



Auckland Regional Dental Service

## Pukekohe Intermediate Dental Clinic – air supply water contamination

### Glossary

|       |                                        |
|-------|----------------------------------------|
| ARDS  | Auckland Regional Dental Service       |
| CMDHB | Counties Manukau District Health Board |
| TDU   | Transportable Dental Unit              |

### Report Summary

This report describes the incident, the key findings and the corrective actions arising from the January 2017 air supply water contamination in the Pukekohe Intermediate Dental Clinic.

At approximately 12:20 pm on Monday 23 January 2017, employees at the Pukekohe Intermediate Dental Clinic were alerted to a potential contamination of air supply used to supply the dental rooms. Staff observed that water was coming from the air supply button on a triple syringe (dental equipment), the dental chair and the cart. A service technician was called to the clinic and found that a redundant hose, left behind from a loan suction pump, had been attached to the air compressor intake with the other end secured in a grey water tundish, allowing the grey water to be sucked into the air compressor air receiver, then into the clinic air supply.

The compressor and air supply to the surgeries were isolated immediately and clinic employees were advised to cease use of all dental equipment.

Appropriate actions were taken to contain the situation; Plan and manage the contact tracing and communication with the patients and whanau affected; and investigate the cause of the problem.

Pukekohe Intermediate Dental Clinic ceased all operation on that day (and remains temporarily closed). Immediate action over the following 24 hours was to transfer appointments for children needing treatments to alternative clinics in the immediate district.

The Auckland Regional Dental Service [ARDS] area Team Leader advised the ARDS regional managers of the incident. After initial assessment, notification of the incident was made to key agencies i.e. Waitemata District Health Board management as the dental clinic staff are employees of this DHB; Counties Manukau District Health Board since the facility is owned by Counties Manukau District Health Board; Ministry of Health and WorkSafe New Zealand.

After initial assessment, an emergency response process was initiated, led by Counties Manukau District Health Board. An Incident Management Team was established and decisions made about the need for contact tracing, communication with parents and key

agencies. A conservative decision was made to test 2100 children who had received treatment in the clinic over previous months, as it could not be immediately ascertained how long children had been exposed to the grey water discharge.

An independent technical investigator, Mike Schulze of Construct Health Limited, was contracted to establish the cause of the contamination (key points are outlined below). Construct Health is a health and safety consultancy and Mr Schulze has 15 years' experience in safety management and systems development in heavy industry. The investigation has identified the basic cause of the event and highlighted latent casual factors allowing conditions to go undetected. The recommendations address the localised error and mistake producing conditions (causal factors) leading to the event. Immediate corrective actions have been completed and wider systems actions are underway to be completed within two months.

The clinic will open on 6 June 2017, now that the technical issues, equipment and systems have been reviewed and there is formal sign-off.

## 1 Findings

The technical investigator undertook a review of the incident sequence, equipment and site following the ICAM investigation methodology. The key findings are:

- In July 2016, when a temporary Turbo Smart suction pump was repaired, a redundant hose was left installed in a non-compliant manner. The hose was left below the water line in the tundish, which created the potential for the incident as below.
- In January 2017, an unidentified individual who did not have a technical background, placed the redundant discharge hose on the compressor intake. This was a skill-based mistake. The unidentified individual may have believed they were fixing an unrelated fault experienced elsewhere in the clinic on seeing the redundant discharge hose.
- Staff at the Pukekohe Intermediate Dental Clinic have tended to first troubleshoot and attempt to resolve a fault before placing a call to a service technician due to the geographical location of the clinic, the time it takes for a repair technician to respond from the city and pressure on chair productivity.
- Each District Health Board has responsibility for the clinic buildings in their DHB area. There are different service-level agreements dependant on clinic type, with different cost structures for support services and procedures for active maintenance management. Auckland Regional Dental Service [ARDS] has responsibility for supply and ownership of the dental equipment, with the active maintenance management overseen at a district level.
- ARDS quality assurance processes are lacking in complexity and implementation for control of a regional service including contractor management; procedures for localised management of faults; training of staff attending to troubleshooting or minor maintenance; and both visitor and key control.

