THE FIVE DAY CHALLENGE - REBUILDING THE KILMORE WTP AFTER THE BLACK SATURDAY BUSHFIRES

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35th Annual Qld Water Industry Operations Workshop
Community Sports Centre, CQ University, Rockhampton
22 to 24 June, 2010

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ABSTRACT

This paper details Goulburn Valley Water's response to replacing the electrical and control systems and chemical dosing works destroyed by the Black Saturday fires. This task was done in five days using largely internal resources. Good planning was critical to the success of the project.

1.0 INTRODUCTION

The fires in Victoria on the 7th of February 2009 will be regarded as one of the worst disasters in Victorian history. The fires ravaged towns throughout the state damaging the environment and local infrastructure. The Kilmore Water Treatment Plant, located in the Mt Disappointment region, sustained substantial damage to its electrical system, control room and chemical dosing system. The initial site investigation by the Goulburn Valley Water (GVW) Incident Response Controller determined that the treatment plant control room was completely inoperable and beyond salvage.

The Treatment Plant serviced the communities of Heathcote Junction, Wandong and Kilmore Township with a combined population of approximately 7000 people. With an average daily consumption of 3 ML/day and the recent high summer temperatures the real possibility of these communities being without potable water had become extremely likely. This paper will step through the process of why, how and the challenges faced to restore the treatment plant using in-house skills provided from the Corporation's Operations IT section. The task at first seemed near impossible but with some clear thinking, in-house expertise and sound management, the task was completed within the time period.

2.0 DAMAGE TO KILMORE WATER TREATMENT PLANT

Following a more detailed investigation by an assessment team on Sunday afternoon it was found that while the control room at the Kilmore water treatment plant (WTP) was completely destroyed (see figure 1) the Dissolved Air Filtration (DAF) filters, motors, backwash pumps, dispersion system, raw water supply and most pipe work was still intact and serviceable.

All field wiring (415Vac, 240Vac, low voltage and instrumentation) cables were in good condition. Although the cabling was burnt at the cable entry point to the building, it had suitable length on it to be serviceable which later would become a very important aspect to the solution to this incident.

To save water Stage 4 restrictions had been immediately introduced after the fire. A limited supply from Yarra Valley Water's Wallan system had been reconnected. With these steps in place it was estimated that the water in storage would sustain the system's water supply for approximately five days. Within five days the 7000 people could be without drinking water. This was not an option and could not be allowed to happen. A solution to the problem had to be provided within five days. It also had to be sustainable and possibly last 6-12 months. Not an easy task.

Figure 1: ***Burnt out dosing and control room***

3.0 THE PLAN

A number of ideas were considered, from portable water systems to carting in water by truck, but none were thought to be viable or sustainable for any length of time. Considering that the DAF system itself was largely intact the only solution was to try and use it and rebuild the control room and start producing water in the shortest time possible.

The Operations IT department members had intimate knowledge of the plant from its programmable logic controller (PLC) code, Supervisory Control and Data Acquisition (SCADA) interface and electrical infrastructure. As time was not on the Corporation's side there was little opportunity to brief contractors or consultants. It was decided that the Operations IT team would manage and resource the project.

Work on the concept plan was started immediately on Sunday night. It was hoped that this effort would dramatically increase the chances of success and enable the procurement of the necessary equipment to be well on the way at the start of business Monday morning. Three members of the Operations IT team met Sunday night to plan in more detail. The basic plan consisted of:

- Use a shipping container to house the temporary control room containing the motor starters, PLC, interface cubicles, human machine interface (HMI CitectSCADA), telemetry, UPS.
- The timing of restoration of power to the site was unknown. Therefore a 300KVA diesel generator would be required.
- Local electrical contractors would be employed to investigate, test, label and get the existing field cabling ready to be connected to the new control room.

The Corporation's South West Operations team, in conjunction with GVW treatment specialists, would arrange for the replacement of the chemical dosing systems.

The Sunday night meeting was to become the most important facet for the success of the project. Over an eight hour period various scenarios were discussed and alternatives considered. A twenty foot shipping container was decided upon which would adequately hold the switchgear and control equipment while still being able to fit onsite. A conceptual design for the layout of the shipping container (see figure 2) was drawn up outlining where it would be located onsite and where various cabinets (including junction boxes for the power and control cables from the field) and motor starters would be installed.

