Overpressure Protection Requirements for Pressure Vessels and Pressure Piping

AB-525

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1.0 Introduction

The Administrator in Pressure Equipment Safety discipline has issued Directive IB13-003 to establish that this ABSA Document AB-525, *Overpressure Protection Requirements for Pressure Vessels and Pressure Piping*, defines Alberta requirements that must be met for systems that consist of pressure piping and/or pressure vessels where overpressure protection is provided by:

- pressure relief valve (PRV) in compliance with Sections 38(1)(a), 38(2), and 38(3) of the PESR; and/or
- other means of overpressure protection in lieu of PRV as provided for under Sections 38(1)(b) and 38(3) of the PESR.

In addition to providing guidance as to how overpressure protection requirements can be met, AB-525 also addresses how certain types of overpressure protection by system design (OPPSD) for pressure vessels and pressure piping may be registered without applying for individual case-by-case consideration.

AB-525 applies to pressure piping and pressure vessels that are subject to the *Safety Codes Act* and are not exempt from the *Pressure Equipment Safety Regulation*. This document also applies to pipelines subject to ERCB Directive 077 and ABSA Directive IB10-006.

The *Pressure Equipment Safety Regulation* (PESR) establishes requirements that must be met by persons who own, operate, design, construct, install, repair, alter or maintain pressure equipment or provide related services to ensure that the pressure equipment is safe for operation.

According to the PESR, all pressure equipment must have overpressure protection, and the overpressure protection system must be properly designed and operated.

The general opinion is that pressure relief valves are the best and the most economical choice for most applications.

For the purpose of this document, “OPPSD” will refer to protection of pressure vessels and “Piping OPPSD” will refer to protection of pressure piping. OPPSD is a term that comes from the ASME Boiler and Pressure Vessel Code (e.g. Section VIII, Division 1, paragraph UG-140(a)).

Systems with OPPSD where pressure is self-limiting and no higher than the respective piping design pressure or pressure vessel MAWP may provide equivalent safety as pressure relief valves. This document refers to systems which include centrifugal pumps, centrifugal compressors, or Steam Assisted Gravity Drainage (SAGD) production piping as cases whereby OPPSD may be considered to provide...
an equivalent level of safety as the use of pressure relief valve. This document includes the registration submission requirements for both pressure piping and pressure vessels and also includes the Integrity Management System requirements for pressure equipment owners to apply the OPPSD principles. The design reviews of such systems are not considered “special cases”. Future revisions of this document may include additional cases.

Systems protected by OPPSD where pressure is not self limiting or systems protected by other means of overpressure protection that are specified in Section 5.5 of this document may not provide an equivalent standard of safety as relief valves. This warrants special consideration. Design review of such systems are considered special cases.

Before the development of this document, the Administrator asked the Boilers and Pressure Vessels Technical Council (BPVTC) for the input. A Task Group on Overpressure Protection by System Design (OPPSD) was formed and the objective of this Task Group was to develop a report (guideline) that will define limits and specify requirements for certain types of pressure equipment with OPPSD. The Task Group included three members representing owner-users, two members representing designers, and two members representing the jurisdiction. At the September 2011 meeting, the BPVTC endorsed the Task Group report and recommended to the Administrator to issue a Directive in the form of a province-wide Variance that would be based on this task-group report.

The BPVTC Task Group on OPPSD report: “The Use of Overpressure Protection by System Design (OPPSD) Principles for Both Pressure Piping and Pressure Vessels in the Province of Alberta as Provided Under Section 38(1)(b) of Alberta Regulation 49/2006” was used as a basis for the development of this document. The Task Group report recommended that a requirements document be created to identify the requirements for specific cases for use of OPPSD principles for both piping and pressure vessels in the province of Alberta. The report also recommended that this requirements document will be used by the Administrator as the basis for the acceptance of certain types of OPPSD in place of the provision of a pressure relief valve as provided for under Section 38(1)(b) of the PESR.

This document was developed through close cooperation with the taskforce members and their input has been invaluable in compiling this document.

ABSA policy documents are periodically reviewed to ensure that they are aligned with current industry practices. We would welcome any suggestions you have to improve this document. Please provide your comments to:

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2.0 Definitions

For the purpose of AB-525, the following definitions apply. Relevant definitions from the Alberta Safety Codes Act and Pressure Equipment Safety Regulation are also included in this section.

**ABSA** - refers to the pressure equipment safety authority authorized by the Alberta government for the administration and delivery of all safety programs related to pressure equipment under the *Safety Codes Act*.

**ABSA Design Surveyor** - is an ABSA Safety Codes Officer (SCO) who holds the required Safety Codes Officer designation and designated powers under the *Safety Codes Act* and is competent to assess that the design of pressure equipment complies with the Alberta Regulations and Code of construction requirements.

**ABSA Inspector** - is an ABSA Safety Codes Officer (SCO) who holds the required Safety Codes Officer designation and designated powers under the *Safety Codes Act* and is competent to inspect pressure equipment.

