



Indoor Pollution in Nurseries



Laboratory of study and Prevention of Indoor pollution (LPI)

Public Hygiene in Hainaut
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Autoévaluation des Pollutions
Intérieures dans les crèche



With the Support of the Ministry of Social Affairs
and Health



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Laboratory of study and Prevention of Indoor pollution (LPI)

• The service exists since 2002
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Missions



- Support medical diagnosis when pathologies are suspected to be linked to IAQ
- Surveillance campaigns and programs (radon, mold, lead contamination...)
- Specific projects related for example to specific settings (nurseries, schools, workplaces, ...)



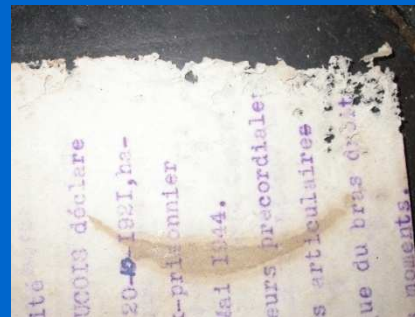
Hainaut Vigilance Sanitaire



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☑ Support medical diagnosis for private purposes

- On medical request (description of symptoms suspected to be linked to IAQ, serology testing results, ...) (free service (Public Service) to ensure social equalities)
 - > Home visit (IAQ enquiry, measurements and testings)
 - > Report presenting results from home visit and proposing recommendations (addressed to doctor and patient)



| | Tobacco | Combustion particles | CO | Radon | Dampness, mold, dust mites, bioaerosols | Chemicals (Formaldehyde, VOC's, Pb, ...) |
|---|---------|----------------------|----|-------|---|--|
| 1. Effects | | | | | | |
| Allergic and Asthma symptoms | ● | ● | | | ● | ● |
| Lung Cancer | ● | ● | | ● | | ● |
| Chronic obstruction pulmonary disease | ● | ● | | | ● | |
| Airborne respiratory infections | ● | ● | | | ● | |
| Cardiovascular morbidity and mortality | ● | ● | ● | | | |
| Odour and irritation | ● | ● | | | ● | ● |
| Others (liver, dermatologic, neurologic effects; other types of cancer, ...) | | | | | | ● |
| 3. Causes & Sources | | | | | | |
| Outdoor Air | | ● | ● | | ● | ● |
| Building/Equipment/Ventilation | ● | ● | ● | ● | ● | ● |
| Consumer products | | ● | | | | ● |
| Occupants behaviour & maintenance | ● | ● | ● | ● | ● | ● |
| 4. Policies | | | | | | |
| A.Gv.C.Fr. regulating "Nurseries" (Code related to quality of Nurseries) | | | | | | |
| + A.Gv.C.Fr. 09.07.2007 (Arrêté Infrastructure) mentioning specifically IAQ aspects | | | | | | |
| Housing Code (salubrity criteria refers to Health effects criteria), revision 2005-2006 | | | | | | |
| 5. Actions | | | | | | |
| Remediation | | | | | | |
| Awareness Raising | | | | | | |
| Training | | | | | | |



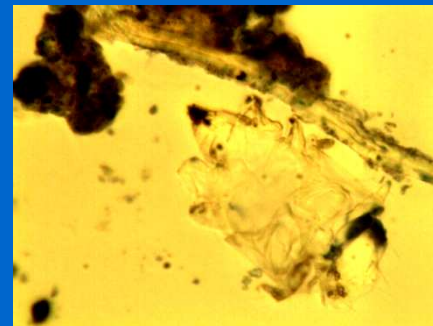
EnVIE Scheme



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☑ Collaboration with school doctors

- Free service on request from medical school inspection
 - School visit (can be linked to IAQ Home visit)
 - Report presenting results from school visit and proposing recommendations (addressed to school Doctor and Manager)



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☑ Collaboration with occupational doctors

- On request from an occupational health doctor
 - Site visit (can be linked to IAQ Home visit)
 - Report presenting exposure analysis results and proposing recommendations (addressed to occupational health Doctor and Company manager)



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☑ Surveillance Campaigns and Programs

- Collaboration with hospitals and Doctors for lead poisoning surveillance (free service)
 - › LPI proposes to the requesting Doctor a systematic analysis of lead sources at home (lead base paint, tajine dishes, khôl,...)
- Radon surveillance campaigns in areas with higher risk
- Mold surveillance campaigns in social housing

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Laboratory of study and prevention of indoor pollution (LPI)
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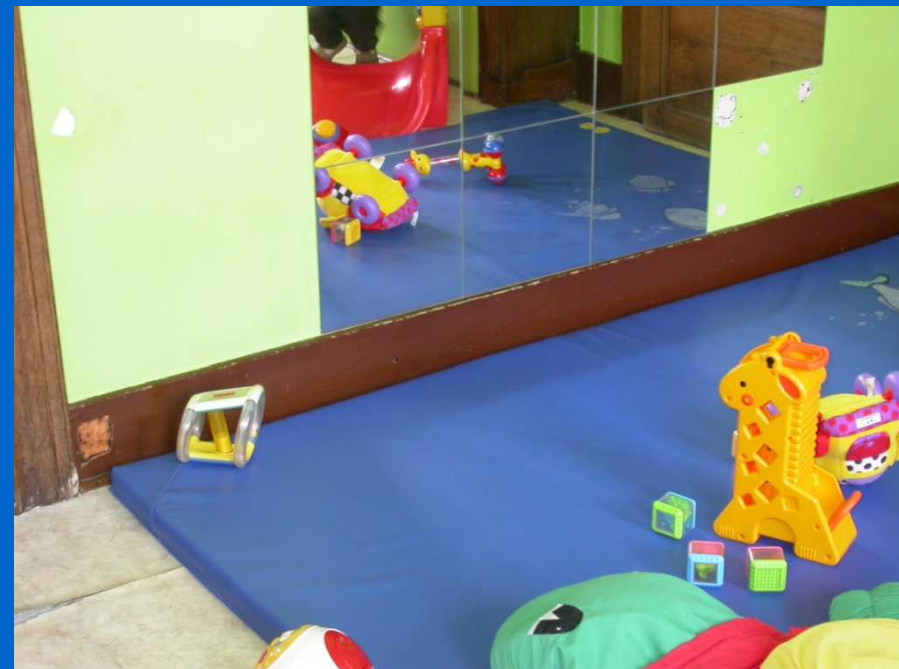
Results



➤ 80 % of positive effects on pathologies when appropriate actions have been undertaken

➤ More than 500 visits in the Hainaut Province since 2002

Nurseries project



AIMS :

1. Assess the quality of the indoor environment within agreed nurseries in the Hainaut Province (Belgium)
EXPOSURE
2. Establish relationship between children's health living whole day in nurseries and their indoor environment
EFFECTS
3. Provide practical recommendations of good practices allowing to reduce exposure of children to indoor environment
CAUSES & SOURCES
4. Develop specifications for the future
POLICIES