An important concept in the layout of the container was the ability to work on more than one item at a time. This enabled simultaneous construction phases to be completed while others were put on hold if parts were unavailable. As the week progressed this decision was instrumental in achieving success.

The other important and equally valuable decision was to use the existing PLC code and CitectSCADA project that was operating before the fire. The PLC code and CitectSCADA projects were proven to work. It was thought that re-writing the code to a modified version would add extra time and produce errors. The Corporation's change management systems contained the latest backups of these projects and were easily obtained.

The next stage was to develop a detailed parts and equipment list. This covered cabinets, cables, motor starters, PLC equipment, computer equipment, timber and a suitably sized generator. This information was placed in a spreadsheet and periodically e-mailed to vendors throughout the night/morning. This ensured all the required parts would be sourced and received as early as possible. In addition to this the major vendors were contacted Sunday evening to inform them of the situation so they would be fully prepared for an immediate order early Monday morning.

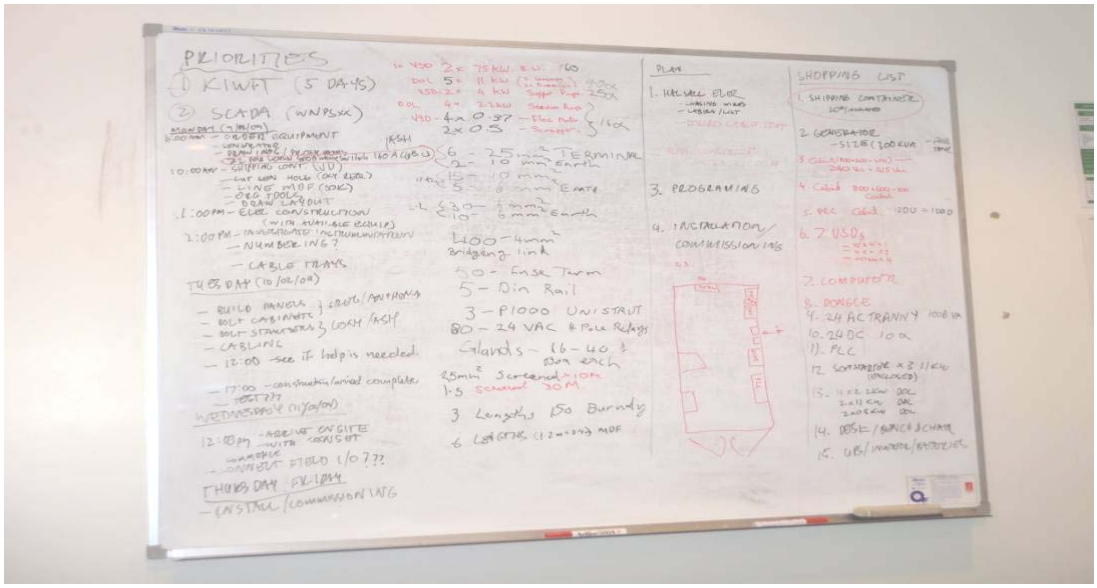

Figure2: ***Concept, parts list and container layout***

With the design and procurement aspects completed the attention turned to developing a time line for the construction, installation and commissioning phases of the project. Construction would begin first thing Monday morning. Milestones were set for various stages to be completed with regular update meetings to monitor progress and assess whether extra resources were needed. A list of items for the critical path (show stoppers) were itemised with contingencies put in place so that objectives could be achieved even when experiencing long delays. The core team consisted of five members of the Operations IT team and a maintenance officer from the central water group to assist with general construction duties.

4.0 CONSTRUCTION

Day 1

The first task Monday morning was to brief the other team members of the situation and the task ahead. The container arrived approximately 10.00am, ahead of schedule, and was found already lined and insulated. This saved an enormous amount of time and allowed the real construction phase to begin. Initial construction tasks (measurements and layout) were carried out in conjunction with finalising procurement of the materials ordered in the late night planning session. There were two local electrical wholesalers involved who greatly assisted in this area. Lighting was installed in the container as a priority so that work could continue into the night. The remainder of Monday saw the mounting of the cabinets, cable tray and some initial wiring. A scheduled progress meeting was held to check on progress late afternoon. It was agreed that the project was on target and that some items that had not arrived would be on site first thing Tuesday morning. For the project to succeed it was realised that long hours were going to be needed. Fatigue management issues were discussed to reduce the risk of mistakes and accidents. Team members were required to get at least 6 hours sleep a night.

