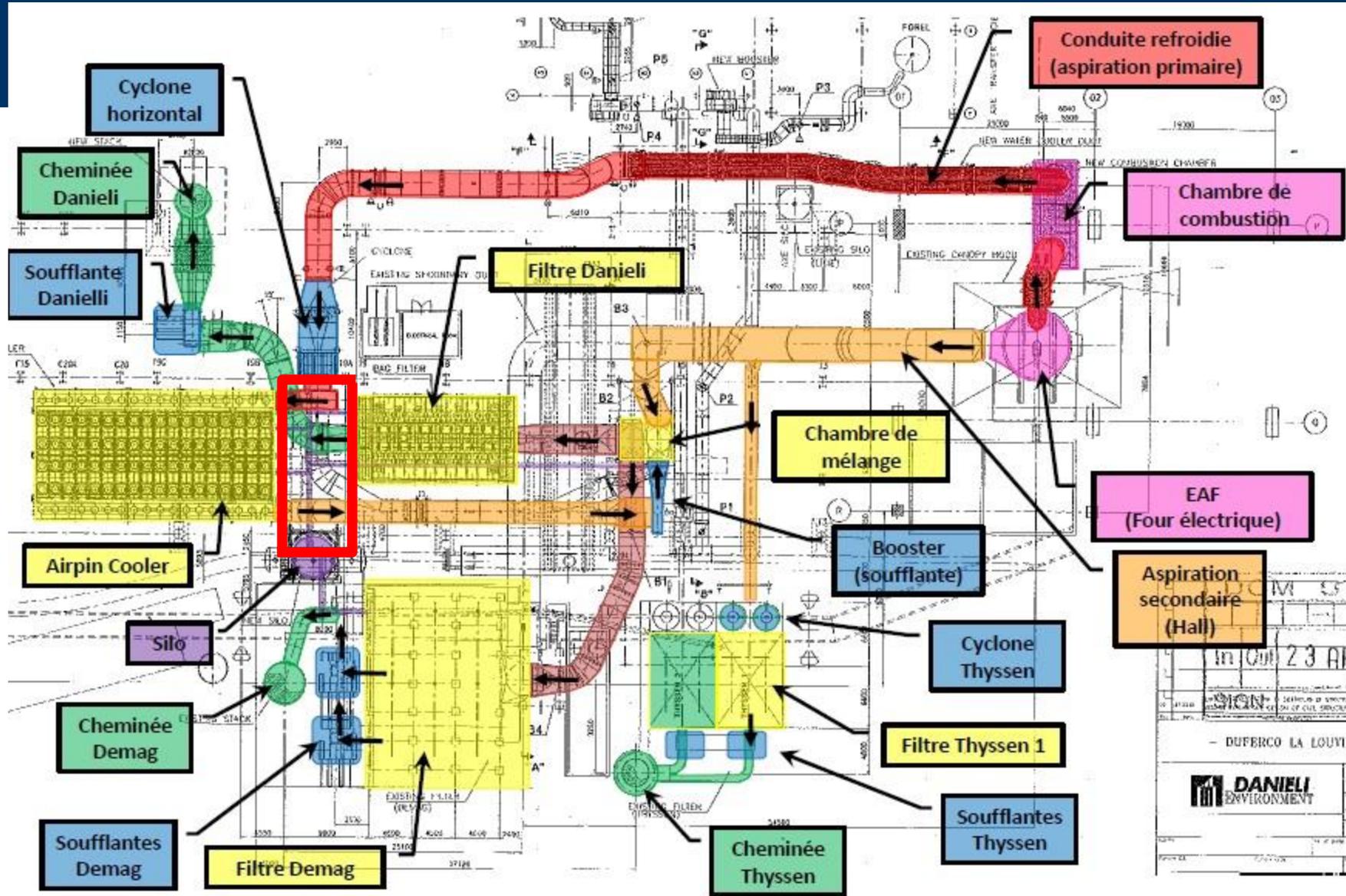
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Airpin Cooler