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Methodology ?...Partnership

- In partnership with the National Office of Childhood (ONE)
- 59 nurseries invited to participate
⇒46 voluntary nurseries (78 % participation)
- « Anonymous » participation (participation number)

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Methodology ?... Protocole

- **Environmental Protocol - EXPOSURE**
 - Measurement of ambient parameters (T°, Humidity)
 - Search for mold (per contact and in ambient air) and others allergens
 - Evaluation of bacterial contamination of surfaces
 - Search for legionella
 - Analyse of formaldehyde in ambient air
 - Analyse of VOC's in ambient air
 - CO Control
 - Asbest control
 - Assessment of radon level
- **Medical Enquiry** **EFFECTS**
- **Recommendations in order to improve children's environment** **CAUSES & SOURCES**

Environmental Protocole

Exposure

| | 2. Exposures | Tobacco | Combustion particles | CO | Radon | Dampness, mold, dust mites bioaerosols | Chemicals (Formaldehyde, VOC's, Pb, ...) | Legionella | Asbest |
|---|--------------|---------|----------------------|----|-------|--|--|------------|--------|
| 1. Effects | | | | | | | | | |
| Allergic and Asthma symptoms | | ● | ● | | | ● | ● | | |
| Lung Cancer | | ● | ● | | ● | | | | ● |
| Chronic obstruction pulmonary disease | | ● | ● | | | ● | | | |
| Airborne respiratory infections | | ● | ● | | | ● | | ● | |
| Cardiovascular morbidity and mortality | | ● | ● | ● | | | | | |
| Odour and irritation | | ● | ● | | | ● | ● | | |
| Others (liver, dermatologic, neurologic effects; other types of cancer, ...) | | | | | | | ● | | |
| 3. Causes & Sources | | | | | | | | | |
| Outdoor Air | | | ● | ● | | ● | ● | | |
| Building/Equipment/Ventilation | | ● | ● | ● | ● | ● | ● | ● | ● |
| Consumer products | | | ● | | | | ● | | ● |
| Occupants behaviour & maintenance | | ● | ● | ● | ● | ● | ● | ● | ● |
| 4. Policies | | | | | | | | | |
| A.Gv.C.Fr. regulating "Nurseries" (Code related to quality of Nurseries) | | | | | | | | | |
| + A.Gv.C.Fr. 09.07.2007 (Arrêté Infrastructure) mentioning specifically IAQ aspects | | | | | | | | | |
| Housing Code (salubrity criteria refers to Health effects criteria), revision 2005-2006 | | | | | | | | | |
| 5. Actions | | | | | | | | | |
| Remediation | | | | | | | | | |
| Awareness Raising | | | | | | | | | |
| Training | | | | | | | | | |

CO ?

Exposure



From inside, the air entrance is not clear !



From the outside, the size of the air inlet is barely 20 cm sur 20 cm



Looking closely at the air inlet, it is not clear

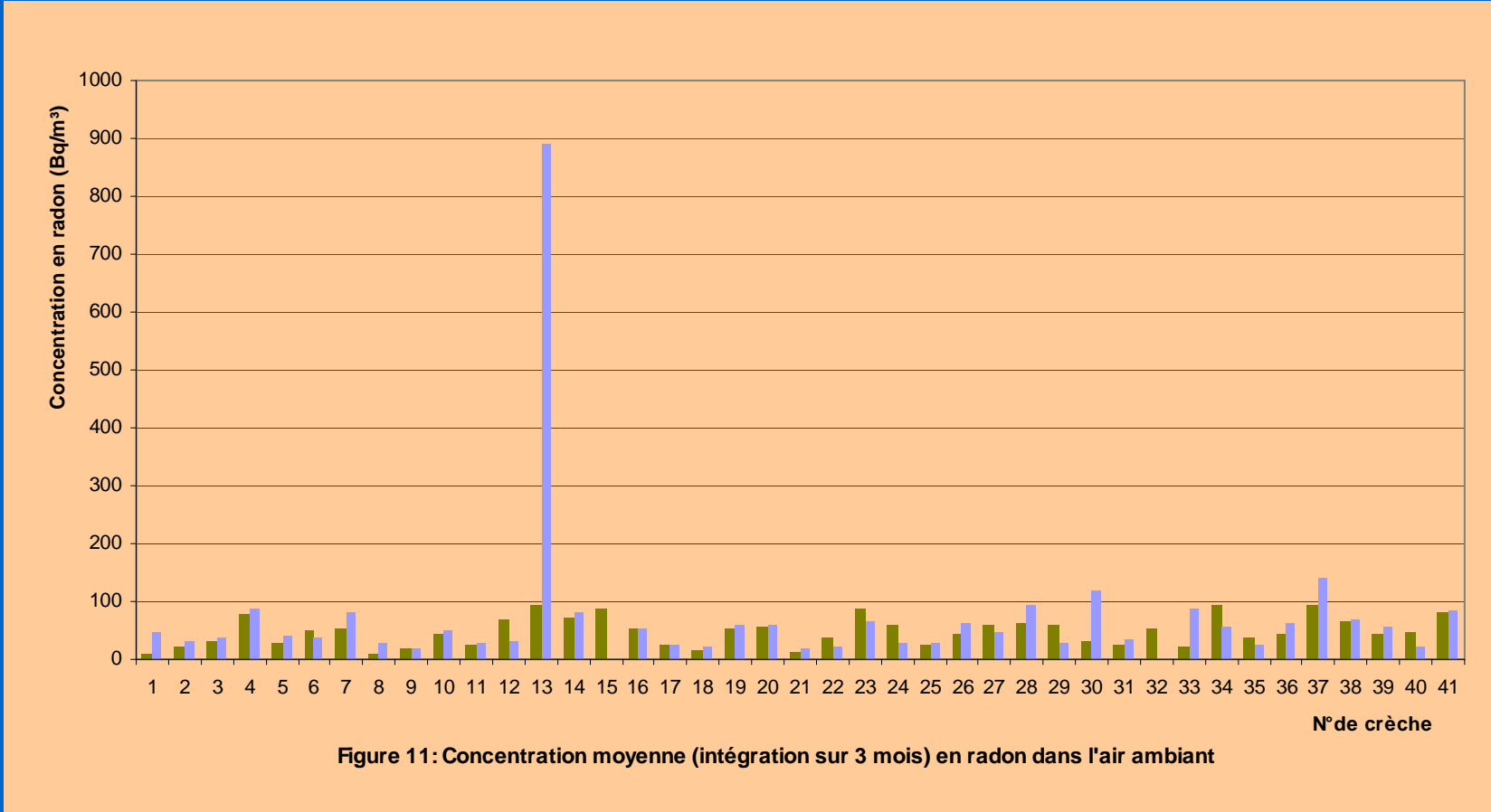
1 nursery with potential high risk

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Exposure

Radon ?