### 1.1 Cause of the Air Supply Water Contamination

The dental clinic is fitted with a Turbo Smart suction pump to support the dental equipment used in providing dental treatment. In July 2016, the Turbo Smart suction pump at the Pukekohe Intermediate Dental Clinic failed and was temporarily replaced with a loan pump while the original control panel was repaired. Suction pump discharge connections for the failed static pump and the loan pump differed in diameter by 1 mm, so a second discharge hose was added to the loan equipment and secured at one end into the grey water discharge tundish.

The original Turbo Smart suction was reinstated some weeks later and the loan pump was removed, but the now redundant discharge hose was left in place with the discharge end in the water of the tundish. The tundish provided the source of water which was later drawn into the compressor air receiver [and discharged to the surgeries] when the discharge hose was pushed onto the compressor air intake nozzle.

The plant room is not frequently monitored or attended by maintenance and service technicians. This meant that the redundant discharge hose and open connection went unnoticed from the time the loan pump was removed.

The incident on Monday 23 January 2017 occurred when a person, most likely someone without technical knowledge of the plant itself, entered the plant room on a date shortly before 23 January. The person has made a skill-based mistake and attached the free end of the redundant hose to the compressor air intake nozzle under the presumption they were correcting another existing fault. This was likely because the person observed the redundant hose and concluded that, due to the length of the hose and its proximity to the air compressor, the hose has come from the air intake nozzle and should be attached. A person without technical knowledge could mistakenly assume the hose had come loose from the compressor. The length and position of the redundant discharge hose was such that it could appear to have come from the adjacent air compressor. In addition, it was possible to push the hose to onto the air intake nozzle. Air intake nozzles on the compressor are designed with a serration-type arrangement that look as though a hose could fit over it.

Design of the suction and air supply systems in the clinic is such that they are interconnected; so a fault will affect all four surgeries.

It was not possible to identify the person who attached the hose. Consequently an accurate timeline could not be established. Testing undertaken by the technical investigator to ascertain the possible timeline suggests that the time needed to fill the air compressor - air receiver was approximately 17 days before the foaming liquid was first noticed. A worst-case scenario of approximately 75 working days could also be possible but not likely. Replication of the fault at Pukekohe was attempted at another Dental clinic with the same chair numbers and patient load as a 'yard stick measure'. This was to reverse-engineer the probability of the air receiver filling with water and to establish a timeline during which the redundant hose was connected to the compressor. As this approach involved many variables, it was unsuccessful in identifying an accurate timeline.

Also noted in the investigation was a structural issue. The second discharge hose was introduced with the loan suction pump and secured at one end into grey water discharge tundish below the water line; this is not an accepted solution to maintain an air gap between the discharge hose and water. If there had been an air gap, this may have prevented water from being drawn from the tundish.

## **1.2 Staff role in addressing equipment issues**

Suction at the Pukekohe Intermediate Dental Clinic had been identified as an issue previously, with employees noting loss of or reduction in suction. It was common practice for employees to attempt to remedy issues with suction themselves. This meant that faults were not always logged and therefore could go unrecorded.

ARDS employees routinely troubleshoot equipment faults in the surgery and plant room before logging a fault because of the time it takes a technician to arrive at the distant geographic location of the clinic.

During the investigation, employees were asked to identify the dental equipment and the processes they would follow in a trouble-shoot situation in the plant room. Not all employees are able to correctly identify equipment and its function, some confusing the various systems in the plant room. This identifies a gap in the knowledge and training of the employees to be able to locally manage their equipment.

The location of the clinic in rural South Auckland, means waiting for the technician to arrive involves substantial 'chair' downtime and additional call-out service costs. These factors combine to impact on clinic operation, productivity and patient turnover. Therefore, employees are more likely to undertake trouble-shooting, relying on consultation with other ARDS employees and technicians who they believe are more knowledgeable with plant and equipment.

Manuals regarding the care and use of dental equipment exist and identify some plant room processes, including those for minor maintenance of equipment. This, along with other ARDS employee's knowledge of the plant, may influence an individual to exceed their skill level when trouble-shooting. No formal training is in place for trouble-shooting faults or performing minor non-technical maintenance on plant room equipment or on the dental assistant arms. There is also no signage or labelling to identify the plant room dental equipment or the function, supply, suction, flow direction on pipework, or reset buttons.

