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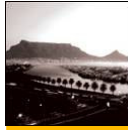


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## **Legionnaires Disease Case investigation – An Environmental Health Perspective**

PRESENTATION TO :  
Legionnaires Disease Symposium  
12 May 2011  
Cape Town Civic Centre  
Presented by: Ian Gildenhuys



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## CONTENT

- What is Legionellosis ?
- Causative Agent
- What about Legionnaires Disease is of interest to EHP's
- Known outbreaks of Legionella pneumophila
- Case Investigations within City of Cape Town 2009
- Phase 1 Investigation
- Phase Two Investigation
- Sampling Results and findings
- Outbreak prevention
- Conclusion



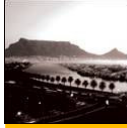
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## WHAT IS LEGIONNAIRES DISEASE OR LEGIONELLOSIS

- **Primarily a respiratory illness.**
- **Causes a mild flu like symptoms (Pontiac Fever) or**
- **Severe Respiratory disease – causing acute pneumonia ( Legionellosis) with possible permanent damage.**
- **Possible long term debilitating effects to:**
- **Kidneys and other organs**
- **Nervous System – Brain Damage can result.**



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## Causative agent: *Legionella pneumophila*

- A Gram-negative,
- Heterotrophic,
- Aerobic
- Transitionally motile
- Rod shaped
- 1 Micrometer long and <sup>C5</sup> half as wide



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## What about *Legionella pneumophila* is of interest to EHP's

- Thermo tolerant
- Grows in water temp. 20 – 60 degrees C
- 37 – 45 degrees C ideal growth range
- It is found naturally in aquatic systems
- Is known to colonize <sup>C6</sup> built water systems
  - HVAC cooling towers
  - Humidifiers
  - Water features/ Spa Baths
  - Building hot & cold water systems
  - Dental Lines in Dental Surgeries



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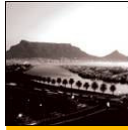
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## About Legionella pneumophila cont..

- **Parasitic**
  - Grows in biofilm in water pipes,
  - parasitizing aquatic host organism ie Amoeba.
  - Can incidentally infect human phagocytic cells including Alveolar Macrophage and Alveolar Epithelial Cells<sup>C7</sup>
  - 48 known species of Legionella, more than half of which are known to be pathogenic to humans
  - Serotyping can assist identifying infection source



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## MODE OF TRANSMISSION

- It is not transmissible from person to person
- One must inhale the infected droplet nuclei from a contaminated water source
- It is entirely environmental factors that result in infections
- It is thus preventable!

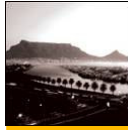
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## Known Outbreaks of Legionellosis or Legionnaires Disease

- The first known outbreak occurred at the 1976 “American Legion” Convention, Philadelphia.
- It resulted in 221 cases and 34 deaths
- The causative agent for the outbreak was discovered by the US CDC in 1977 and named Legionella pneumophila
- Numerous well documented outbreaks have since occurred around the world.



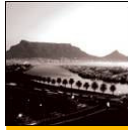
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## WHO IS LIKELY TO CONTRACT LEGIONNAIRS DISEASE

- **ANYONE, BUT MORE LIKELY:.....**
- **SMOKERS;**
- **ALCOHOLICS;**
- **MALES OVER 40 yrs TWICE AS LIKELY AS FEMALES!!**
- **IMMUNOCOMPROMISED or**
- **PATIENTS ON IMMUNE SUPPRESSIVE MEDICATION – Cortico Steroids etc**
- **NOSOCOMIAL (HOSPITAL ACQUIRED) INFECTIONS MORE COMMON**



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## CASE INVESTIGATIONS CoCT 2009

- In RSA it is a listed Notifiable Medical Condition in terms of R 328/1991

The patient - 35 yr old female, Dental Receptionist – resided in Elsie's River and worked in a large multi-storied Building which also happens to be a private Hospital

- Established case history, in terms of Time, Place and Person
- Investigated:
- Possible exposures to infected droplet nuclei through:
- Aircon plant; Water Features; domestic and work building water systems – Hot & Cold



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## Case Investigation cont.. Phase 1 investigation

- Assemble necessary investigative expertise.
- Full facility walk through inspection,
- Noting:
- Condition of Mech. Ventilation Plant
- Its location in relation to fresh air inlet system
- Whether the facility has a Legionnaires monitoring program in place? If so what are the results?
- Are the samples representative?





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## CASE INVESTIGATIONS CoCT 2009



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## Phase 1 investigation cont..



Check interior of roof  
Water tanks for scale,  
rust & biofilm

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## Check buildings hot water supply infrastructure



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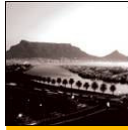


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## Check water supply end point fixtures



Check Shower heads  
& tap splash arrestors  
for biofilm build-up &  
temperature of water



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## Case Investigation cont.. Phase 2 investigation

- Plan and implement sampling program:
- We initially focused on:
  - Patients place of residence <sup>C10</sup>
  - The Dental Practice where the patient worked and sampled some outer lying sample points in the building.
  - Tried to identify possible sources of infection



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## Case Investigation cont.. Phase 2 investigation



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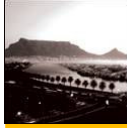
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**Sampling results received 30/01/09 - of the 13 samples taken, four sample points showed the presence of Legionella**

