ENGINEERING MINUTE 1
PRESTARTUP SAFETY REVIEWS (PSSR)

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PRESTARTUP SAFETY REVIEW (PSSR)

Sutton, Ian S.
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THE AUTHOR'S APOLOGY FOR HIS BOOK

I have been working in the area of process risk management for many years. During that time I have written a number of books and ebooks on the topic; titles include *Process Safety Management, Management of Change, Writing Operating Procedures for Process Plants, Process Reliability and Safety, Y2K and the Process Industries, Fault Tree Analysis* and *Process Risk Management. See details at https://bin95.com/sutton/*

The purpose of this particular Engineering Minute, which is published as an ebook, is to help managers, engineers and technical specialists understand the topic of prestartup safety review (PSSR) in order to ensure that all process changes are carefully controlled and understood before being implemented the changed process is put into operation. In all of my publications I attempt to blend empirical practice with theoretical concepts to come up with a product that is, I hope, useful to a wide range of technical professionals and managers as they develop long-range risk management programs. At the same time, my intent is that the practical guidance provided here will be of immediate use at 8 o'clock on Monday morning.

As always when I write, my greatest difficulty is in knowing when to stop. Engineering companies use a phrase, 'shoot the engineers'. It means that there comes a time when design must stop, and construction must start. Project managers use the term 'scope creep' to express the same concept. Projects have an inexorable tendency to grow 'all by themselves' unless someone says, "Stop!". So it is with the writing of books. When I first arrived in New York in the year 1974 I was taught the phrase, 'Enough is enough already'. There's a good time to stop writing — and that time is now.

Finally, in every publication that I have written so far I have concluded the preface with the words Edmund Spenser used in the introduction to his poem *Faerie Queene*, 'Goe little book: thy selfe present'. So it is with this book — it is now in your hands gentle reader.

Ian Sutton

Houston, Texas
2007

CONTENTS

PRESTARTUP SAFETY REVIEWS

Plus ça change, plus c'est la même chose.

(The more things change, the more they stay the same.)
Alphonse Karr (1808 – 1890)

INTRODUCTION

The term Prestartup Safety Review (PSSR) first received prominence in the process industries with the introduction of the Process Safety Management (PSM) regulations. In the United States two federal agencies, the Occupational Safety & Health Administration (OSHA) and the Environmental Protection Agency (EPA) require that companies conduct prestartup safety reviews. The wording of the two standards regarding PSSRs is virtually identical (*see* page 2), although the industries covered and the reporting requirements differ slightly.

The fundamental purpose of a prestartup safety review is to ensure that any changes that are made to a facility or item of equipment meet the original design or operating intent. The PSSR aims to catch any changes that may have crept into to the system during the detailed engineering and construction phases of a project. PSSR covers not only equipment, but also 'soft' issues, such as operating procedures and training.

PSSRs play a particularly important role in large projects because such projects all too often fall behind schedule and/or run over budget, thus creating pressure on the project team to eliminate or postpone the installation of any items that are not absolutely necessary for the start-up. If not controlled properly, this can lead to corner-cutting — either intentional or inadvertent — which may then jeopardize safety. By carrying out a PSSR, the operations and maintenance departments

have the authority to refuse to accept responsibility for a plant or item of equipment that they judge to be unsafe. In effect, a prestartup safety review provides a breathing space for everyone to make sure that the plant that they are about to start is safe and operable.

It is not the purpose of a PSSR to replace this normal 'punching out' of a new or modified facility. Indeed, one of the purposes of a PSSR is to make sure that routine checking processes were in place and that they were followed. Nor is a PSSR a last-minute hazards analysis. The PSSR team will typically check that a hazards analysis was carried out on the proposed changes, and that all the findings were implemented or closed out in a professional manner, but the PSSR does not aim to identify new hazards.

THE OSHA PSM REGULATION

Because of its role in creating the concept of prestartup safety reviews in the process industries, the OSHA (Occupational Safety & Health Administration) process safety management (PSM) regulation to do with the topic is discussed in this section.

Regulation and Guidance

The OSHA standard to do with Prestartup Safety Reviews is to be found in paragraph (i) of the regulation as shown in Table 1; OSHA's guidance on the topic is provided in Table 2.

Table 1
OSHA PSM Regulation

The employer shall perform a pre-startup safety review for new facilities and for modified facilities when the modification is significant enough to require a change in the process safety information. The pre-startup safety review shall confirm that prior to the introduction of highly hazardous chemicals to a process: (i) Construction and equipment is in accordance with design specifications; (ii) Safety, operating, maintenance, and emergency procedures are in place and are adequate; (iii) For new facilities, a process hazard analysis has been performed and recommendations have been resolved or implemented before startup; and modified facilities meet the requirements contained in management of change, paragraph (l) [of this regulation].

