OVERDUE PRESSURE SAFETY VALVE MAINTENANCE REDUCTION PROGRAM

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What happened?

In 2004 the preventive maintenance backlog was over 220 Pressure Safety Valve's (PSVs) overdue, when Atomic Energy of Canada (AECL) at the Chalk River Laboratories site first took action to reduce this backlog. Over two years, the PSV overdue backlog was reduced to about 25 valves.

At fiscal year end 2006, AECL had 154 PSVs reported as overdue from the Preventive Maintenance (PM) as they were not tested within their service frequency. The number of PSVs reporting overdue was increasing and the service groups tasked to perform the on-time maintenance lost oversight of the regulatory compliance requirement for the PSV program. To resolve this issue, an action plan with dedicated resources was established in early 2007 to address the overdue PSVs preventive maintenance as well as to reassess the entire preventive maintenance program associated with the PSVs.

How do we resolve it?

Management effectiveness at identifying a lack of program oversight was questioned. After making good progress at nearly eliminating the overdue PSV maintenance in 2006 **(Figure 1)**, the number of overdue PSVs was rising again.

Management took this issue seriously and demanded an action plan to resolve overdue maintenance to meet the regulatory compliance issue on their safety related equipment.

In January 2007 an action plan was put together to eliminate the overdue PSVs and to reassess the preventive maintenance program associated with these PSVs. Management assigned a team of keen workers to make recommendations on how to eliminate the backlog.

The PSV team was mandated to perform all required maintenance activities on the Overdue and Coming due PSVs within 1 year. From Senior Management's perspective, it is relatively easy to prepare a plan but reality shows that it is not always that easy to execute and achieve the stated goals.

Job priority was elevated to ensure adequate support was provided as the program demanded.

The action plan developed was straightforward:

1. Identify the main reasons for not performing maintenance prior to the due date.
2. Identify the PSVs that were overdue.

3. Identify PSVs that required unique comprehensive work plans.
4. Balance workload and schedule maintenance over a 12 month period, all PSV work which included the overdue PSV work and the preventive maintenance on PSVs coming due during this period.
5. Verify existing records to confirm that all PSVs are captured within the existing preventive maintenance program.

Challenges encountered

The reasons identified for the overdue PSV are multiples:

- maintenance on this type of equipment was not considered a high priority,
- inadequate technical support,
- inadequate focus on maintenance related activities,
- performing maintenance unnecessarily on equipment out of service,
- system design classification was changed without having updated the associated technical documentation,
- difficulty in the tracking of some PSV history records due to the inconsistence logging of maintenance activities within the Computer Maintenance Management System (CMMS),
- some equipment found not maintainable,
- equipment not available for maintenance due to facility operational priorities and scheduling,
- limited staffing for bench testing of the PSVs,
- limited Design support,
- increasing maintenance staff demand due to the current backlog encounter with the PSVs as well as new construction work and new PSV installations.

The list of why we could not get the jobs done could go on forever but we still had to resolve the issues.

It was also identified that most overdue PSVs were on steam related equipment.

The first decision made was that “Maintenance” was to do maintenance. This sounds simplistic but AECL had made a previous decision to revisit all PSV sizing calculations on steam/air lines. By making such a decision, this created major delays in servicing the valves and getting the PSV sized and documented prior to performing the installation. These PSVs were part of Technical Standard and Safety Authority (TSSA) registered systems and many documents associated with the registration bared a professional engineering stamp. To further convince AECL management that the resizing was not required and did not pose any great safety risk, a steam accumulation study was conducted along with the guidance of the TSSA Authorized Inspector.

Steam Accumulation Study

Before we proceeded with the field test, the team had to convince themselves of the acceptability of the approach. Experience had driven the team to state the valves were properly sized but we still had to have a technical background. Feeling was not enough.

The first part of the PSV test was modelled in Flow of Fluids™ according to the technical article #1372 Modelling Pressure Relief Valve Operation from Engineered Software, Crane Flow of Fluids. The results and values of the Flow of Fluids calculations were very promising and supported the Maintenance hypothesis that the existing PSVs were properly sized.

