International Cadmium Association

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Minutes of the 10th ICdA H&S Committee

Minimisation of Cd in water emissions

October 23th, 2012
DIAMANT - CONFERENCE & BUSINESS CENTER
Meeting room NEWTON BC
Boulevard A. Reyers 80
B-1030 BRUSSELS

1- Introduction

Welcome and individual introduction of the participants (cf. file 1 Attendance list); each participant is invited to sign a statement of compliance (Competition law).

The provisional agenda proposed by ICdA is adopted (cf. file 2 Provisional Agenda 10th ICdA HS ctee- 23 Oct 2012), with 2 main subjects namely: Water treatment – Cd emissions minimization and overview on the results of the "Occupational Cadmium Bio Indicators Observations"

2- Approval of the minutes of the 9th H&S committee (June 19th, 2012)

The minutes of the ninth H&S committee (June 19th, 2012) are approved unanimously.

3- Objectives of the meeting: ICdA program, "Risk Management measures" and related communication thereof *(Patrick de Metz - Chairman)* (cf. file 3 ICdA 10th H&S Committee)

It is reminded that the main objective of the ICdA Health & Safety committee is to disseminate the ICdA Guidance document to ICdA member companies and their key personnel.
The Cd/CdO risk assessment having initially showed that there were in Europe risks for workers under current management methodologies, the decision was taken, some 3 years ago, to assist ICdA members with the implementation of the ICdA Guidance document "ICdA Guidance on the management of the risk related to chronic occupational exposure to cadmium and its compounds".
The question was posed if there are changes needed in the objectives of the H&S Committees. Evaluation, discussions are foreseen at the end of this meeting.

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The past H&S committees are reviewed, especially the topic of the current 10th H&S committee, which is "Minimisation of Cd in water emissions". The aim of this meeting is to illustrate this with the Experiences at SNAM and to situate the Waterframe work directive

4- Technical solutions(s) for avoiding Cd-water emissions *(Eric Nottez-President SNAM)* (cf. file 3 ICdA 10th H&S Committee)

As introduction to his presentation Eric Nottez mentioned that during Meetings with the French authorities in 2008, SNAM got aware about the fact that industry should be prepared by January 2021 to come to an absolute zero level of Cd into released waste water.
The aim of this presentation was to present what was done sofar in SNAM to reach this 'impossible' goal.

Why was water a concern for SNAM?

- "Zero Level" of non ferrous metal wasted in water before the end of 2020
- Water directive, as transposed, includes higher concern for biotic assets
- "Seveso" applies to recycling activities since 2011 (decrees) bringing higher controls and expectancies…

What are the external key factors to SNAM?

SNAM is located at a local, tiny river with a quite low flowrate (<<1m^3/s), and huge impact of the effluent on receiving waters acidity and temperature fluctuations

What are the internal key factors to SNAM?

- SNAM processes many different metals and chemicals, which could be found in water: Nickel from NiCad, NiMH batteries, Cobalt from Li-ion, Cadmium from NiCad and wastes, Aluminum and Copper from connectors and casings Chemicals from electrolytes (KOH, …)
- SNAM uses water as a cooling agent for thermal process, within a closed circuit. The foundry activity has usually no pollution effect but huge quantity per hour, exiting at high temperature, … without energy recovery
- SNAM uses water as a production agent for hydrometallurgical process. Pollution must be prevented, with huge quantity per hour/batch, exiting at hot temperature, with metals inside like Zinc or Nickel, or emerging Lithium
- SNAM uses water as a production agent for the washing of clothes

Which principles to be used?

- At the beginning (2008)

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Water was taken from the big river Lot, and then used in the hydrometallurgical process and afterwards discharged in to the small river

- Later (2009):

  Clothes were sent to an external company (with capacity to 30T clothes/day) for washing and afterwards water discharged into the small river

  A restricted tanking capacity was built.

- Further (2010):

  A distillation process was -as extra- put into place and the distillated water was more conform as to be expected. Cd and Ni go back into the process.