Airpin Cooler

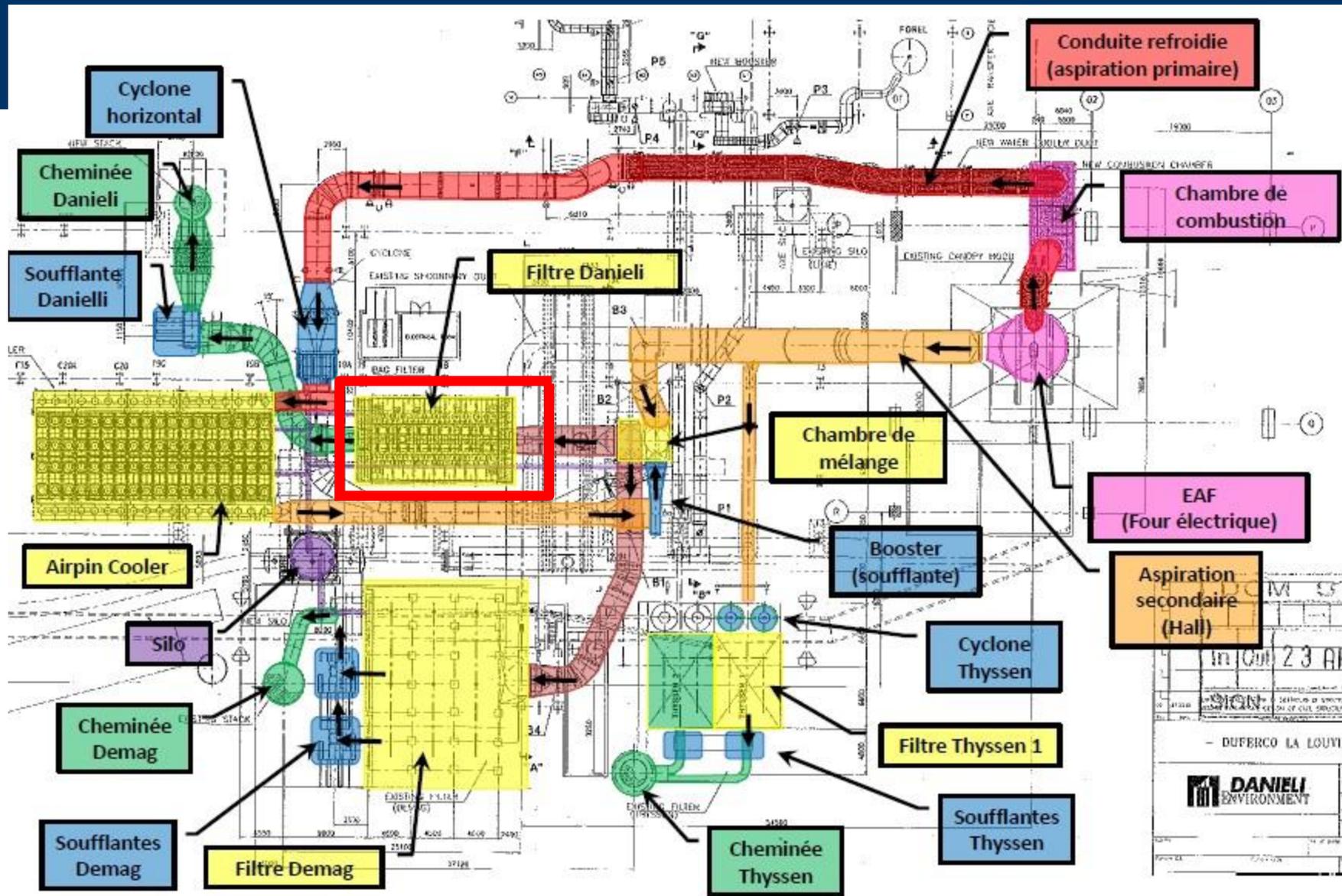




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 DANIELI ENVIRONMENT

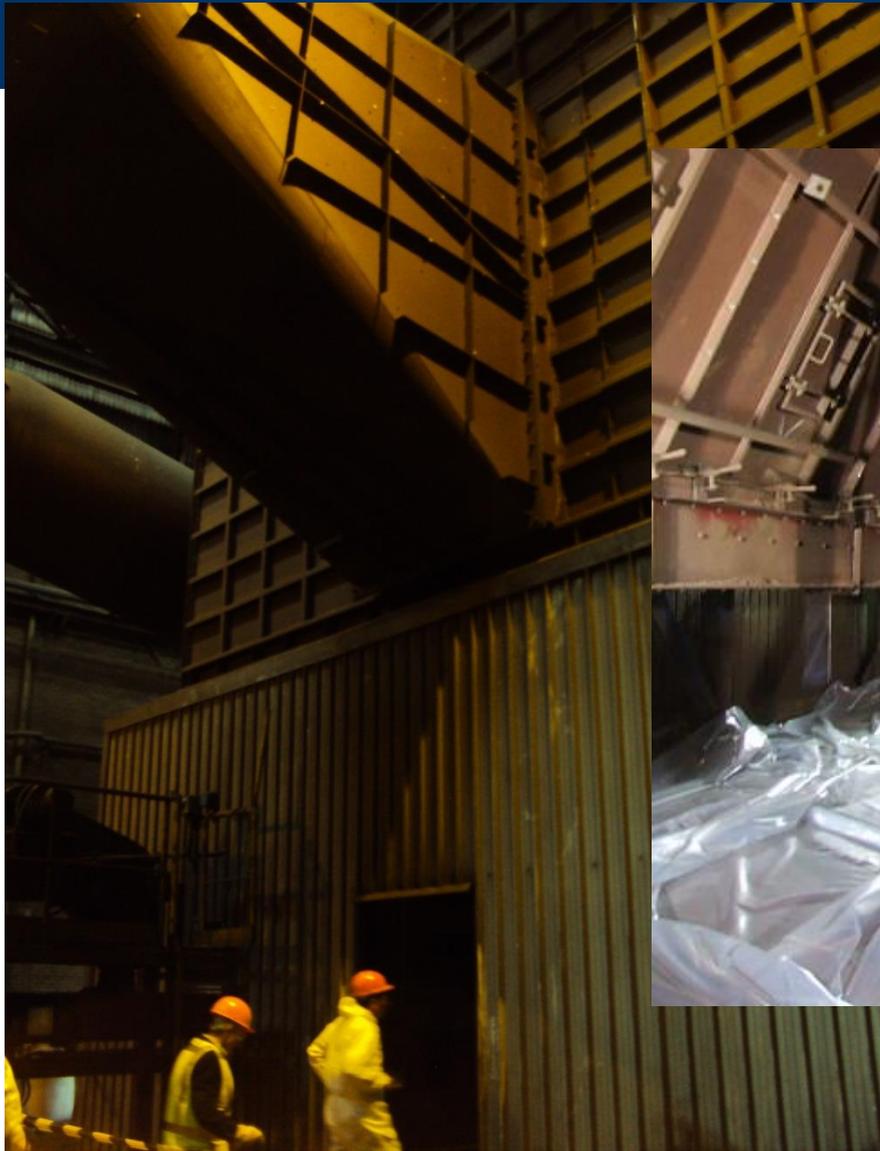


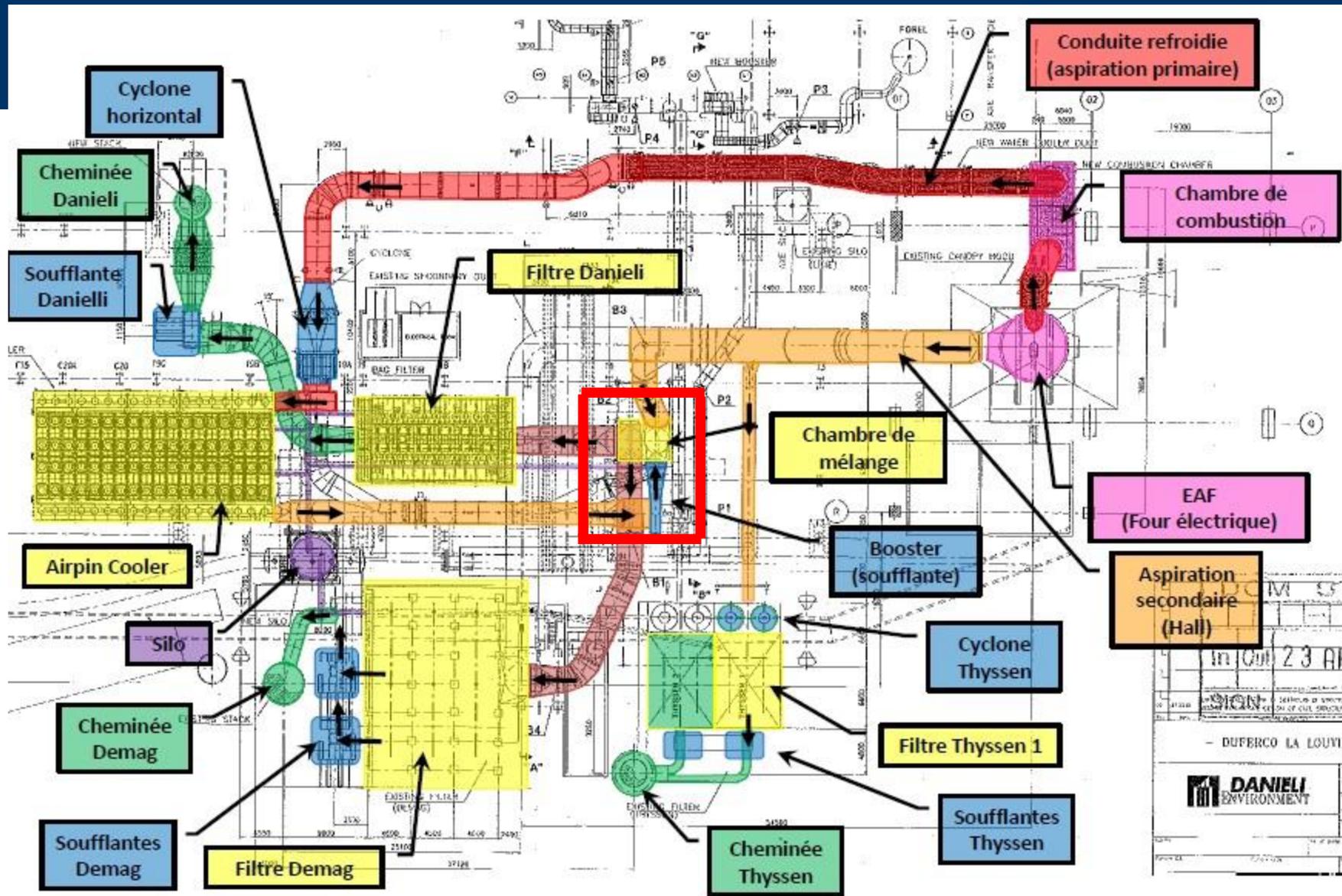
Redler – Convoyeur



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 DANIELI ENVIRONMENT