Table 2
OSHA PSM Guidance

For new processes, the employer will find a PHA helpful in improving the design and construction of the process from a reliability and quality point of view. The safe operation of the new process will be enhanced by making use of the PHA recommendations before final installations are completed. P&IDs are to be completed along with having the operating procedures in place and the operating staff trained to run the process before startup. The initial startup procedures and normal operating procedures need to be fully evaluated as part of the pre-startup review to assure a safe transfer into the normal operating mode for meeting the process parameters.

For existing processes that have been shutdown for turnaround, or modification, etc., the employer must assure that any changes other than "replacement in kind" made to the process during shutdown go through the management of change procedures. P&IDs will need to be updated as necessary, as well as operating procedures and instructions. If the changes made to the process during shutdown are significant and impact the training program, then operating personnel as well as employees engaged in routine and nonroutine work in the process area may need some refresher or additional training in light of the changes. Any incident investigation recommendations, compliance audits or PHA recommendations need to be reviewed as well to see what impacts they may have on the process before beginning the startup.

Discussion of the Regulation

The first paragraph of the regulation states that a PSSR is needed whenever process safety information is changed. Since virtually all changes result in updates to the facility documentation, particularly P&IDs, the effect of this requirement means that virtually all changes will have to be reviewed by a PSSR. There are very few changes that do not require some information changes to do with topics such as safe limits, engineering drawings and equipment lists.

(i) Construction and Equipment

Paragraph (i) of the standard requires that construction and equipment is in accordance with design specifications. PSSR team members can carry out spot-checks of the installed piping and equipment, and compare it with the piping lists and equipment data sheets.

(ii) Procedures

Paragraph (ii) requires that the facility's procedures reflect the manner in which the facility is to be operated after the process changes have been made. The PSSR should check that safety, operating and emergency procedures for the new operation have been written down, and that they accurately describe what has to done. This paragraph does not mention training, but it can be assumed that operators and maintenance workers must be trained in the use of the new procedures.

(iii) New / Modified Facilities

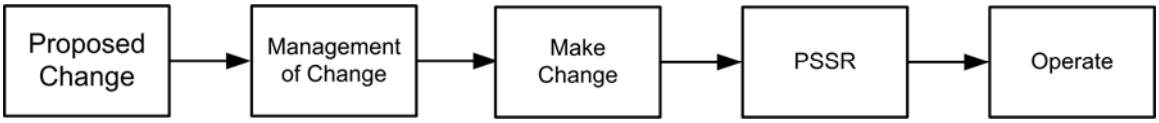
The regulation requires that new facilities conduct a process hazards analysis (PHA). The PSSR team should check that the PHA was in fact carried out, and that its recommendations were either resolved or implemented. During the pressure of construction, there is sometimes a tendency to postpone some of the PHA recommendations until 'there is sufficient time'. The PSSR should check that the recommendations have, in fact, been closed out properly.

Additional information to do with the topic of hazards analysis is provided in the ebook *Process Risk Management*, details of which can be found at https://bin95.com/sutton/.