- Today :

  An increasing tanking capacity is built, and a process for self washing of clothes is established. As a result, today all water used in the process goes back into it.

Which technologies are available?

- Waste water treatment process:

It is consisting of several steps: distillation unit with 3 tanks in order cool enough, monitoring system for acidity, pressure. All the measurements are analyzed and a 24h/7d dynamic control. Refrigerated sampling is also in place.

- Clothes & IPE (individual protection equipment) decontamination unit

This unit started in September 2011 with 1 ton of dry clothes/ month capacity. It has also partnerships with external companies (SNAM operating for other companies)
The result is Zero waste water and reused inside the plant
An industrial washing machine is used and placed in the middle of the room which has a 2 parts area with 1 door entry (dirty clothes) and 1 door exit (clean clothes)

IPE Cleaning (masks) : first with wipes + also with ultrasonic waves to remove after the end of a cycle all particles

- Closed loop within the plant ; Today:
  - AIR /Glycol Cooling : this was put in place because previously too much energy required ; now an efficient aerotherm unit
  - Plate exchange system with double Backup (industrial and city water)
  - Zero waste = full compliance water directive 2015, 2020

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- Water consumption reduced (quantity divided by 3) since reuse and therefore less water has to be bought; also rainwater and firewaters containment is forseseen and re-use favoured.

Some first results in SNAM

Cadmium is still rejected in water, but there is a huge reduction achieved during the last 3 years.
In 2008 more than 690 g/year, in 2011: 49.4 g/year and end of Sept 2012 only 15.59g/year was reported as a figure from external control.

It is proven that the water treatment also helps treating the air. E.g. it is shown that the locker area was much cleaner after the decision for having putting new water units.

5- Regulatory aspects of Cd-releases- Water Framework Directive (WFD) *(Marlies Messiaen – IZA Environment)*

Marlies Messiaen starts her presentation (cf. file 3 ICdA 10th H&S Committee) with situating the Water Framework Directive (WFD) which is one of the most important pieces of European environmental legislation in recent years and which is EC regulation 2000/60/EC.
The purpose of this Directive (as defined in its article 1) is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater.
How is this to be done?
The WFD requires from the EC (European Commission) to establish EQS (Environmental quality standards) for Priority substances and Priority Hazardous Substances (PHS). These EQS are safe concentration levels which should not be exceeded in order to protect human health and the environment. Currently 33 substances (including Cd and its compounds) are on this list of Priority substances (pollutants presenting a significant risk to or via water), with the most hazardous of these, classified as Priority Hazardous Substances (PHS) and 'Cd and its compounds' are considered as PHS (Cfr Annex I of the EQS Directive (2008/105/EC)). The aim of this EQS directive is that MS (Member States) should have to achieve a good chemical and ecological status of their inlands waters. The MS had to make River Basin Management Plans (RBMP) by 2009 and the aim of the WFD requires that all inland and coastal water achieve a "good status'' by 2015.
An overview of the specific Cd-EQS values per hardness category as published in Annex I of the EQS Directive (2008/105/EC) is shown (cfr table in file 3). An important note is that the EQS refers to dissolved concentrations, i.e. the dissolved phase of a water sample obtained by filtration through a 0.45 µm filter or any equivalent pre-treatment.
For Europe, the Water Framework Directive (2000/60/EC) aims at enhancing protection and improvement of the aquatic environment in Europe. This Directive tries to accomplish

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through progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing out of discharges, emissions and losses of the Priority Hazardous substances (as Cd). The WFD aims to achieve this phasing-out and cessation of discharges by 2020. However, the WFD and the EQS directive contain no specific measures on how MS have to achieve this. The WFD contains some basic measures for the MS: e.g.: Best avaiable techniques (BAT), emission limit values, programmes of measures, emission registrations, pollutor pays principle... But the WFD contains no product related measures.
In any case in the EQS Directive (art 5.5) it is mentioned that the Commission shall verify by 2018 that the aims for the WFD are met, i.e. that emissions, discharges and losses are making progress towards compliance with the reduction or cessation objectives. However, EQS Directive (point 10) refers also to naturally occurring substances: 'MS should implement necessary measures with the aim of ceasing or phasing out emissions, discharges and losses. For substance occurring naturally or though natural processes, the cessation or phasing-out of emissions, discharges and losses from all potential sources is impossible'.

