

Developing the appropriate monitoring programme for the cost effective operation of the drinking water system producing a high quality product

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I am the Water System Engineer (WSE) directly responsible for the operation, maintenance and monitoring of the essential services of drinking water, foul & storm drainage systems and sewage treatment installations, at the Akrotiri Royal Air Force (RAF) station in Cyprus.

My project deals with the development of an appropriate monitoring programme for the cost effective operation of the potable water distribution/fire fighting system, which will produce a high quality product.

This is necessitated by the importance of water, apart for domestic use, as an operational requirement for,

- fire fighting purposes
- oxygen production plant
- aircraft washing facility
- heating and cooling etc

It is also a very urgent need because of the fact that major parts of existing water installations are over 50 years old, reaching the end of their expected useful life.

TERMS OF REFERENCES / LITERATURE REVIEW

- Aim - Objectives :
 - The aim of the project is to develop a cost effective monitoring programme, which would and could safeguard the uninterrupted supply of the water distribution system, giving a high quality product.
 - The main objectives are the following:
 - The introduction of the recently installed telemetry system and the evaluation of its performance and reliability.
 - The identification and addressing of any unknown deficiencies in the system and the minimisation of existing problems like water wastage and the fire hydrants flow efficiency. It is estimated that the present leakages

are reaching the high figure of 25%, while there are deficiencies in both, the technical/operational sites and the domestic area.

- The 3rd objective refers to water quality issues, such as disinfectant level, bacteriological and chemical control and the conformity of domestic installations to Water Regulations and ACOP L8

- Literature Review:

The literature sources

- the university's resource packs
- set books
- handouts of various training courses
- the Health and Safety Executive published regulations
- the Ministry Of Defence Policy for quality control of drinking water services
- the internet

METHODOLOGY

As the appropriate research approach for my project I have selected to use the case study approach.

- As a case study research approach comprises an in-depth exploration and understanding into the issues being under investigation of a subject, I opted for this tactic as being the most appropriate approach.
- More particularly, the case study allows you to demonstrate theoretical concepts through the application of praxis (the development of practice through a critical examination of the relationship of theory and practice).
- It also encourages active learning by providing an opportunity for the development of key skills such as communication, group working and problem solving.
- Finally it increases the participant(s) enjoyment of the topic and hence their desire to learn.

Fieldwork and Deskwork research strategies

Both strategies were of crucial importance and have been used under this research in order to complete the project.

Fieldwork

Research process of collecting data, out in the field.

Deskwork

Research process carried out in an office at work or at home behind a desk.

Preparatory work towards data collection techniques

- Briefing of my assistant on the various tasks as listed in the data collection action plan.
- Marking on water distribution drawing the position of all issues concerning the research, i.e. sampling points, water low & high level zones and local zonal metering areas.
- Checking of mobile measuring instruments and accessories that are fit to purpose.
- Site identification and familiarity with all sampling/recording locations. Join visits with my data collection assistant at all the above points.
- On-site briefing and training of the assistant regarding the purpose of the project and data collection techniques.
- Comparison of collected data with data arising from previous records and literature.
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Data collection techniques:

As most appropriate for my investigation I decided to use the following data collection techniques.

- By Observation (spot analysing & recording various events like the on site instrument readings & chlorine residual sampling)
- By Reviewing and analysing literature
- By Reading from Policy documents and previously collected data

PROJECT FINDINGS

- Introduction of Telemetry water monitoring system:
 - The system proved its cost effective operation with annual savings up to £37K which is considered beyond my expectations
 - System's reliability in its major components (software & hardware) and capability in remotely controlling critical equipment was found satisfactory
- Water System Deficiencies:

- Chlorinating system, in general, was found satisfactory and coping with the demand apart from station's further points which do not get the minimum disinfectant chlorine residual.
- Sampling points fed from water ring main sections of the system, their disinfectant behaviour was better.
- High level tanks inlet supply pipes installed at wrong position. Occurrence of streaming in tanks during filling process and water stagnation of major part of the stored water at the top level of tanks.
- Water leakages were found around 19% of the total station average water consumption.
- Water Quality issues
 - Existing bacteriological and chemical analyses monitoring regime found satisfactory.
 - Most of the existing hot & cold water installations within properties do not conform to the Approved Code of Practice L8 and Water supply (water fittings) Regulations.
 - Ultra Violent disinfecting units were found as very cost effective equipment used in water systems, especially on the sewage recycled treated water.
- Fire Fighting System

The majority of Fire Hydrants do not meet the minimum flow rates as laid down by the "Crown Fire Standards"

RECOMMENDATIONS

- Audience:
 - Address recommendations to my Line Manager first and then to the Defence Estates (DE) senior management via the Planning & Technical Department.
 - Station Estate Representative who is the decision making authority of Ministry of Defence (MOD) in regards to future projects.
 - Individual parts of the reports should be copied (for their comments & advice) to other specific MOD departments like the Joint Services Health Unit and Fire Station Commanding Officer.
 - To the Water Policy maker "Chief Inspector" at the Cyprus DE headquarters.
- Recommendations on findings :
 - Telemetry:

To introduce maintenance Specialist Term Contract (STC) for the all year round inspection and servicing of the system, covering minor repairs up to a certain limit.

- Water deficiencies:
 - Initiate the introduction of a flushing regime to system's dead legs at further points with disinfection problem.
 - Install 2 No spot chlorinators to locations shown on drawing.
 - Alter water supply pipes to high level tanks from bottom feed to top feed. Possible solution for the trihalomethanes problem in Water Quality issues.
- Water quality issues:
 - Initiate the introduction of weekly bacteriological sampling programme instead of the present monthly one. Total number of samples to remain the same but changed into a 4-week cyclical sampling programme.
 - Increase number and sequence of bacteriological sampling in areas where chlorine residual was found low.
 - To reduce total trihalomethanes (TTHM) found in the sample from high level tanks outlet, clean and disinfect tanks using non chlorine solutions.
 - Reposition or supply an additional UV system for above, installed at a location before the chlorination application point. This way the demand of chlorine shall be less resulting to lower values of TTHM.
 - If problem persists initiate an in-depth case study to recommend various other solutions as listed in chapter 6, for example, introducing "enhanced" coagulation, activated carbon filters etc).
 - Initiate the introduction of a professional survey to record the level of compliance with ACOP L8 & Water Regulations of the station's properties in regards of cold & hot water installations.
- Fire fighting system
 - Inform fire station authorities the location of the 2 zones isolation valves (as a temporary proactive measure in case of a crisis scenario).
 - Initiate the introduction of a professional hydraulic modelling study for an upgraded water distribution/fire fighting system

Reflection upon learning.

- Being a mature student and an inside researcher at the same time, made me think that I should be acting as a learner first and then as an expert in my area of work.

- Now I am in a position to acknowledge the fact that I have to allow and convince myself to be ready to accept additional learning at any time, through any available medium and mode.
- Already this project has proved to me that using research approaches would have helped me arrive at better solutions in respect to solving problems of the past.
- The academic approach obtained through this project in my capacity as an insider researcher has put an end to my behaviour in respect to all my future plans. For example I will always listen and think more and speak less. Everything I will say, practice, or write should result from a more systematic way of thinking.
- There is always something interesting to be investigated and learned about, in order to expand and widen the horizon of general knowledge.
- Taking into consideration what other people have to say, is another lesson I have learned, as there is always something to gain from other people's perspectives.
- Keeping a diary, should from now on be changed into a learning log, rather than being a calendar.