MANAGEMENT OF CHANGE AND AUDITS

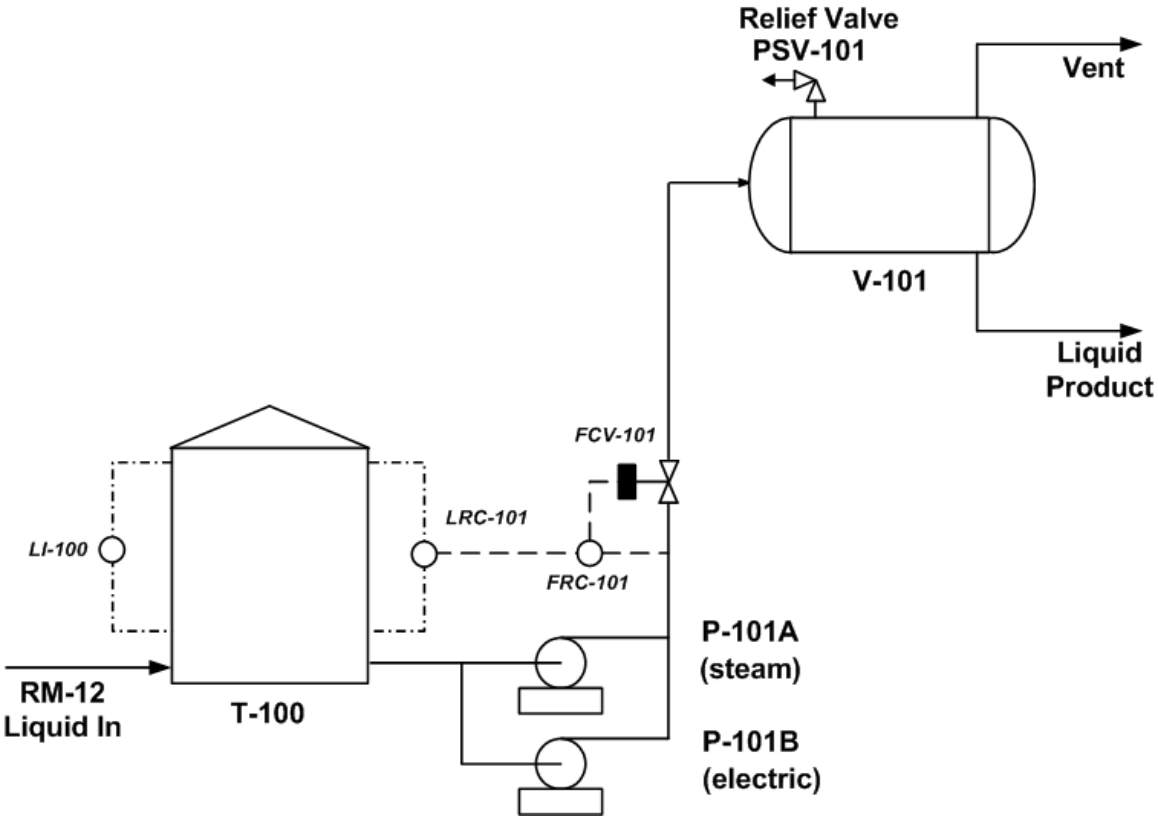
The way in which PSSRs, MOCs and audits link to one another is demonstrated in Figure 1.

Figure 1
PSSR / MOC / Audit



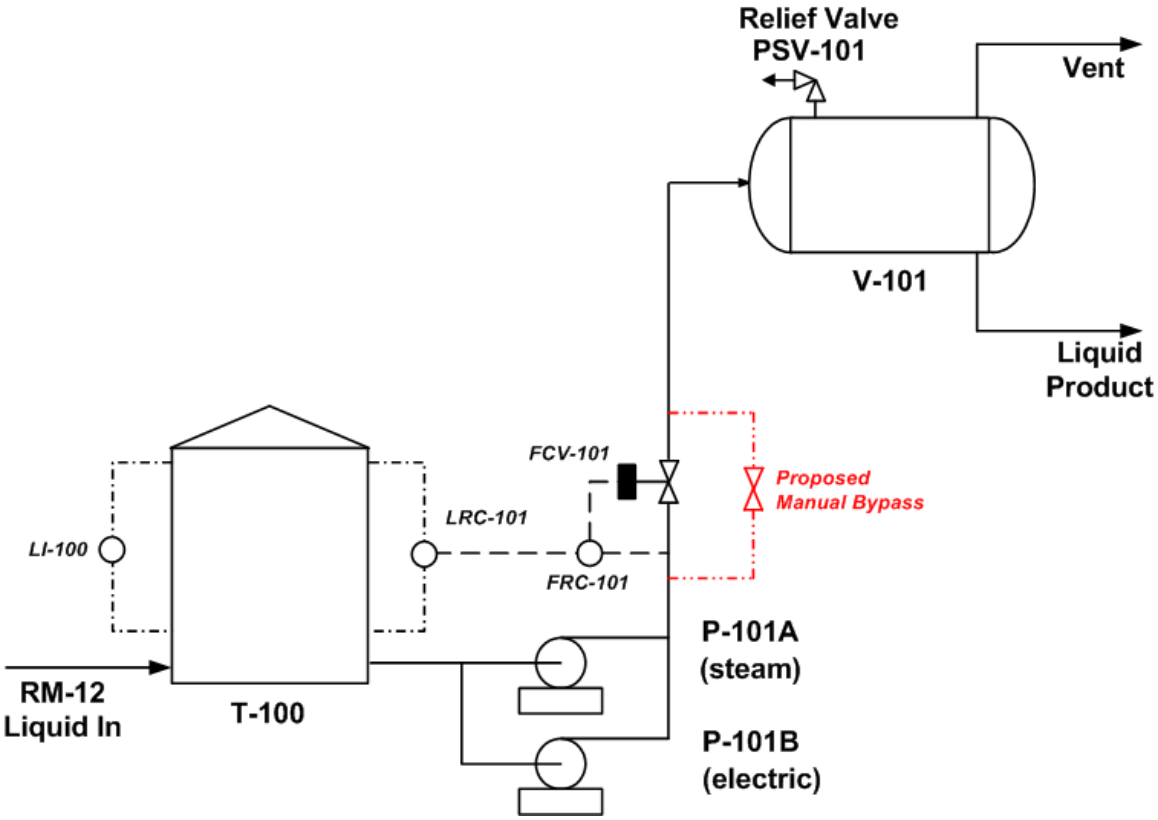
The process in Figure 1 can be illustrated using the standard worked example. The example is based on a simple liquid flow system, reproduced below in Figure 2.