Furthermore the EQS directive states that:

- A time-table for cessation or phase-out can only be related to an inventory.
- The quantification of losses of substances occurring naturally or resulting from natural processes, in which case complete cessation or phase-out from all potential sources is impossible. In order to meet those needs, each MS should establish an inventory of emissions, discharges and losses for each river basin district or a part of a river basin district in its territory
- MS have to make an inventory/time-table via monitoring programmes: the use of RBMP (River River Basin Management Plans), E-PRTR (European Pollutant Release and Transfer Register),
- Causes of pollution should be identified and emissions should be dealt with at source, in the most economically and environmentally effective way.

Note: Another monitoring program applied is WISE (Water Information System for Europe) which is an electronic data and information system on water and developed by the European Environment Agency

Further to the WFD and EQS directive, MS have to take into account other legislations (IPCC, REACH, Waste Directive,...)
The EQS directive states that (art. 8) : As regards emissions controls of PS from point and diffuse sources it seems more cost-effective and proportionate for MS to include, where necessary, in addition to the implementation of other existing community legislation, appropriate control measures in the programme of measures to be developed for each river basin district.

In the end, it is up to MS how to achieve "zero" discharges....

In a discussion at the end of this presentation, the idea is launched towards industry if there would be interest in a small research project checking those Cd-EQS standards versus water hardness (CaCO3), dissolved organic carbon (DOC) concentration. Since the ICdA overall budget is limited for 2013 and just approved at the GA (oct 18th) in London, it was agreed only on some preliminary exploration towards university lab information, literature. Frank Van

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Assche mentions he will inform for interest under the umbrella of IZA environmentally programs.

6- 'Occupational Cadmium Bio Indicators Observations" *(Prof. A. Bernard)* (cf. file 3 ICdA 10th H&S Committee)

Christian Canoo gives a short introduction with reminding the aim of the OCdBio. The OCdBio, in which biomonitoring data is collected in the Cd industry, started up in 2008 in order to convince ourselves and authorities on the efficiency of our risk management program and the compliance of the current exposure levels with the OELs. The selection of the 2 biomarkers of exposure is explained. Cd-B (µg/l) is an indicator of recent exposure and Cd-U (µg/g cr) as biomarker of the amount of Cd stored in the kidney cortex where the first signs of Cd toxicity develop.
An overview of the solicited and responded EU sites is shown.

Review of OCdBio 4 (data 2011), vs.1, 2 and 3 (data 2008-2009-2010)

Prof Bernard starts his presentation by commenting a tentative scale to evaluate risks of Cd-induced renal dysfunction according to urinary Cd in occupationally exposed subjects based on his publication Bernard (1996) establishing 4 zones, namely Cd-U (µg/g cr) : <2 :
2-5; 5-10; >10; the red one (>10 µg Cd/g cr) being the zone we should avoid, considering that above this value there is a linear increase of the risk.
The distribution of Cd-U in EU-sites has been established using the data of
15 EU sites (2008), 15 EU sites (2009), 21 EU sites (2010), 21 EU sites (2011).
These OCdBio data over the several years include not the same individuals but the same companies.