**Act** - means the Alberta *Safety Codes Act* and the regulations under this Act that apply to pressure equipment.

**Administrator** - means the Administrator in the pressure equipment discipline appointed under the Act.

**Control Valve** – is a valve that is used to control conditions such as flow, pressure, temperature, or liquid level by fully or partially opening or closing in response to signals received from controllers that compare a set-point to a process variable whose value is provided by sensors that monitor changes in such conditions.

**Controlled Valve** – is a valve that is controlled (by safety procedure) to prevent inadvertent operation. Control can be in the form of car seals, chain locks, operation/maintenance procedures (e.g. exchanger isolation for cleaning), or Instrumented Interlocks (e.g. emergency isolation valves linked to compressor or pump trip systems). API-521 annex B and ASME BPV Code, Section VIII, Division 1 non-mandatory appendix M provide additional guidance.

**Existing system** – is a piping and pressure vessel system that was completed, form AB-81 submitted to ABSA, and was placed in service on or before the date this document was first issued.
**IMS** - means Integrity Management System. This is a system for ensuring that the pressure equipment is designed, constructed, installed, operated, maintained and decommissioned in accordance with the Act.

**MAWP** – is Maximum Allowable Working Pressure for a pressure vessel as stated on the data report and nameplate.

**Maximum Upset Pressure** – is the maximum pressure that the piping or pressure vessel may see from any event (startup, operation, upset condition, shutdown, operator error, instrument malfunction, etc.) as determined from the Overpressure Risk Assessment (ORA). For ORA, see definition below.

**OPPSD** – means Overpressure Protection by System Design. This is the term utilized in ASME, BPV Code (e.g. Section VIII, Division 1, paragraph UG-140(a)) and refers to the protection of a pressure vessel against overpressure without the use of a pressure relief device. For *Piping OPPSD*, see definition below.

**ORA** – means Overpressure Risk Assessment. This is a risk assessment to determine the sources of overpressure and the Maximum Upset Pressure. It may follow the guidance of WRC-498 – *Guidance on the Application of Code Case 2211 – Overpressure Protection by System Design* or other equivalent risk assessment procedure. The ORA must use an organized, systematic and documented approach conducted by qualified personnel through a multi-disciplinary team. The process used for ORA must be based on recognized standards and good engineering practices (WRC-498, ANSI/API 521, ANSI/API-520, etc.). The ORA shall include a list of Safety Critical Elements utilized in the determination of the Maximum Upset Pressure.

**Overpressure** – is a condition where the piping design pressure or pressure vessel MAWP is exceeded.

**Owner** - includes a lessee, a person in charge, a person who has care and control, and a person who holds out that they have the powers and authority of ownership or who for the time being exercise the powers and authority of ownership.

**Owner-user** - is an owner that has provided an Integrity Management System in accordance with the *Pressure Equipment Safety Regulation* and has been issued a quality management system Certificate of Authorization Permit under Section 11(3) of the PESR.

**PEIMS** – means Pressure Equipment Integrity Management System, which is a system for ensuring that the pressure equipment is designed, constructed, installed, operated, maintained, and decommissioned in accordance with the Act. The PEIMS needs to be submitted in a form acceptable to the Administrator, and it must be acceptable to the Administrator. The requirements for PEIMS are specified in AB-512.
Pin Device (PD) - is a nonreclosing pressure relief device actuated by inlet static or differential pressure and designed to function by the activation of a load bearing section of a pin that supports a pressure containing member.

Piping Design Pressure – is the design pressure value of the piping system as listed in the line designation table that is registered with ABSA.

Piping OPPSD – is the term that applies to the protection of a piping system(s) against overpressure without the use of a pressure relief device.

Pressure equipment - means a thermal liquid heating system and any containment for an expansible fluid under pressure, including, but not limited to, fittings, boilers, pressure vessels and pressure piping systems, as defined in the regulations.

Pressure Relief Device (PRD) – means a pressure relief valve, rupture disc device, or pin device. For pressure relief valve, rupture disc device, or pin device, see definitions in this document.

Pressure Relief Valve (PRV) – means a safety valve, relief valve, or safety relief valve. For safety valve, relief valve, or safety relief valve, see definitions in this document.

Pressure piping system - means pipes, tubes, conduits, fittings, gaskets, bolting and other components that make up the system for the conveyance of an expansible fluid under pressure and may also control the flow of the fluid. For the purpose of this document, piping and piping system refers to ASME B31 Piping Codes and CSA Z662 pipeline codes.

Relief Valve - is a pressure relief valve actuated by inlet static pressure which opens in proportion to the increase in pressure over the opening pressure.

Rupture Disk Device (RDD) - is a nonreclosing pressure relief device actuated by inlet static pressure and designed to function by the bursting of a pressure containing disk.

Safety Codes Officer (SCO) - is a Safety Codes Officer in pressure equipment discipline employed by ABSA who holds the required safety codes officer designation and designated powers under the Safety Codes Act.