With this supporting calculation, a Steam System Pressure Accumulation Study was performed physically to determine the ability of a Pressure Safety Valve (PSV) to protect a steam heating system from overpressure. To perform this study safely and make it repeatable, a representative steam heating system was assembled that incorporated the essential elements of a steam heating system typical of those at Chalk River Laboratories (CRL). Pressure gauges were installed to measure both the high and low-pressure sides of the system. This study has found that CRL plant steam supplied at 98 psig and introduced to a steam heating system by a 1" globe valve on a 1" bypass line, when fully opened, can be vented by a 1 ½" MNPT X 2" FNPT Watts Figure 41, without the steam heating system down stream of the PSV being subjected to pressures exceeding the permissible overpressure of 18 psig. The PSV preformed as expected and protected the Steam Heating System as required by applicable codes.

This study was approved and witnessed by a TSSA Authorized Inspector.

The Accumulation Study was successful and convincing enough to finally say:
"Let Maintenance Do Maintenance".

Team

Once the decision to perform the maintenance activity was agreed to, everything rolled quickly. Commitments from various groups were obtained to proceed with the work as planned.

- A Design, single point of contact (SPOC) was identified to provide specifications when needed on valves that had no formal specification documented and to revise documentation where the existing documentation was inadequate,
- One Assessor was tasked for the PM planning and pressure boundary documentation,
- A Maintenance Engineer was assigned to track and manage the work,
- Planning department ensured that the priority of the job was maintained to schedule the work activities,
- Trades were dedicated to PSV removal, installation and testing,
- Management oversight was drastically improved.

Results

The overall results were phenomenal. With no increase in staffing and by keeping people focused on the plan, the backlog was reduced drastically. The PSV team performed servicing on 402 valves in one year, which 138 were overdue. At year-end of the fiscal year 20 valves were reported as overdue carried over into the next year target. As of September 2008, the program is reporting 4 valves overdue. Due to the amount of overdue valves that had to be serviced in this period, the workload had increased by 65% over a typical year.

(Figure 2) shows the work performed in from December 2006 to March 2008.

Other Improvement

This work reinforced the need for one group to concentrate their effort on performing maintenance.

It also helped realigning the way PMs were documented in the CMMS. Historically maintenance was not always linked to a specific location or piece of equipment, position, or asset, but rather at the higher system level. To further add complexity to this problem some valves were attached to a maintenance route list. This made the planning and maintenance oversight difficult which resulted in poor history tracking. To avoid a further reoccurrence of this problem, a decision was made to introduce a Maintenance SPOC to ensure all PMs are developed as per maintenance and regulatory guidelines.

Further follow-up actions resulted in a number of PSVs positions being removed from the PM process, as the systems were fully shutdown or dismantled.

The 1500 PSVs in the CMMS that were considered in use but only about 1000 had associated PMs. This number did not agree with to our analysis. One would expect a PSV to be required by code therefore would need a PM by code. Further investigation was conducted to confirm reality from fiction. The investigation required planning and we needed to ensure information captured during the investigation was not lost. A PSV field check form **(Figure 3)** was developed to document all the PSVs found in the field to record valve information as found in the field.

After months of field walk downs and many installation pictures taken, over 248 PSVs were identified as requiring PMs. To ensure preventive maintenance is assessed for all components, a new process was implemented at the assessment stage.

Now what?

Corrective work is being performed on the PSVs that were never maintained and PMs are scheduled over the next few years to balance the work.

All new Structures, Systems and Components (SSCs) are reviewed to confirm if PMs are needed.

And finally all this hard work is useless if every one is resting on one's laurels. Management oversight has to stay on top of the program. Any drift in the numbers has to be captured and resolved. Without management support, work cannot go on.

Better reports are being prepared to better identify any issues.

We still need to be more proactive to ensure we stay on top of the issues. Preventive Maintenance on coming due PSVs are reviewed on a 52-week forecast to reduce chances of not having the required parts or technical documentation.

We still need to be more proactive to ensure we stay on top of any issues as they arise.