... 1 nursery largely above country average of 53 Bq/m³



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Mold ? (Air and surface identification)

Comparison between indoor and outdoor fungic burden

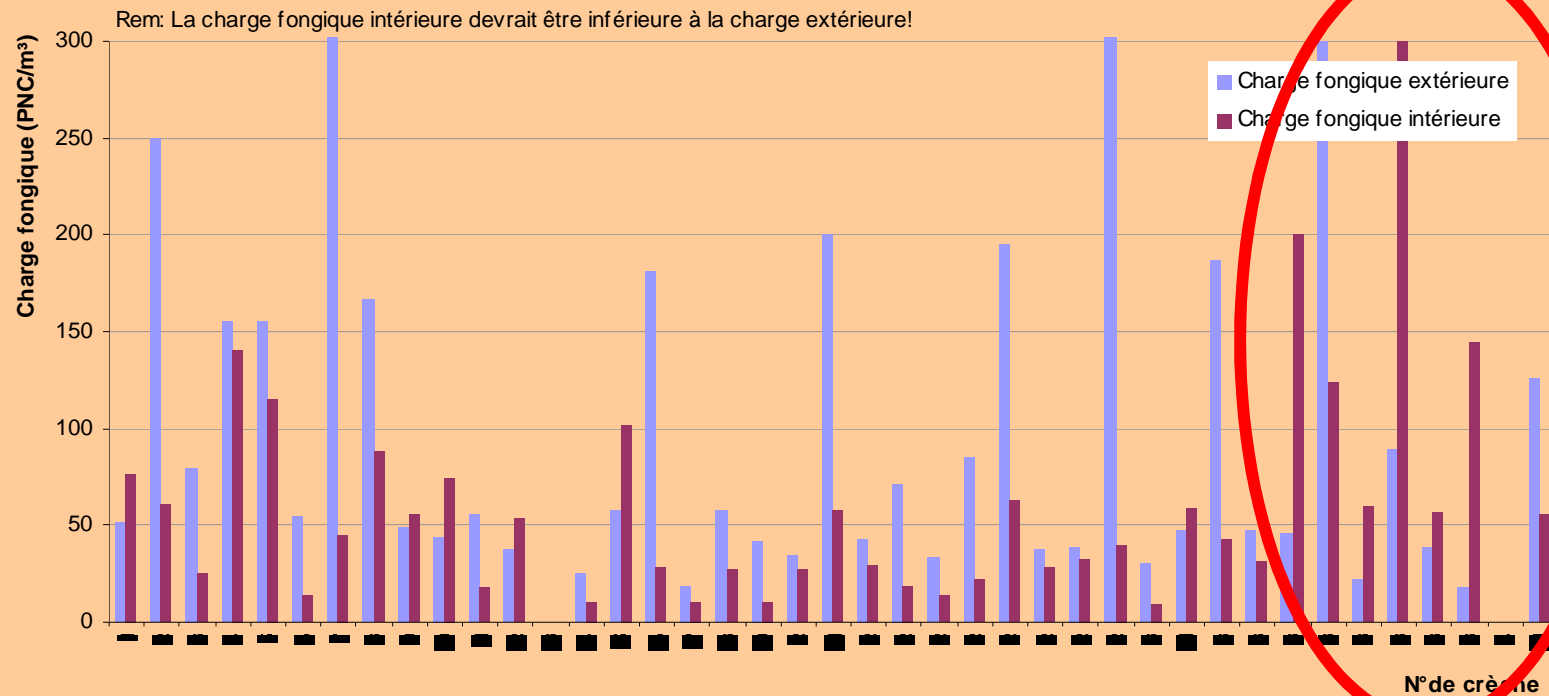
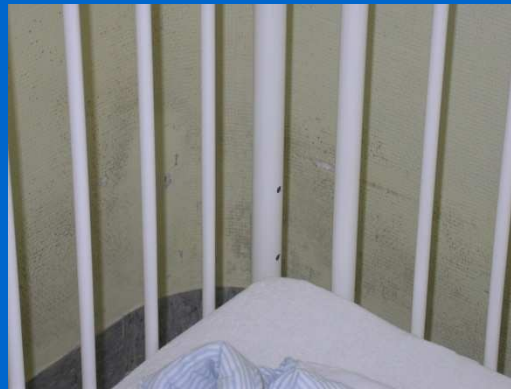


Figure 4: Comparaison entre les charges fongiques intérieure (la plus élevée) et extérieure



Penicillium sp.



Aspergillus sp.

Some « lockers » with hand towels often contaminated



Others, better designed allow to avoid mold development



Mold ?

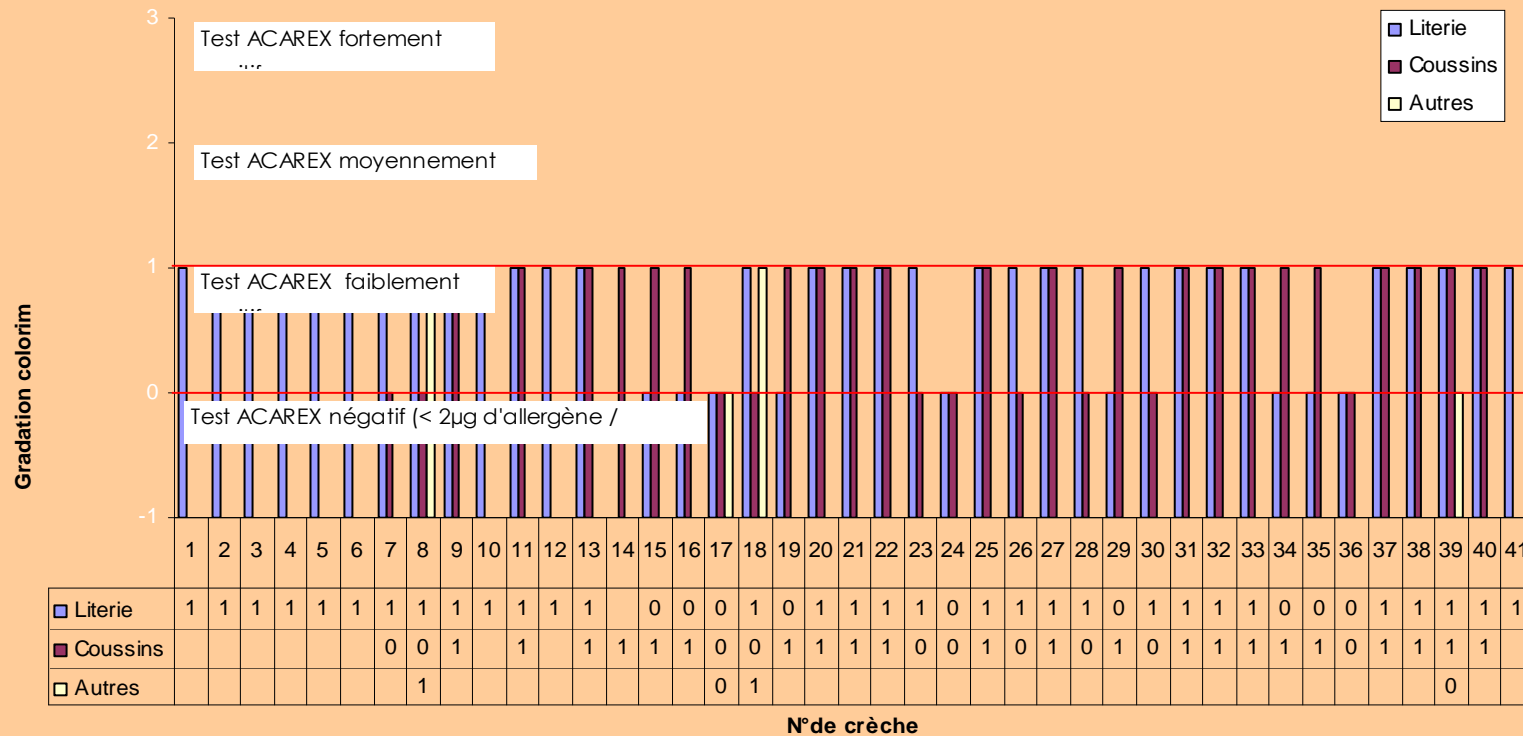
...Observed in about 30 % of the nurseries