Sample number / Point:	Result:
Patients place of residence	Negative for Legionella
CCT/W/XXX/4 2 <sup>nd</sup> Kitchen Hot Tap <sup>C13</sup>	1000 CFU/Litre Legionella pneumophila serogroup 1
CCT/W/XXX/6 Oral Hyg – Hot Tap	1200 CFU/Litre Legionella pneumophila serogroup 1
CCT/W/XXX/8 Dr XXXX Hot Tap	200 CFU/Litre Legionella pneumophila serogroup 1
CCT/W/XXX/10 Accounts Kitchen Hot Tap	18 000 CFU/Litre Legionella pneumophila serogroup 2 – 14



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**Further Samples were taken on 05/02/09 focusing on the remainder of the building to assess the extent of the problem.**

**All other sample points came back negative for Legionella <sup>C16</sup> Pointing to the Mezzanine Floor as the problem area**

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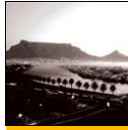
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## **CASE INVESTIGATION – OUTBREAK PREVENTION**

- An urgent meeting between City Health and the Hospitals Management Team – GM; Maintenance Manager & Infection Control Sr.
- Obtained specialist input from Dr Neil Cameron
- We resolved on action plan & way forward included:
  - Heat shock treatment of the Hot Water System
  - Hospitals boiler temp was gradually raised to 65 degrees then to 70 degrees C and maintained as such for approximately 12hrs.



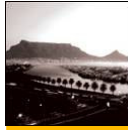
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## **CASE INVESTIGATION – OUTBREAK PREVENTION Cont...**

- Special precautions were taken to:
  - Communicated to all section heads/ Nursing Staff
  - Prevent Patient scalding by steam
  - Protect Maintenance crew from Occupational hazards. PPE were worn – N95 Respirator masks, Gloves and disinfectant was sprayed, Alcohol disinfectant hand rub etc
  - Every tap aerator/ shower head in the hospital and dental surgery was then removed, cleaned, disinfected with Hibitane
  - Then hot flushing each point at above 60 degrees C for 25 minutes
  - Then reassembled.



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**Follow-up Sampling received 23/02/09 - of the 14 samples taken, two sample points showed the presence of Legionella – Serious head scratching followed!!!**

Sample number / Point: <sup>C17</sup>	Result:
CCT/W/XXX/8 Dr XXXX Cold Tap	400 CFU/Litre Legionella pneumophila serogroup 1
CCT/W/XXX/10 Accounts Kitchen Hot Tap	8 800 CFU/Litre Legionella pneumophila serogroup 2 – 14



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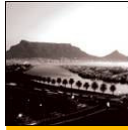
### **CASE INV Cont...**

- The hospital subsequently called in their National Head of Technical Services who flew down from JHB
- Root Cause Analysis was conducted.
- Which included full tracing of all Hot water supply lines to the Mezzanine floor, in roof spaces etc
- Doing ten second interval temperature measurements at hot water taps ( Found to be at 46 – 47 degrees C)
- Assessing temperature of cold water lines (found to be at 24 degrees C)

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## CASE INVESTIGATION – Findings:

- Fault findings included:
  - Faulty temperature thermostat at Hot Water Boiler,
  - Faulty temperature gauge to Boiler,
  - Faulty non-return valves,
  - Faulty hot water return pumps for Boiler
  - Cold water supply lines in roof space lacked insulation lagging
- All these findings contributed to reducing the hot water supply temperature to fixtures and increasing the cold water supply temperatures to within Legionella spp. ideal growth range.
- Immediate actions were taken to address short comings.



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**Follow-up Sampling results received 20/05/09 - of the 5 samples taken.....**

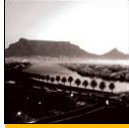
**All came back negative for Legionella**

**Persistence Pa<sub>C18</sub>!!**

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## ONUS OF PREVENTION

- Legionellosis is an entirely preventable disease
- It is a listed Class Two Hazardous Biological Agent in the Hazardous Biological Agents regulations R 1390/2001 promulgated in terms of the OHS Act.
- This implies a duty of care on every self-employed person or employer to take steps to prevent its spread.
- Prevention is best ensured through:
  - Either the use of WHO Water Safety Plan approach or
  - HACCP



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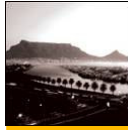
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## STANDARDS FOR LEGIONELLA

- IN RSA THERE ARE NO PUBLISHED STANDARDS
- INTERNATIONALLY STANDARDS VARY
- THE DOSE RESPONSE RELATIONSHIP IS NOT WELL UNDERSTOOD
- GUIDELINES:
  - US DEPT. OF LABOUR OSHA Technical Manual
- SUGGESTS:

CFU Legionella / ml

Action	Cooling Tower	Domestic Water	Humidifier
Level 1	100/ml	10/ml	1/ml
Level 2	1000/ml	100/ml	10/ml



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## STANDARDS Cont...

- Action Levels :
- Level 1 – Prompt cleaning and or Biocide treatment of system
- Level 2 – Immediate cleaning and or biocide treatment. Take steps to prevent employee exposure.
- Note: These standards are based on a number of assumption
- The ideal standard to strive for is zero Legionella /ml



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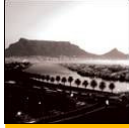


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## CONCLUSION



- *Legionella organisms are known to have caused major outbreaks of Legionellosis worldwide.*
- *The organism is capable causing severe illness, disability and death*
- *A cooperative, multi-skilled team effort is essential to prevent major outbreaks*
- *All parties need to bring their A game to the table when large communal building infrastructure is involved.*
- *Good communication is essential*
- *Persistence pays off more often than not!*
- *RSA standards are needed.*
- *Preventative policy direction is needed from the authorities and building managers*



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**LADIES AND GENTLEMENT**

**THANK YOU**

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