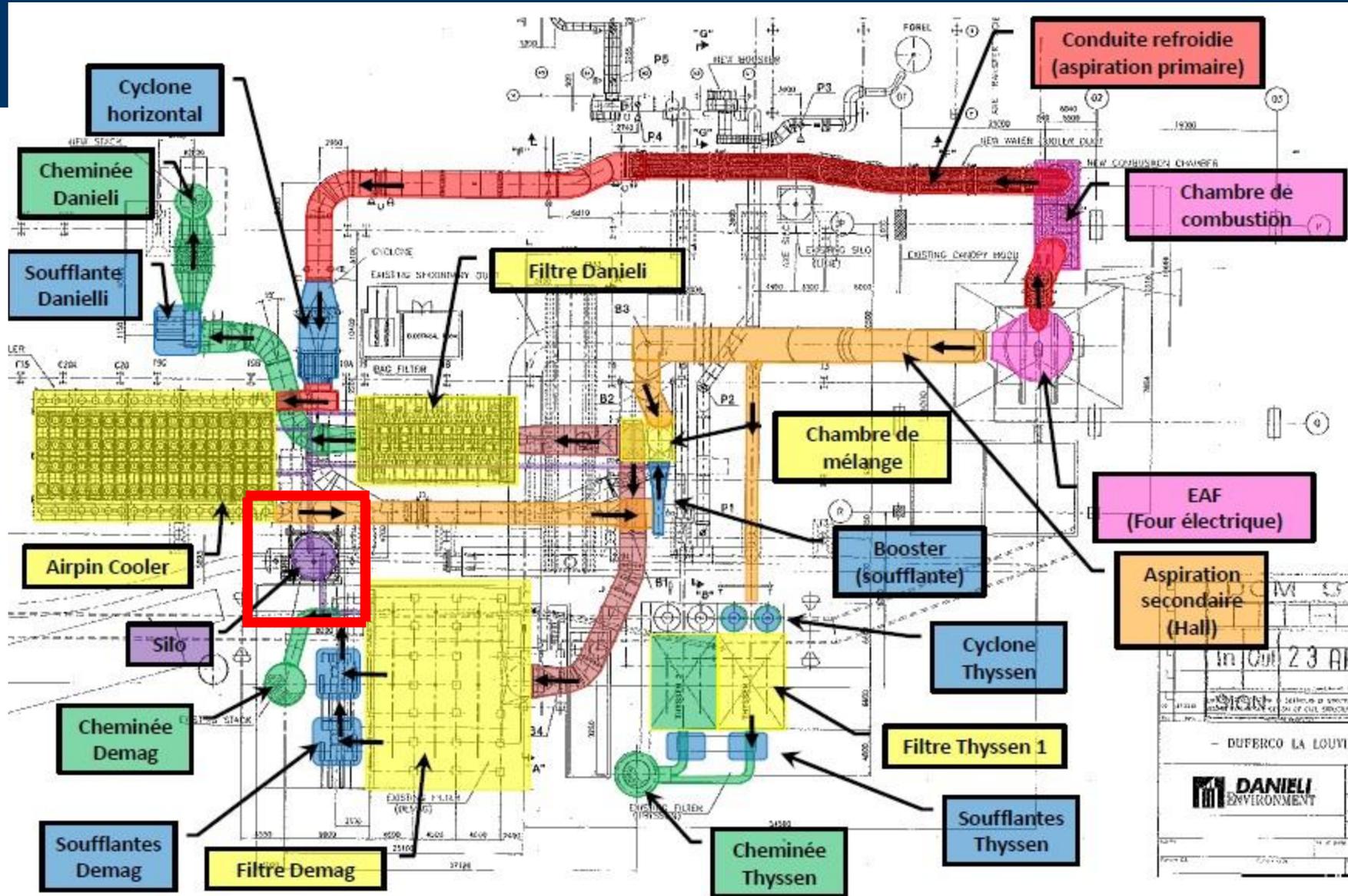
Demag







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SILO



SILO

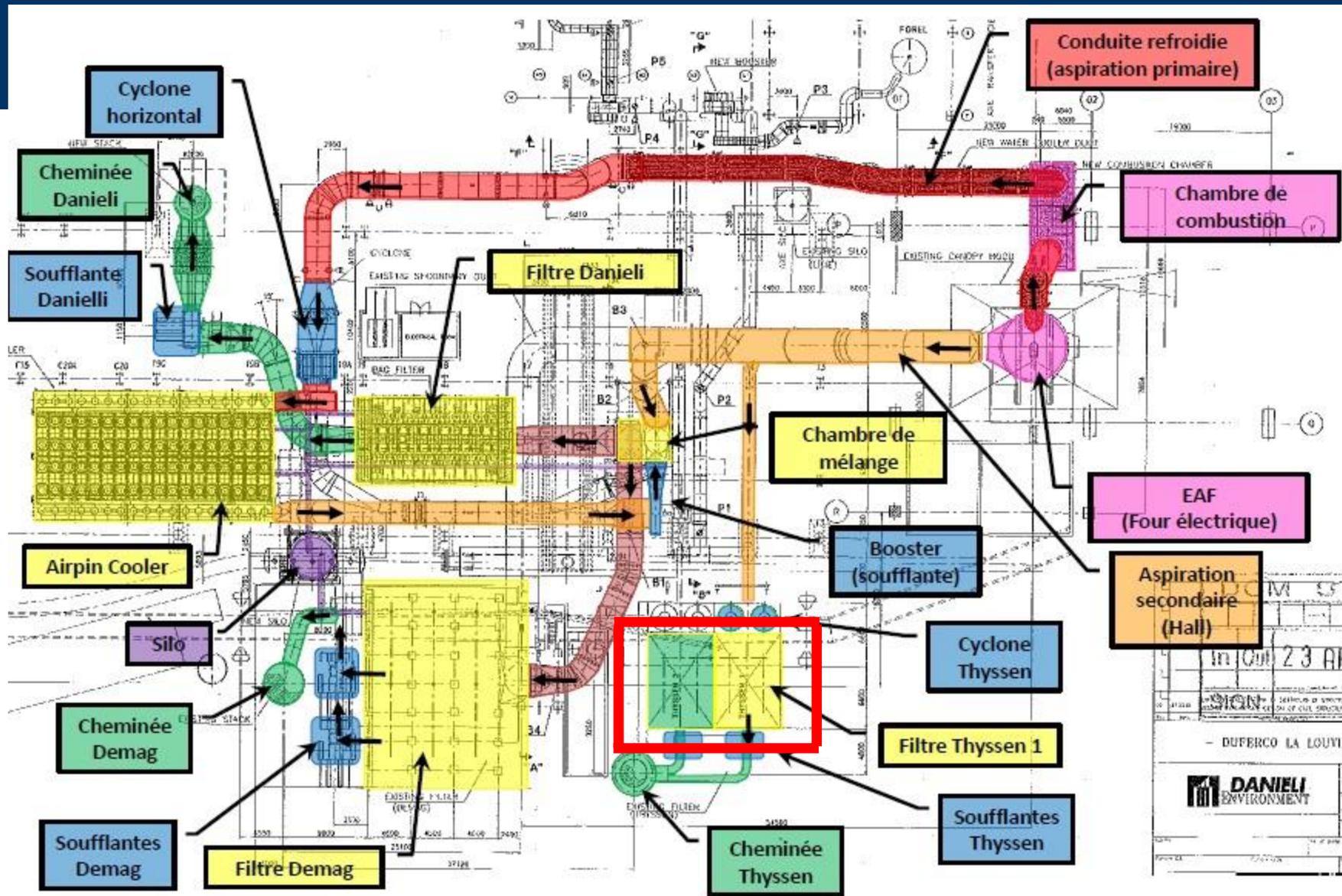


SILO



Silo / Storage (1)





in Oct 23 AP
 - DUFERCO LA LOUVRE
 DANIELI ENVIRONMENT

THYSSEN



THYSSEN



Equipements Contaminés



Résumé

	Big-Bag	Fûts	m ³	t