Other allergens ?

Exposures

Contamination par les allergènes d'acariens



Bacterial contamination of surfaces ?

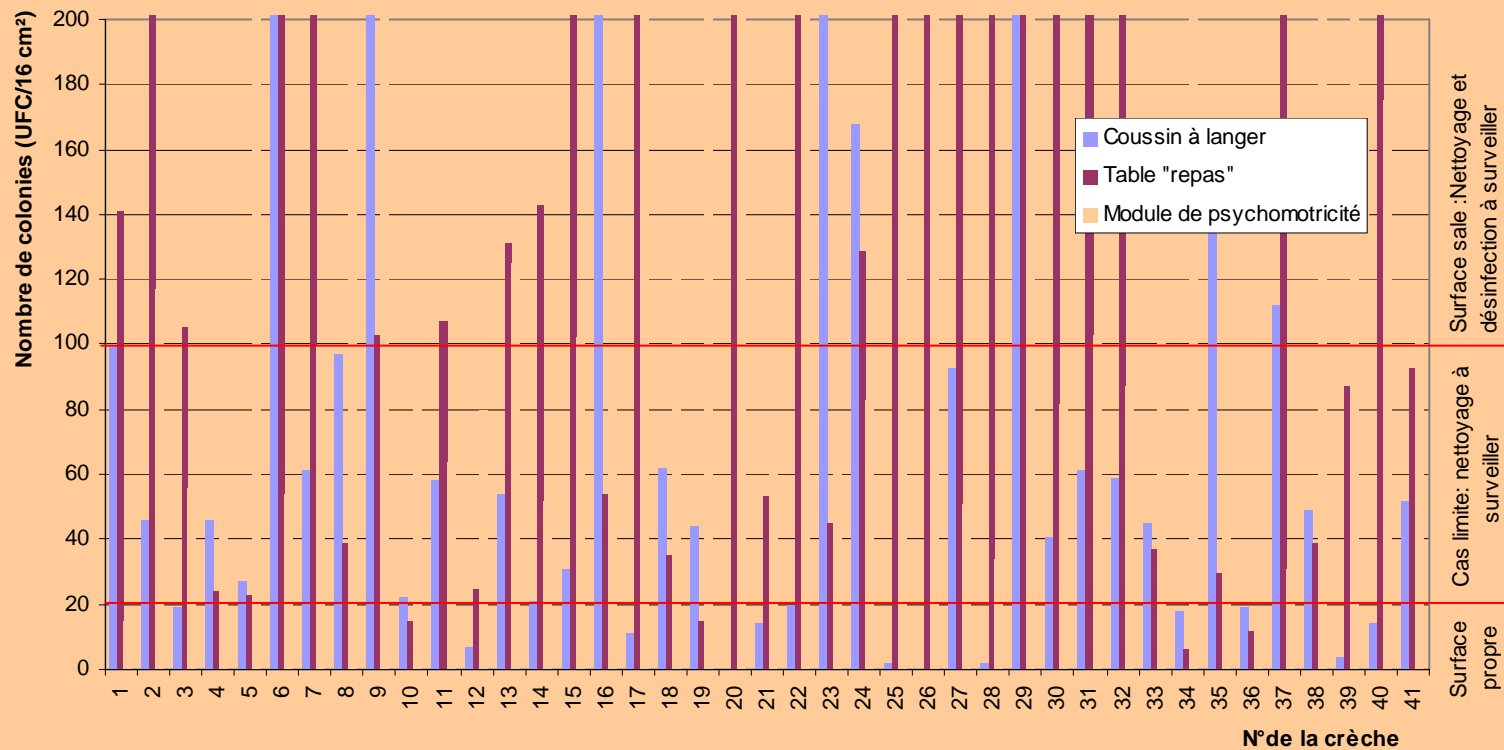


Figure 5: Contamination bactérienne des surfaces

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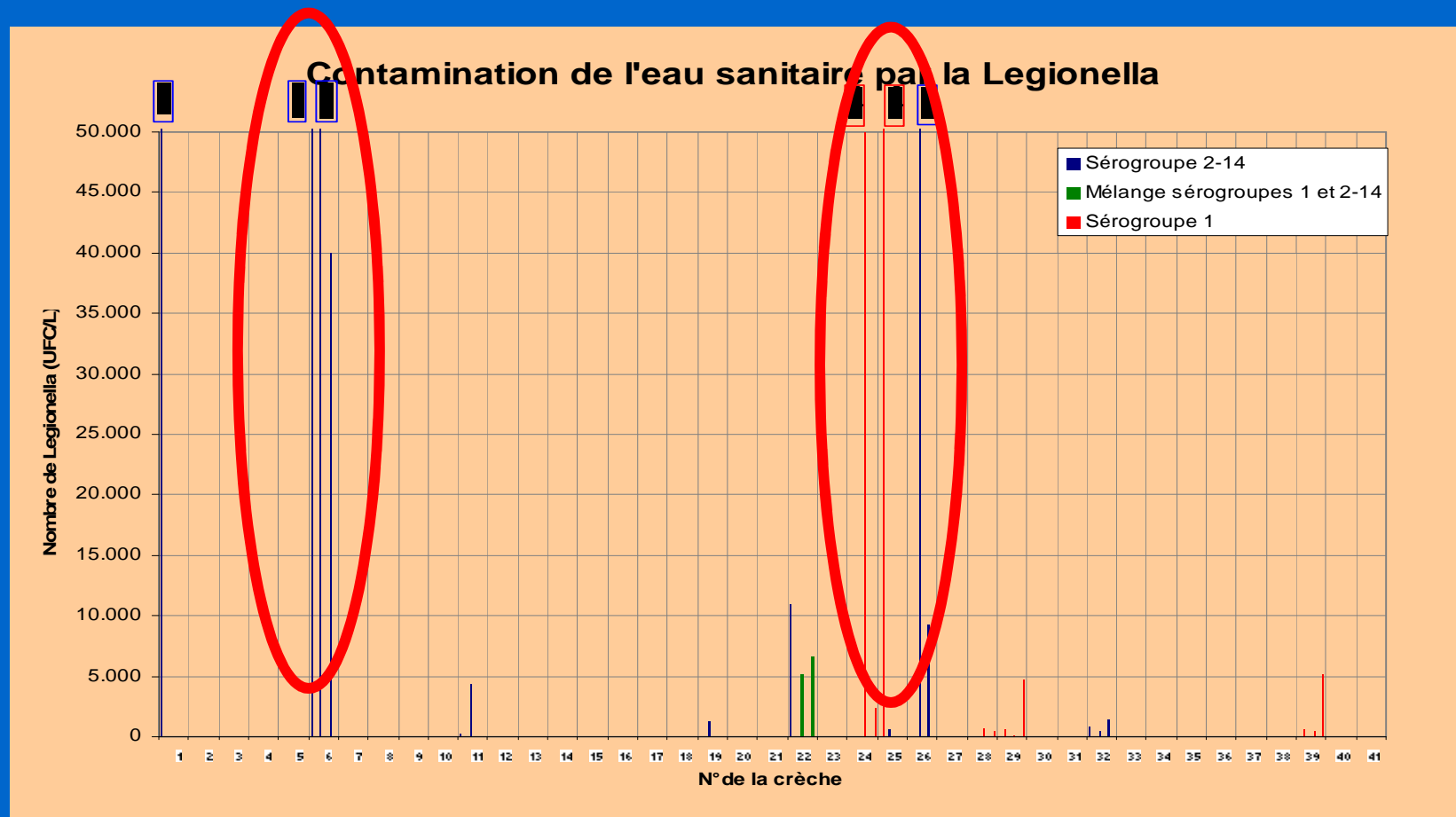