Figure 2
Standard Example



During normal operation of the above system, it is found that the control valve FCV-101 is unreliable. Therefore an operations engineer proposes to install a manual bypass around FCV-101, as shown in Figure 3. The bypass would be used while FCV-101 is being repaired.

Figure 3
Proposed Change



Change Process

The first step in the process shown in Figure 1 is that someone proposes to make a change to the facility. In this case, the proposed change is the manual bypass shown in Figure 3. The operations engineer develops his proposal and submits it to the MOC process. If the proposed change is accepted, the new piping and valve is installed, *but the system is not put into operation.*

Before the bypass can actually be used, a prestartup safety review must be carried out. With regard to the example shown in Figure 3, members of the PSSR team will check for issues such as:

- Have the facility P&IDs been updated?
- Has an operating procedure for the new system been prepared?
- Are the operators trained in the use of that procedure?
- Has the new piping and valve been inspected and pressure tested?
- Has a hazards analysis on the modified process been carried out, and have any recommendations been implemented?

Audits

A PSSR has the form of an audit, but it is not a formal compliance audit. The purpose of the PSSR is to make sure that all necessary process safety work has been completed prior to startup, not to check the process safety management systems themselves. Audits are used to check on the implementation of the process safety management systems. In Figure 1 it can be seen that audits check on the MOC and PSSR processes.

ORGANIZATION OF A PSSR

A PSSR is not always a paper-based check. It is sometimes feasible to test the new system in the field before actually putting it into operation. For example, on one facility an interlock system was upgraded in order to prevent such unauthorized over-rides. Part of the PSSR was to have a knowledgeable and determined operator try to override the new interlock while the plant was shut down in order to see if he could 'beat the system'.

Generally, a PSSR is conducted by a team. The leader represents the operations group because it is they who are usually the ultimate customer for the changes that have been made. Supporting the leader are technical specialists and representatives from the process safety team. The leader should have sufficient authority to delay the startup if he or she identifies a significant deficiency. Given that such a delay could lead to a serious financial loss, the leader may find himself under very strong pressure to let things go ahead as they are. He or she must have the personality, and the organizational authority to resist such pressures.

RESTART SAFETY REVIEWS

PSSRs should be conducted on equipment that been idle for an extended period prior to restart. Such a PSSR is called a *Restart* Safety Review, or RSSR, and they are carried out even if no (intentional) changes have been made to the equipment. The following are some of the reasons for conducting an RSSR:

- If a plant has been shut down for a long time, uncontrolled changes may have been made to it. For example, personnel from other departments may have cannibalized the shutdown equipment for spare parts.

- During the shutdown period the integrity of the plant may have deteriorated. Equipment and piping may have corroded, rotating equipment shafts may have bent, seals may have become degraded, pockets of corrosive materials may have formed at the base of storage tanks, or instruments contacts may have covertly failed. The RSSR will check that all necessary maintenance has been completed.

- During the shutdown period, external factors may have changed. For example, the quality of the streams feeding the unit may be different, or the utilities may have changed properties.

- On restart it is quite likely that new operations and maintenance personnel will have been assigned to the unit during the period of the shutdown. The RSSR will check that these people are properly trained, and that they are supported by updated documentation.

CONCLUSIONS

Prestartup and Restart Safety Reviews are an important part of any process safety management program, yet are not always given the attention that they deserve. They provide a last chance for everyone associated with a project to make sure that no unsafe acts or conditions have slipped through before operations actually start. The temptation to rush this step must be avoided. Everyone involved in operating the modified facility must have an opportunity to make sure that conditions are safe, that effective procedures have been written and that the operators and maintenance personnel have been properly trained.

INDEX

Citations and references for this ebook and for other publications in this series are located full versions.