>10 Bq/g	360	57	334	301
1-10 Bq/g	174	5	158	142
< 1 Bq/g	241	1	217	195
Compressible		21		
Combustible		30		

	Radioactif
	Non radioactif contaminé
	Non radioactif

- >1600 échantillons !
- estimation activité totale : 37,5 GBq Cs137

1983 Mexico	60Co
1983 Auburn Steel, NY	60Co
1983 Taiwan	60Co
1984 US Pipe & Foundry AL	137Cs
1985 Brazil	60Co
1985 Tamco, CA	137Cs
1987 Florida Steel, FL	137Cs
1988 Italy	60Co
1989 Bayou Steel, LA	137Cs
1989 Cytemp, PA	Th
1989 Italy	137Cs
1990 NUCOR Steel, UT	137Cs
1990 Ireland	137Cs
1991 India	60Co
1992 Newport Steel, KY	137Cs
1992 Border Steel, TX	137Cs
1992 Keystone Wire, IL	137Cs
1992 Poland	137Cs
1993 (?) Russian Federation	137Cs
1993 Auburn Steel, NY	137Cs
1993 Newport Steel, KY	137Cs
1993 Chaparral Steel, TX	137Cs
1993 Kazakhstan	60Co
1993 Florida Steel, FL	137Cs
1993 South Africa	137Cs
1993 Italy	137Cs
1993 Russian Federation	226Ra
1993 Southern Zinc, GA	U Depl
1994 Austeel Lemont, IN	137Cs
1994 US Pipe & Foundry	137Cs