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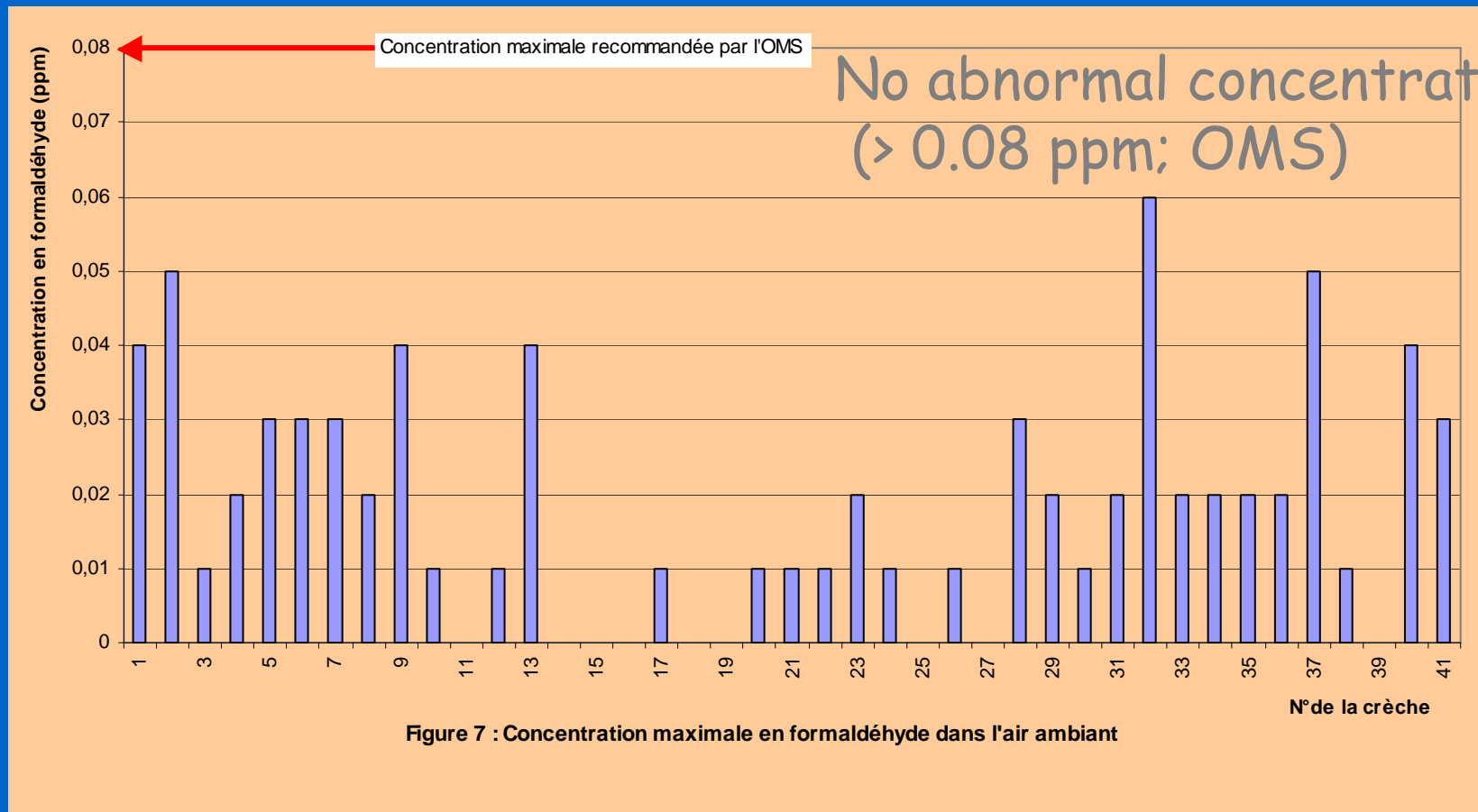
Legionnella ?