Day 2

Tuesday saw the bulk of the construction take place. The main tasks carried out included continuing to mount the cabinets and motor starters, cabling, setting up the laptop for the HMI, air conditioning installation and cutting holes for the field wiring to enter the control room. The team followed the layout drawn on the white board at Sunday's planning meeting, improvising where required to appropriately install the cabinets, motor starters and cable tray for the large task of interfacing the field cabling.

The main item on the critical path for the construction phase in Shepparton was to adequately prepare the power and control junction cabinets ready for the field equipment to be wired. Connections between the motor starters, power junction box and the power distribution board were also carried out. The layout of the container continued to be very important with five team members working independently side by side (see figure 3). After a second planned progress meeting it was decided to gain the assistance of 2 extra electricians to aid in wiring duties. By the end of day 2, progress was still on track but the enormity of the task was becoming apparent.

Figure 3: ***5 team members working side by side***

Day 3
Construction continued on Wednesday morning. Work was progressing well which lead to the decision to relocate the container to Kilmore Water Treatment Plant on Wednesday afternoon and begin the next stage of wiring in the field devices and a 300KVA generator.

Day 4
The wiring of the external field cables into the interface cubicles continued Thursday along with the PLC cubicle. The PLC input/output (I/O) wiring was a huge task and the time needed was underestimated. This could have had the potential to delay progress considerably. A subset of the Operations IT team concentrated on this and made the important decision to test each I/O point from the PLC code through to the CitectSCADA HMI as it was connected. While this was painfully slow the effort was well worth it when it came to commissioning and the finished product. The pre-built dosing system arrived and was installed then interfaced to the control system. Thursday proved to be the longest day with some 20 hours worked but the end was in sight and we had renewed belief the dead line could actually be met.

Day 5
The PLC wiring continued Friday morning and was still the main task to be completed. All of the 415 and 240 Volt supplies were connected enabling motor direction testing to begin and valve operation to be tested. Some online water quality instruments were interfaced to the HMI as a "nice to have" but not essential to the over all task. Control signal cables were all terminated and by mid afternoon motors and valves were starting to operate in automatic mode.

Late Friday afternoon water was being treated in one filter. This water was then used to backwash the second filter. At approximately 7.00pm Friday night the plant had 2 filters online producing reasonable quality water in automatic mode. At around 9:00pm on the Friday night the inlet valve at the Kilmore township 16ML tank was opened and the tank commenced filling.

It was then time for a well earned beer and some sleep.

5.0 CONCLUSION

The objective of rebuilding the Kilmore Water Treatment's Plant control room in five days was achieved. The control system allowed for full automation of the plant, and the operators claim that that it worked better than before. Figure 4 shows the finished control room.

While this project was conceived as a result of one of the worst disasters in Victorian history, it showed all aspects of project delivery from the decision making process to management, procurement, construction and installation.

The Sunday night planning session was the key to the success of the overall project, having a clear and decisive direction made it easier to solve problems as they arose and importantly to maintain focus on the task. With such a project it would have been easy to become distracted and to head off on tangents.

Another highlight during the five days was the way the Corporation handled the incident and how it had faith in its employees to undertake such an important task. Each team member made an extraordinary contribution to the project. It was a case of "There's a job to be done, let's do it and do it well".

It was also apparent how important it was for the Corporation to have an internal skill base with the expertise to complete such a task. It was a very rewarding experience but one that hopefully will not have to be repeated.

6.0 ACKNOWLEDGEMENT

The support from the Corporation staff that was not directly involved the project.

The vendors for their help sourcing equipment at short notice and making trips to Melbourne to deliver parts and equipment on time.

The families of Corporation staff for their support during the project

The contractors that helped support the Operations IT team

Figure 4: ***The finished control room***