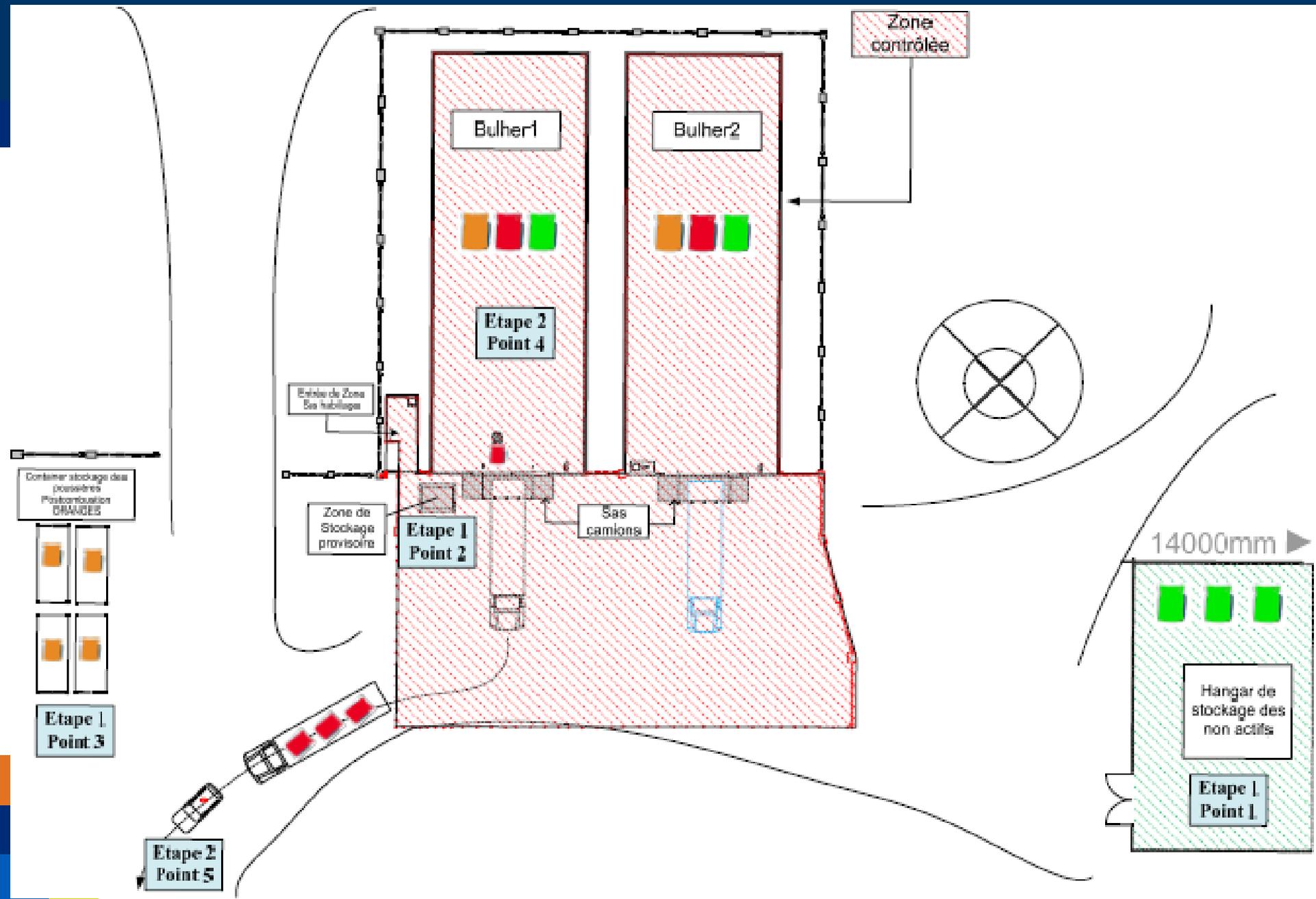
1994 Bulgaria	60Co
1995 Canada	137Cs
1995 Czech Rep.	60Co
1995 (?) Italy	137Cs
1996 Sweden	60Co
1996 Austria	60Co
1997 WCI, OH	60Co
1997 Kentucky Electric, KY	137Cs
1997 Italy	137Cs/60Co
1997 Greece	137Cs
1997 Birmingham Steel, AL	137Cs/241Am
1997 Brazil	60Co
1997 Bethlehem Steel, IN	60Co
1998 Acerinox Spain	137Cs
1998 Sweden	192Ir
2001 Siderurgica Sevillana Spain	137Cs
2002 Acciaierie Beltram Italy	137Cs
2003 Aceria Compacta de Bizcaia	137Cs
2004 Timken Canton OH	137Cs
2004 Cape Gate South Africa	137Cs
2004 Wu Yang Steel China	137Cs
2004 Aser Erandio Spain	137Cs
2004 Sidenor Cantabria Spain	137Cs
2004 Acciaierie Beltram Italy	137Cs
2006 Texas	137Cs
2008 Carbon Steel Plant Germany	137Cs
2009 Industeel Le Creusot (France)	137Cs