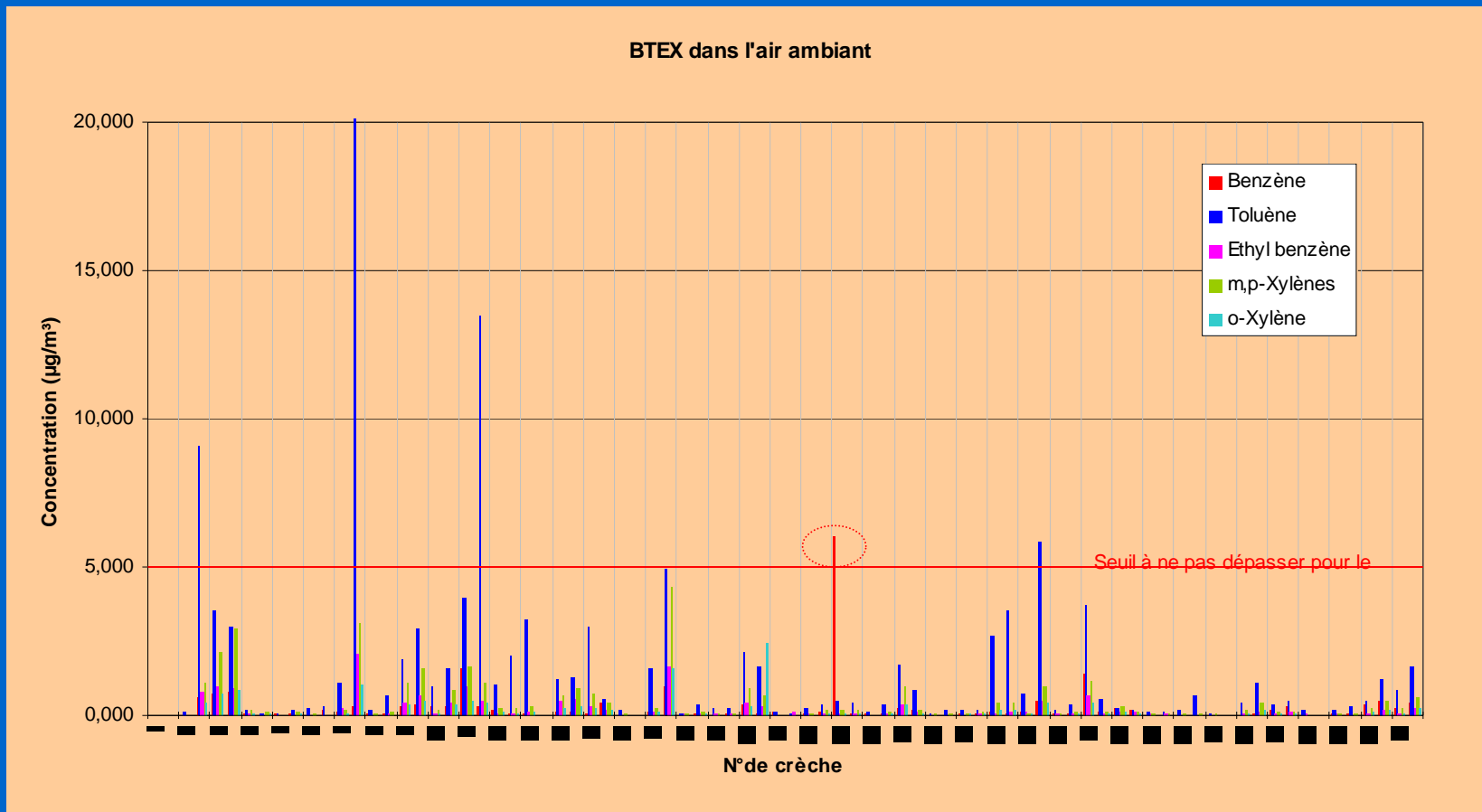
... about 30 % contaminated
by *Legionella pneumophila*



Formaldehyde in ambient air ?



VOC's ?... no abnormal concentrations



VOC's ?



In the basement, storage and maintenance of gardening material



Pipes conduct air emissions towards the kids sleeping room . High levels of toluene have been highlighted.

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Exposures

Pb in water ?

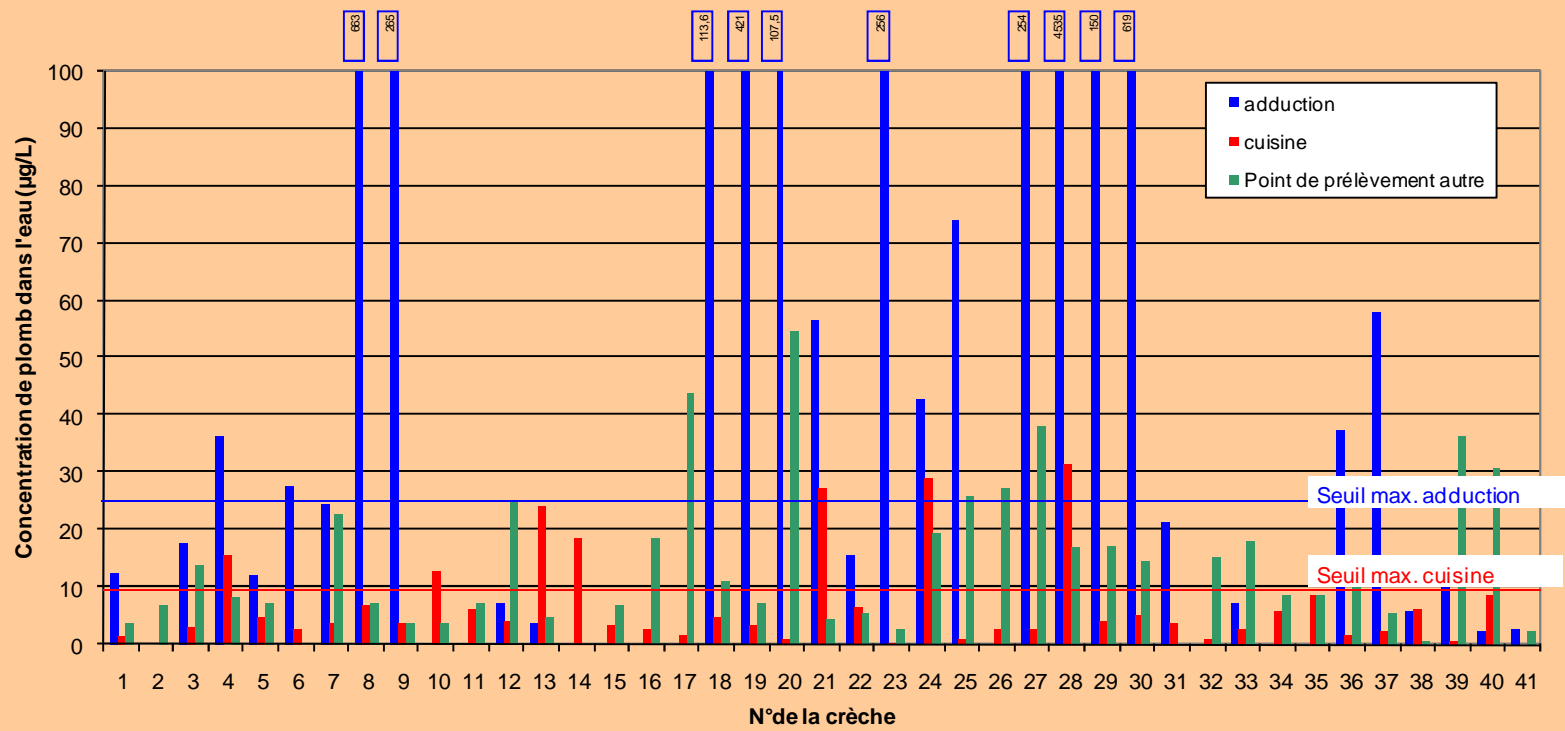


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- 44%: 18 nurseries (on 41) presented a concentration $> 25 \mu\text{g/l}$ of lead at the adduction
(Arr. Gouvernement wallon janvier 2004 fixe la concentration de plomb à $10 \mu\text{g/L}$ et tolère $25 \mu\text{g/L}$ jusqu'en 2013).
- 17%: 7 nurseries (on 41) presented a concentration $>$ supérieure à $10 \mu\text{g/l}$ of lead in the kitchen *(Arr. Royal de janvier 2002 qui fixe la concentration maximale admissible à $10 \mu\text{g/L}$).*

Plomb dans l'eau de distribution



Lead based paint ?