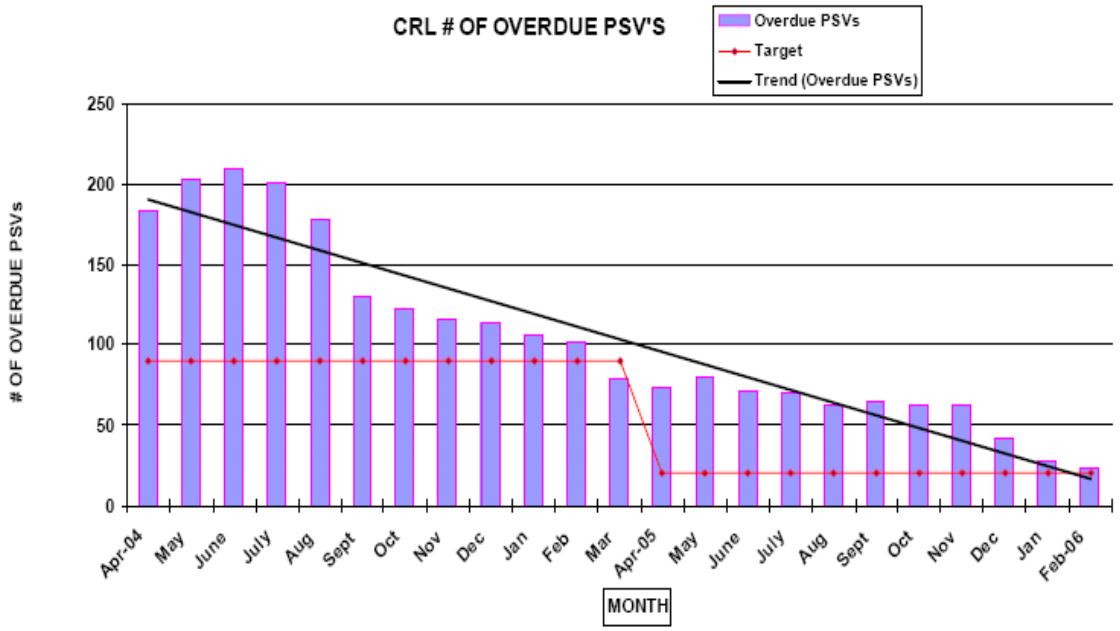


Figure 1 Pressure Safety Valves Program Compliance for CRL Site April 2004 to Feb 2006