### 1.3 Other Findings

The design of the plant room is such that the equipment is in close proximity to each other and other clinic equipment. Action could be taken because of the size of the room that would allow for separation of the equipment, which would reduce the ability to connect non-related plant together with redundant hoses/equipment, thus reducing the chance of human error.

Agreements sighted between Waitemata DHB, Auckland DHB, ARDS and Counties Manukau DHB only generally define the ownership and maintenance arrangements across the various DHB facilities. Practice, however, varies across mobile units, fixed clinics, and transportable dental units. This results in a complex and inconsistent understanding of ownership and responsibility for maintenance of the equipment. In addition, the dental equipment has not been clearly defined as either clinical or plant. As a result, the standards to which the plant room dental equipment is meant to be maintained are unclear. Work is required to review the status and management of the contracts between the parties so there is consistent management of installation and maintenance of the clinics and clinical equipment and monitoring of compliance with regulations and operating policies.

Standard operating procedures, works compliance and general service manuals for maintaining dental equipment were identified and confirmed in place within the ARDS clinic. The implementation and key processes, however, require further work and sophistication to ensure consistency across all clinics in the region, including:

- structured visitor control
- control of access to the plant room
- contractor management
- quality management systems frameworks for maintenance
- scope of maintenance services
- employee refresher training for dental equipment
- authority and training to trouble-shoot plant and equipment in the plant room.
- roles and responsibilities of stakeholders under a joint operating and management framework.

To provide assurance about the other regional clinics, third party engineering consultants were contracted to carry out confirmation that the same or similar conditions do not exist in other clinics. The review has provided a base-line condition assessment and allowed for establishment of a common installation design of dental equipment.

## 2 Immediate actions taken

- The immediate response of closing the clinic and relocating the service to other units in the locality was appropriate.
- Independent investigation was undertaken to ascertain the cause of the incident.
- Appropriate action was taken by the Counties Manukau District Health Board on behalf of the Pukekohe population to initiate an Incident Management Team to coordinate the patient and parent communication, contact tracing and follow-up. In the initial immediate phase it was not possible to ascertain the exact time that the discharge hose had been connected. In the circumstances the appropriate conservative decision was made to contact the large number of parents and children, to advise the community and to initiate contact tracing. The processes were well managed, with support from Waitemata DHB staff and regional laboratory services. Of the 2139 children / families contacted for screening, there are approximately 400 who have refused screening and 20 who have not yet been able to be contacted. Counties Manukau DHB staff are continuing to pursue these individuals.

## 3 Recommendations

In light of these findings, recommendations have been made in the following areas. Corrective actions are underway or completed.

| Recommendations                                                                 | Implemented                                                                                                                                             | Future actions                                                                                                                                   |
|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Visitor Protocols                                                               | Process to control visitor access to the clinic and plant room for all ARDS clinics in place<br><br>Visitor management policy established and published |                                                                                                                                                  |
| Plant room security and access permission                                       | System to control access to plant room keys and record all entries in place                                                                             | Survey buildings to assess whether electronic access control is feasible                                                                         |
| Clarity of ownership and responsibilities for assets, facilities and operations | High level ownership framework across 3 metro DHBs agreed                                                                                               | Document agreed high level ownership framework<br><br>Define major service level provision agreement between ARDS and metropolitan Auckland DHBs |

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|------------------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                            |                                                | <p>Develop a framework for Service Level Agreements with contractors</p> <p>Develop and implement a faults management system</p> <p>Implement a centralised asset management system, including ongoing performance measures</p> <p>Develop a quality management framework</p> |
| Review ARDS' risk management                               | Reports received                               | <p>Hold workshop, agree recommendations and implement.</p> <p>Formalise risks in risk register</p> <p>Quarterly review of risks</p>                                                                                                                                           |
| Review ARDS' training requirements for maintenance         | Access to plant rooms restricted and monitored | <p>Review of current training guidelines and information underway</p> <p>Agree scope of maintenance work that may be undertaken by ARDS staff</p> <p>Develop self-support training and guidelines and roll out to ARDS staff</p>                                              |
| Commission independent review of dental clinic plant rooms | Completed                                      |                                                                                                                                                                                                                                                                               |
| Ensure plant rooms are kept clear of extraneous items      | All plant rooms cleared.                       | Maintain in cleared state                                                                                                                                                                                                                                                     |