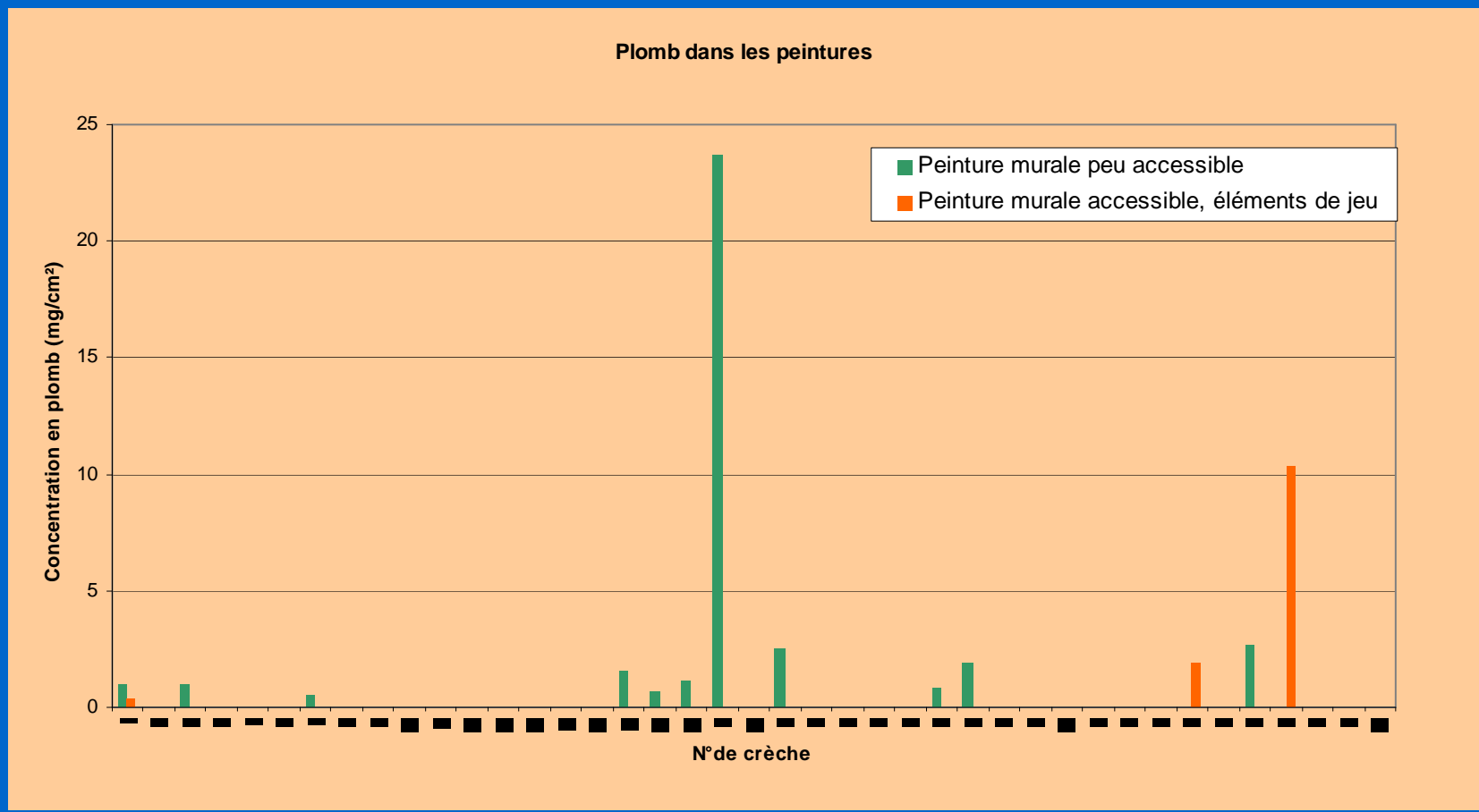
Painting or material presenting an immediate risk of contamination for children



Painting containing lead but not representing an immediate risk (inaccessible or smooth surface)



... a few cases



Asbest ?



In this case, the partial destruction of the insulation makes the asbest accessible to children since clean curtains and sheets are store in the basement



The « encapsulation » and identification with appropriate labelling are not sufficient measures.. « Wild » interventions have been undertaken on the pipes.



→ Suspected into 6 nurseries

→ confirmed in 3

Medical enquiry

- Anonymous questionnaire addressed to parents
 - Pathologies during last 3 months ?
 - Medication consumption during last 3 months ?
- For 1950 children
 - > 844 returned questionnaires
- Difficulty to make a relation between problems identified and pathologies due to a lack of answers into « problematic » nurseries

Recommendations

- Ensure higher ventilation
- Clean mold & example of good practices
- Choice of textile and cleaning process
- Surface disinfection process & choice of adequate products
- Surveillance of combusting installations
- Thermal or chemical sanitation process and further control of legionella
- Choice of building material
- Proposal of indoor pollution prior nursery installation
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Follow-up of the project...

- Each nursery has received a report including recommendations proposals in order to reduce exposure of children to indoor environment
- The National Office of Childhood (ONE) committed to ensure that nurseries would implement actions
- The LPI re-visited the nurseries after implementation of the action plan and sent his report to the National Office of Childhood (ONE)
- In some cases: communication problems

Causes & Sources

Example of remediation :

Radon has been detected in 1 nursery : levels of 692 à 891 Bq/m³ have been detected in the babies sleeping room



After experimentation, an efficient remediation process has been proposed: the cellar has been placed under pressure through a powerful extraction installation, which has been placed on an existing ventilation opening.

After 2 weeks, radon has been measured in different places within the nursery : levels were then below 20 Bq/m³.

The radon level detected in the cellar was 5000 Bq/m³.