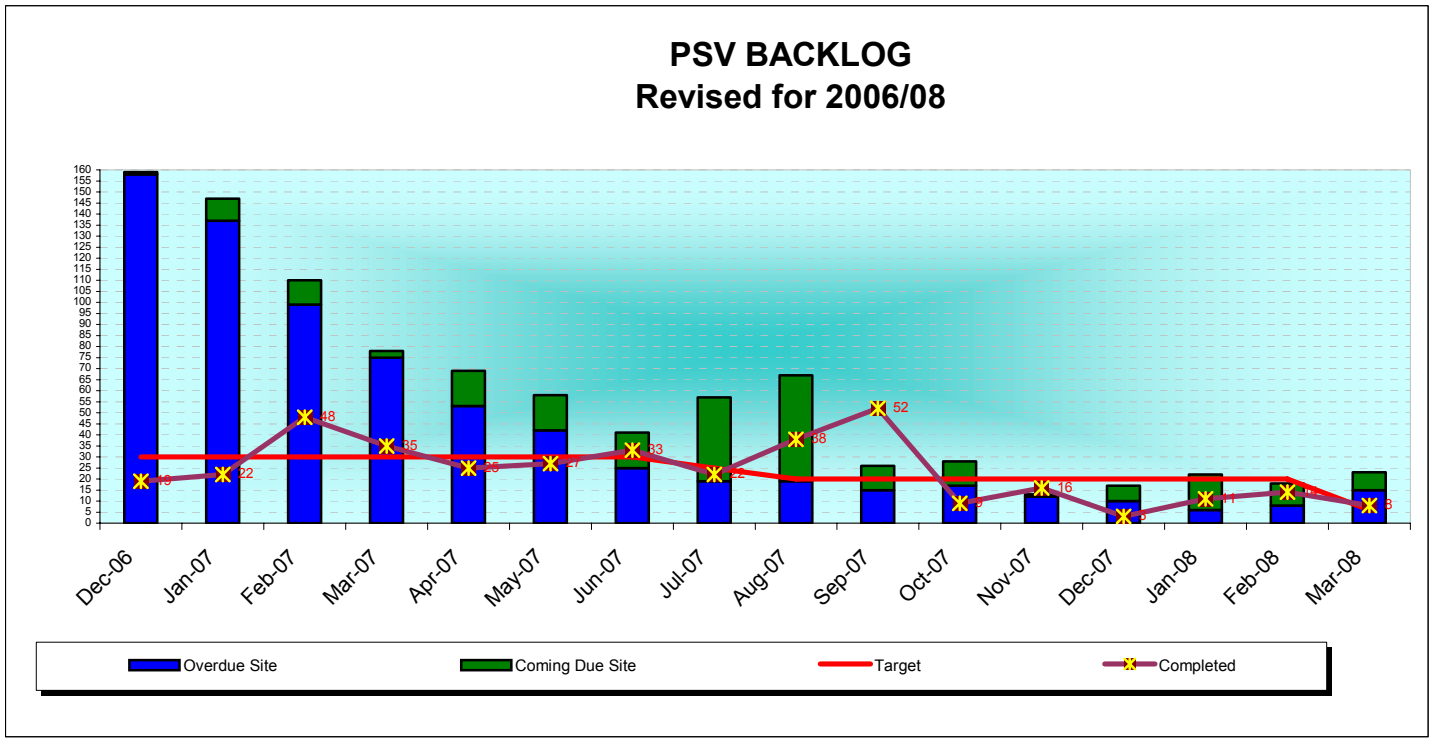


Figure 2 Pressure Safety Valves Program compliance for CRL Site from Dec 2006 to Mar 2008

PRESSURE SAFETY VALVE
FIELD CHECKLIST

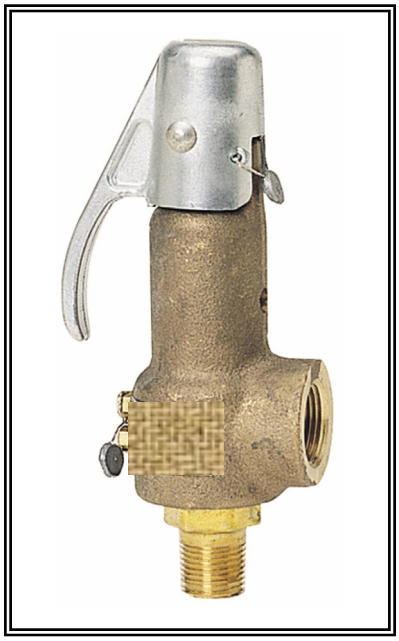
POSITION: _____ (*Tag Installed*) ☐ YES ☐ NO

LOCATION: Building: _____ Room: _____
LOCATION DETAILS: _____
SPECIFICATION DOCUMENT NO.: _____

ASSET NO: _____ (*Tag Installed*) ☐ YES ☐ NO

PSV SIZE: Inlet: _____ Outlet: _____

REGULATOR MODEL: _____
PIPE SIZE ON REGULATOR: _____
PIPE SIZE ON BYPASS: _____
PSV VENTED EXTERNALLY: ☐ YES ☐ NO
PHOTOGRAPH(s) TAKEN: ☐ YES ☐ NO
PATH: J://Site MEA/PSV/PHOTOS/_____



COMMENTS:

_____
_____
_____
_____
_____

ASSESSOR: _____ EN: _____ DATE: _____
yyyy/mmm/dd

PROCEED WITH PLANNED PREVENTIVE MAINTENANCE:

MAINTENANCE
ENGINEER: _____ EN: _____ DATE: _____
yyyy/mmm/dd

Figure 3 Pressure Safety Valve Field Checklist