December 25, 2009 TVRWRF Raw Sewage Spill
Investigation Findings and Report
Date:
Report prepared by Tony Hughes

Background:

On December 25th at the TVRWRF plant there was a sewage spill of approximately 2.4 million gallons. Waste water spilled over the influent structure, into Murrieta Creek.
Mike Balkoski, Bob Naranjo and myself were tasked were to determine what happened with the plant SCADA system. We were to review the historical data and to test & verify the system operation where possible. We were also tasked to determine if the correct decisions were made by staff when they were attempting to rectify the condition and if they had the necessary skills and training.

Available information at the start of this investigation…
SCADA Alarm summary reports
Signed statement from James King # 1811
Copies of related SCADA screens
Memo from John Jannone to Stephen Moore re: Alarm Testing dated 1/12/10
Operational manuals for the channel mounted grinders & the FlexRake barscreens.
Employee accounts of the incident, Edward Westendorf #1134, Clete Fracchiolla # 1438, James King # 1811, Robert Naranjo # 1651 & Jeramy Cook # 1895.

Investigation:

Explain what actions were taken to thoroughly investigate this spill/release.
1/11/10, a site visit and inspection of the TVRWRF headworks & influent structure was conducted by Tony Hughes, Mike Balkoski & Robert Naranjo.
It was determined that interviews of the following were required…
James King # 1811 to be interviewed by Tony Hughes & Mike Balkoski
Melita Caldwell # 1105 to be interviewed by Jane Joy

Interviews were conducted…
1/13/10 @ 2:00pm in the EOC room. James King # 1811 was interviewed by Tony Hughes & Mike Balkoski. with Union representative Steve Shockey in attendance. James King tape recorded the meeting.

Q1. How long have you worked at the TVRWRF facility?
A1. Approximately five and a half years

Q2. Approximately how long was it before you were put on call?
A2. Approximately the same time

Q3. While on call, if an alarm condition or a situation arose that you couldn't deal with, what would you do?
A3. Call my supervisor

Q4. When you logged in at 15:30 hours you stated that you saw a #3 grit pump common alarm. You acknowledged it, and you then acknowledged all. Did you look at the other two annunciator alarm pages?
A4. No, did not look at the other two pages.

Q5. Typically, would you?
A5. No

Q6. Do you recall what other alarms were present at that time?
A6. No other alarms were present.

Q7. What type of connection do you have at your house for the laptop? (dial-up, FIOS, etc?)
A7. Dial-up.

Meeting ended.

1/14/10 @ 11:30am @ the TVRWRF site, Melita Caldwell # 1105 Edward Westendorf #1134 were interviewed by Jane Joy
Both Melita Caldwell and Edward Westendorf were asked questions related to how Operators are trained and to how Operators demonstrate their abilities before being placed on call.
Q1. How are operators trained?
A1. Training is usually on the job training

Q2. How does an operator demonstrate their abilities?
A2. They are closely monitored by Supervisors until a degree of comfort in plant operation is shown.

Q3. How soon can an operator be placed on call?
Q4. When they have demonstrated that they are capable. No OIT's are placed on call.

Based on information gathered during these interviews, further testing of the SCADA operation and alarms was conducted on site by Robert Naranjo. This additional testing provided information that supported and clarified statements made by James King regarding the # 3 Grit Pump alarm and the YIC 12 alarm.

Findings of Facts:
The spill occurred due to the PLC failing to send a run command to the bar screens.
The PLC has no back up controls and is a single point of failure.
The wires that fed the power to the PLC was burned & damaged in the conduit.
The alarm from YIC 12 (PLC) did work and the IOC was notified
The headworks had mechanical float switches installed, but they go through the PLC. They should operate independently and send a run command directly to the bar screen starters.
Critical alarms are not prominent on the screens.
The headworks have been installed for approximately 10 years and have a long history of failures associated with them

Discussion:
The facts show that on December 25th 2010 approximately 2.4 million gallons of sewage was spilled into the Murrietta Creek from the TVRWRF site. The primary cause of the spill was that the PLC at the influent station headworks ceased to operate. Our investigation shows that this condition was due to wires feeding the PLC being burned up inside a conduit. When the PLC stopped operating, the barscreens also stopped. The barscreens soon became clogged with debris. The water level rose and eventually spilled outside the headworks. The spill made it to the

Murrietta Creek. The alarm from YIC 12 (PLC) did work and the IOC was notified of a problem. The on call operator, James King was notified by the IOC and he logged in to the plant. James King noticed on the first page of alarms a Grit Pump # 3 common fail alarm. He acknowledged it, and then acknowledged all. He reviewed the SCADA and proceeded to check other vital parts of the plant prior to logging off. By acknowledging the alarm on the first page he inadvertently released the alarm into the IOC, making the alarm a local alarm only. He logged out without checking pages two and three where the YIC 12 alarm was flashing.

Conclusion:

1) The spill was determined to be caused by the PLC (YIC 12) failing to send a run command to the barscreens at the Headworks.

2) Contributing factors were:

The PLC was the single point of failure.

The wiring feeding the PLC was damaged and burnt up inside a conduit.

There were no engineered redundant controls provided such as high level floats operating independently of the PLC. This should be standard requirement on this critical headworks process

There was a SCADA PLC failure alarm but the significance of this alarm was not clear and not elevated to the highest priority.

The headworks equipment has had a history of design flaws that continue to result in variety of nuisance alarms that resulted in staff having to modify the method of operation and monitoring. I.E. placing equipment in hand and adjustment of grit pump suction alarm pressure switch to minimize down time.

Recommendations:

DESIGN

Install additional float switches to by-pass the PLC in the event of a "PLC failure", and call for the bar screen(s) to run at full speed.
Install float switches inside the containment area to alarm and indicate a spill condition before the spill escapes the immediate area.
Engineering/plant maintenance & operations staff to work together with engineering to provide clarity on the final design of process control systems such as 3D functionality review of operation.

OPERATIONS

Create SOP's related to SCADA and make them readily available to all plant staff.
Coordinate testing of critical alarms and document.

SCADA

Create groups of alarms based on their criticality.
Elevate their priority.
Establish periodic alarm testing. Higher priority alarms would require a physical response to the site. Certain alarms should initiate the immediate response of a Control Technician for example a "PLC failure".
Clear up possible confusion between the old & new systems.
Standardization of alarms between the plants is very important, the naming and appearance means something.
Implement a "change management" procedure.
Conduct a review of the on call remote laptop connections, are they satisfactory? (high speed, dial-up etc)
Provide training on plant SCADA, and document it.

IMPROVEMENTS MADE SO FAR

Alarm acknowledge buttons are now located on the last page, thus forcing all pages to be viewed.
PLC failure alarms are now configured so they cannot be acknowledged or released from the IOC without first being repaired.
Art Beavans informed that these changes are to be enforced on all future expansions.
"YIC12 Comm Fail" alarms now read "YIC12 PLC fail"
High level float controls are being modified to work as local controls, independently of the PLC.
Front alarm pages are being modified to improve visibility oof the more critical alarms.