1. Effects

2. Exposures

| | Tobacco | Combustion particles | CO | Radon | Dampness, mold, dust mites, bioaerosols | Chemicals (Formaldehyde, VOC's, Pb, ...) | Legionella | Asbest |
|--|---------|----------------------|----|-------|---|--|------------|--------|
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| Lung Cancer | ● | ● | | ● | | | | ● |
| Chronic obstruction pulmonary disease | ● | ● | | | ● | | | |
| Airborne respiratory infections | ● | ● | | | ● | | ● | |
| Cardiovascular morbidity and mortality | ● | ● | ● | | | | | |
| Odour and irritation | ● | ● | | | ● | ● | | |
| Others (liver, dermatologic, neurologic effects; other types of cancer, ...) | | | | | | ● | | |

3. Causes & Sources

| | Tobacco | Combustion particles | CO | Radon | Dampness, mold, dust mites, bioaerosols | Chemicals (Formaldehyde, VOC's, Pb, ...) | Legionella | Asbest |
|-----------------------------------|---------|----------------------|----|-------|---|--|------------|--------|
| Outdoor Air | | ● | ● | | ● | ● | | |
| Building/Equipment/Ventilation | ● | ● | ● | ● | ● | ● | ● | ● |
| Consumer products | | ● | | | | ● | | ● |
| Occupants behaviour & maintenance | ● | ● | ● | ● | ● | ● | ● | ● |

4. Policies

A.Gv.C.Fr. regulating "Nurseries" (Code related to quality of Nurseries)
+ A.Gv.C.Fr. 09.07.2007 (Arrêté Infrastructure) mentioning specifically IAQ aspects
Housing Code (salubrity criteria refers to Health effects criteria), revision 2005-2006

5. Actions

Remediation
Awareness Raising
Training

National Belgian project

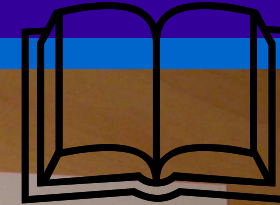
Aims of the project

- Highlight problems and trends among
 - ✓ 600 nurseries « visible side » of IAQ
 - through auto-assessment tool and explaining guide
 - ✓ 25 nurseries : « invisible side » of IAQ (testing)
 - through testing
- Propose targeted and general best practices recommendations
- Encourage awareness raising related to IAQ
- Enhance empowerment of the implementation process of the proposed recommendations

Actions



Nurseries « toolkit »



37. Quelle est la méthode et la fréquence de lavage des sols?
(Plusieurs réponses sont possibles)
[1137]

| | Tous les jours | 2-3 fois par semaine | Moins d'une fois par semaine |
|---|--------------------------|--------------------------|------------------------------|
| A l'eau | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A l'eau et au savon noir ou autre détergent sans odeur | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Avec des détergents parfumés | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Utilisation d'un désinfectant au moment ou après le lavage | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A sec avec un balai ou aspirateur ordinaire (sans filtre HEPA) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| A sec avec un aspirateur équipé d'un filtre HEPA | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Avec une lingette imprégnée (de type « Swiffer » ou équivalent) | <input type="checkbox"/> | <input type="checkbox"/> | Ne sait pas |
| Lustrage avec une cireuse | | Jetables | <input type="checkbox"/> |

38. Vos lavettes et éponges de nettoyage des tables à manger sont-elles ?
[1138]

| | Pas lavées tous les jours | Lavées quotidiennement | Jetables | Ne sait pas |
|---|---------------------------|--------------------------|--------------------------|--------------------------|
| En matériaux poreux (bois naturel par ex.) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| En matériaux lisses et non poreux (plastique par ex.) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Ne sait pas |

39. Les surfaces des tables des repas sont-elles ?
[1139]

| | Oui | Non | Ne sait pas |
|---|--------------------------|--------------------------|--------------------------|
| Les puéricultrices se lavent-elles systématiquement les mains avec un savon et/ou un produit désinfectant entre chaque change ? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

40. Les puéricultrices se lavent-elles systématiquement les mains avec un savon et/ou un produit désinfectant entre chaque change ?
[1140]

| | Oui | Non | Ne sait pas |
|--|--------------------------|--------------------------|--------------------------|
| Possédez-vous des bacs à sable à l'extérieur du bâtiment ? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Changez-vous le sable tous les ans ? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Couvrez-vous vos bacs à sable par un revêtement hermétique ? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

41. Possédez-vous des bacs à sable à l'extérieur du bâtiment ?
[1141]

42. Changez-vous le sable tous les ans ?
[1142]

43. Couvrez-vous vos bacs à sable par un revêtement hermétique ?
[1143]

37 Si votre produit d'entretien contient déjà un désinfectant, réévaluez-vous à : « utilisation d'un désinfectant au moment ou après le lavage ». Le filtre HEPA (Haute Efficacité pour les Particules Aériennes) qui équipe certains aspirateurs doit être remplacé chaque année pour être efficace. Sa présence est indiquée sur l'aspirateur. La lingette est un film en papier qui se fixe sur un balai approprié.

38 Par lavage, on entend : « laver en machine à haute température ».

39 Une surface lisse et non poreuse est, par exemple : du plastique, du bois stratifié ou mélaminé (plastifié), du métal... Une surface poreuse est essentiellement représentée par le bois naturel (non traité) ou un revêtement très usé.

42 Si vous changez le sable tous les 2 ans ou plus, répondez « NON ».

43 Certains bacs à sable en plastique sont équipés d'un couvercle qui protège le sable des intempéries lorsqu'il n'est pas utilisé. Une bâche en plastique peut assurer la même protection hermétique.

48 Dans la catégorie « travaux de peinture », le moindre travail de mise en peinture doit être pris en considération. Pour la catégorie « pose de revêtements de sol », il faut distinguer le linoléum vitrifié du linoléum naturel. Le linoléum vitrifié est traité avec un revêtement plastifiant qui est appliqué avec une cireuse ; il a une apparence brillante alors que le linoléum naturel est mat.

51 On peut considérer que le système de chauffage est en contact avec une ou plusieurs pièces de la crèche lorsque l'accès à la chaufferie est possible par une porte qui ouvre sur l'intérieur de la crèche. Ceci est d'autant plus évident lorsque la chaudière ou le chauffe-eau est installé directement dans la crèche.

52 Adressez-vous au service technique qui doit normalement archiver les preuves d'entretien.

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Département Prévention-Santé
Université Antwerpen

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Université Antwerpen



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13. Indiquez dans quelles pièces, il y a des fenêtres (et/ou portes vitrées) donnant sur l'extérieur ? et si on peut les ouvrir ?

13

| | Pas de fenêtre dans au moins une pièce | Fenêtre existante mais impossible à ouvrir dans au moins une pièce | Existant et possible de les ouvrir dans toutes les pièces |
|--------------------------|--|--|---|
| Salle(s) de jeu | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Dortoir(s) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Cuisine(s) | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Salle(s) de bain | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Salle(s) à manger | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Locaux administratifs | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| Salle(s) de consultation | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

14. Les pièces suivantes sont-elles complètement séparées des autres pièces et fermées (par des portes maintenues fermées par ex.) ?

14

Non, au moins l'une des pièces n'est pas complètement séparée des autres pièces et fermée

Oui, chaque pièce est complètement séparée des autres pièces et fermée

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Obstacles

- Communication
- Responsibilities

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Conclusions ... Future needs

- Importance to ensure communication through adequate channels and means (ex. « learning by doing tools ») in order to tackle:
 - inequalities
 - reach parents at early stages of childhood
 - induce behavioural changes
- Develop clear building guidelines (! Also in case of improvement works)
- Develop strict policies in term of labelling (make the link with REACH policy (ex. of « anti-dust mites » matras))
- Provide means to ensure follow-up after intervention (in term of pathologies)

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Thank you for your attention

Autoévaluation des Pollutions
Intérieures dans les crèches



Hainaut Vigilance Sanitaire



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