2008 data representing a population of 1835 people:
79.7% of the people, under 2 µg Cd/g cr, have in theory no risk
2.5%, above 10 µg Cd/g cr, are probably people under risk
2009 data representing a population of 2125 people:
82% of the people, under 2 µg Cd/g cr, have in theory no risk
1.6%, above 10 µg Cd/g cr, are probably people under risk
2010 data representing a population of 2370 people:
81.7% of the people, under 2 µg Cd/g cr, have in theory no risk
2.2%, above 10 µg Cd/g cr, are probably people under risk
2011 data representing a population of 2656 people:
85.6% of the people, under 2 µg Cd/g cr, have in theory no risk
1.8%, above 10 µg Cd/g cr, are probably people under risk

We may guess that most of these people above 10 µg Cd/g cr, have nowadays been removed from exposed areas

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The distribution of Cd-B in EU-sites has been established using the data of
14 EU sites (2008), 16 EU sites (2009), 19 EU sites (2010) and 17 EU sites (2011)
2008 data representing a population of 1793 people:
74.3% of the people are in the green area (<2 µg/L Cd in blood) and
1.3% in the red area (>10 µg/L Cd in blood)
2009 data representing a population of 1883 people:
73.0% of the people are in the green area (<2 µg/L Cd in blood), and
1.1% in the red area (>10 µg/L Cd in blood)
2010 data representing a population of 2095 people:
73.4% of the people are in the green area (<2 µg/L Cd in blood), and
1.2% in the red area (>10 µg/L Cd in blood)
2011 data representing a population of 2409 people:
76.0% of the people are in the green area (<2 µg/L Cd in blood), and
0.9% in the red area (>10 µg/L Cd in blood)

The above mentioned data are based on various numbers of EU-sites included in the Cd biomonitoring. The data shown only with 15 EU-sites included in the Cd biomonitoring showed similar time trend.

Limitations of the OCdBio data:

- Follow-up on a cohort of which the size varies with time. Time trend can therefore be affected by the employee turnover
- No demographic data (age, gender)
- No data about smoking status and changes of smoking habits with time

It would be nice to have a nested database in parallel with info on the confounding factors and apply a multivariate analysis.

Conclusions:

- CdB: no significant time trend. A tendency to lower CdB levels (0-2 µg/L) appear in 2011 when considering all sites but this might be due to a change in cohort size.
- CdU: confirmation of a decreasing trend over time in the prevalence of elevated CdU values (>2µg/g cr and >5µg/g cr).
  We could hypothesize that in 2-3 years the data will show to be close to 5% of workers with CdU>5µg/g cr. , but still between 5-10 years ahead to reach the 95th percentile for workers with CdU<5µg/g cr.

Summary of the discussions (Trends analysis, comments and suggestions)

The question arises, and related to the definition of adequate control according to ECHA (95% below DNEL), how we can demonstrate this with the current biomonitoring data.

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It is indicated by the members that Pb consortium, as an example, has a DNEL expressed as Pb in blood and shows 95% of the workers has Pb blood below this DNEL.

How to demonstrate adequate control for Cadmium exposed workers related to this 95th percentile?
Some facts:

- DNEL respirable: 4 µg/m3 , so strictu sensu we should demonstrate adequate control for 95% of the workers (air measurement values <DNEL of 4µg/m3)
- Today most data are inhalable air measurements

It is agreed as a first step that we will start in the very near future with collecting air values (total/ inhalable or if available respirable) currently in place in our industry. A spread sheet (**OCdAir**) will be prepared by ICdA and sent to the involved industry parties. The aim is to develop a distribution graph indicating number of workers per level of exposure.

- Trend results (CdU) today are showing we are on the way of adequate control of the workers but we cannot yet 100% prove it. We hypothesize that the workers with CdU >5µg/g cr are related to the older workers and will retire in the near future.

It is proposed and discussed to collect extra data on age since the link age and level of CdU is missing.
This will be confirmed for an extension in the arrangements for OCdBio 5 (data 2012)

7-Settings for the 10th H&S committee and longer term planning

The date for the 11th H&S committee - theme to be determined later- was proposed for June 4th 2013.

It is again unanimously agreed that as key activity of the H&S Committee will remain the continuation of the OCdBio Observatory.

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