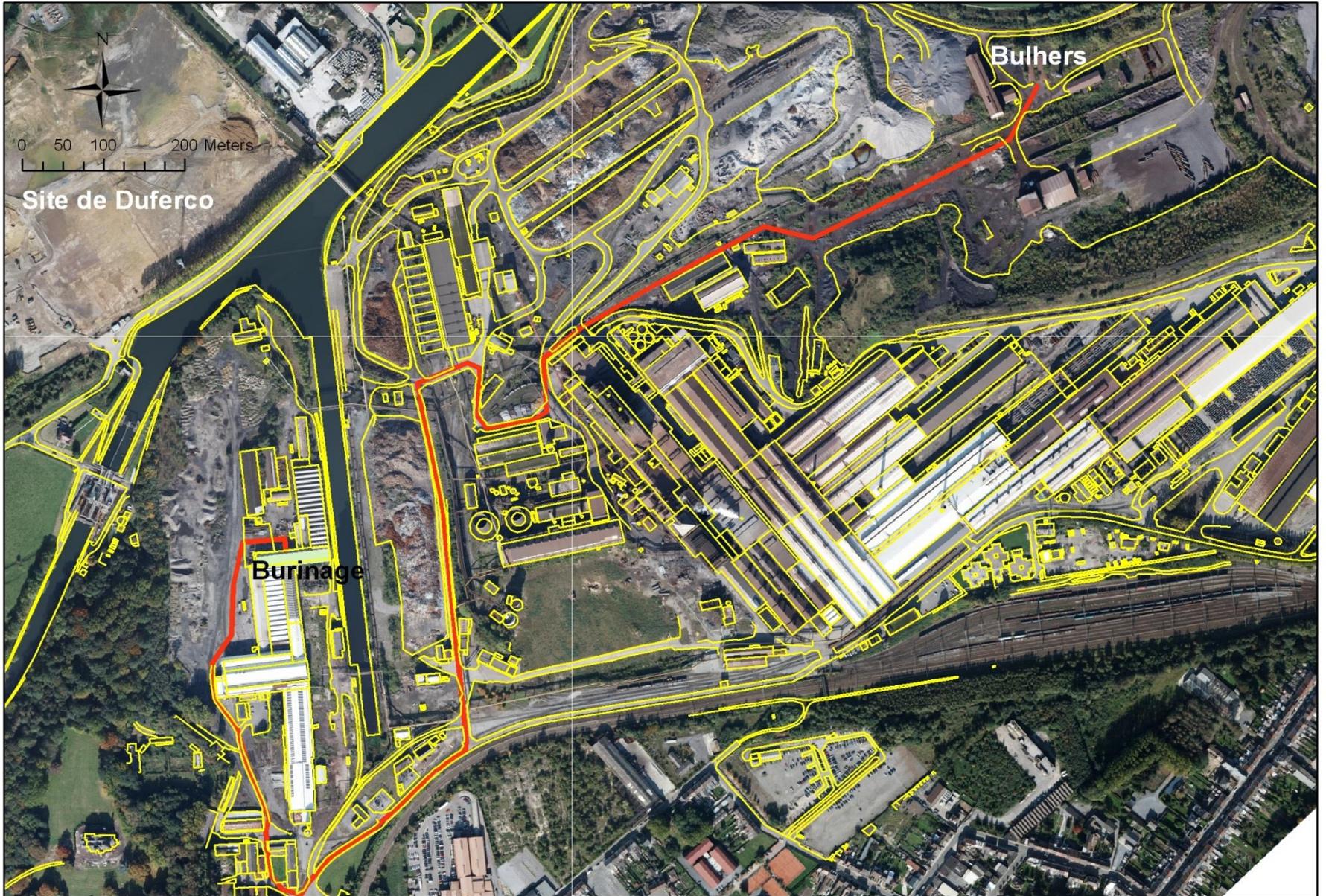
AIEA 2013

Lille 2017



Phase 2: Déplacement du stockage temporaire







Phase 2 bis:
Process: 1 – 10 Bq/g





=> Mesures de contamination après nettoyage





=> Deponie

Phase 2ter:

Suivi des équipements contaminés



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Phase 3: Process: >10 Bq/g





Fig. 6.1. Filter dust barrel.



Fig. 6.2. Filter dust.



Fig. 6.3. Yellow dust barrel with stirring device.



Fig. 6.4. Preparation for suspension and dissolution.



Fig. 6.5. Dust during stirring.



Fig. 6.6. Dust skin and supernatant solution.



Fig. 6.7. 10 µm-Filtration of Washing Water.



Fig. 6.8. Filtered Washing Water.



Fig. 6.9. Adsorption column and collecting vessel.

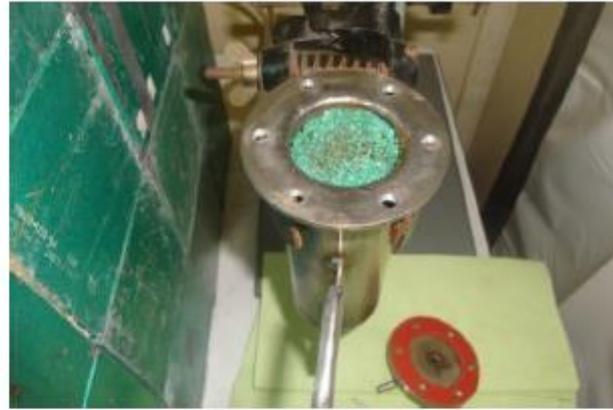


Fig. 6.10. Open column with NHCYF.



Fig 6.11: Used NHCYF from the column containing ^{137}Cs



Fig 6.12: Collected decontaminated washing water

Merci pour votre attention