Safety Critical Elements – are equipment and process parameters that can have an impact on the Maximum Upset Pressure determined in the ORA (e.g. pump impellors, instrument maintenance requirements, instrument redundancy, liquid specific gravity).
Safety Relief Valve - is a pressure relief valve characterized by rapid opening or pop action, or by opening in proportion to the increase in pressure over the opening pressure, depending on application.

Safety Valve - is a pressure relief valve actuated by inlet static pressure and characterized by rapid opening or pop action.

SAGD – means Steam Assisted Gravity Drainage. This is an enhanced oil recovery technology for producing heavy crude oil and bitumen.

3.0 Governing Legislation and Requirements

Legislation that governs the pressure equipment discipline includes the following:

1. Safety Codes Act

The following documents have been accepted by the administrator as requirements under the Pressure Equipment Safety Regulation and must be met for all pressure equipment including pressure piping and pressure vessels with OPPSD:

AB-512 - Owner-User Pressure Equipment Integrity Management Requirements
This specifies quality management system requirements for owners who are required to hold a Certificate of Authorization Permit under Section 11(3) of the PESR.

AB-512a - Owner-User Scope and Responsibilities form
This form is used to define the responsibility for key activities under the owner-user's program.

AB-513 - Pressure Equipment Repair and Alteration Requirements
This covers inspection and certification and other requirements for repairs and alterations to pressure equipment.

AB-524 Pressure Relief Devices Requirements
This applies to manufacture, assembly, selection & sizing, inspections, repairs, servicing, setting & sealing and installation of Pressure Relief Devices in Alberta.
ABSA Form AB-96 – *General Engineering Requirements for Design & Construction of Pressure Piping Systems.*
This form is used for documenting the information for the pressure piping system design and construction under the Safety Codes Act and its Regulations.

IB10-006 - *ABSA Requirements for Steam Pipelines.*
This Directive applies to steam pipelines within the scope of ERCB Directive 077, Part B, Section 3.1.

AB-516 The *Pressure Equipment Safety Regulation User Guide*
Even though AB-516 is not a requirement document, it provides valuable information and guidance to assist stakeholders in meeting the requirements of the *Pressure Equipment Safety Regulation* and in assuring the safe operation of their pressure equipment.

The official versions of AB-96, AB-512, AB-516 and other ABSA policy documents are posted on [www.absa.ca](http://www.absa.ca). Directives and bulletins issued by the Administrator and other valuable information are also posted on the ABSA website.

## 4.0 Referenced Codes and Standards and Other Good Engineering Practices

The adopted codes, standards, and other recognized and generally accepted good engineering standards that are referenced in AB-525 are listed below.

- **ASME BPVC, Section I** – *Rules for Construction of Power Boilers*
- **ASME BPVC, Section IV** – *Rules for Construction of Heating Boilers*
- **ASME BPVC, Section VIII Div 1** – *Rules for the Construction of Pressure Vessels*
- **ASME BPVC, Section VIII Div 2** – *Alternative Rules*
- **ASME BPVC, Section VIII Div 3** – *Alternative Rules High Pressure Vessels*
- **ASME BPVC, Section IX** –  *Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators*
- **CSA B51** – *Boiler, pressure vessel, and pressure piping code*
- **ASME B31.1** – *Power Piping Code*
- **ASME B31.3** – *Process Piping Code*
- **CSA Z662** – *Oil and Gas Pipeline Systems*
- **ANSI/API-520** –  *Sizing, Selection, and Installation of Pressure Relieving Devices in Refineries*
A full listing of the codes and standards that are adopted as regulations is provided in Section 6 of the PESR.

5.0 Overpressure Protection Requirements

Overpressure protection is considered the last line of defense against possible catastrophic failure of pressure equipment. The function of overpressure protection is to:

- Protect people,
- Prevent unsafe operation of pressure equipment,
- Protect equipment from failure due to overpressure,
- Prevent loss of production.

Section 38(1) of the PESR requires that the owner of pressure equipment must ensure it has overpressure protection that is:

(a) a pressure relief valve that meets the requirements of the ASME Code, or
(b) other means of overpressure protection acceptable to the Administrator.

According to the PESR, a pressure relief valve that meets the requirements of the ASME Code is required for protection of all pressure equipment unless the pressure equipment is protected by some other means acceptable to the Administrator. The Administrator may accept an alternative means of overpressure protection that is not a PRV, or the Administrator may issue a Variance for the means of overpressure protection.

Pursuant to Section 14(3) of the PESR, an applicant for the registration of a design must submit the information that the Administrator requires. Sections 14, 15, 16, 17, and 18 of the PESR specify requirements for design registration.

When the use of PRD, OPPSD, and/or other means of overpressure protection is considered to support pressure piping or pressure vessel applications, each design submission for registration needs to satisfy the design submission requirements specified in this document in addition to the requirements specified in the PESR and the code of construction.
Figure 1 – Overpressure protection options flow chart
In addition to the PESR and this requirements document for overpressure protection, the CSA and ASME codes and standards declared in force by the PESR have requirements for overpressure protection (pressure relief valve or other means of overpressure protection) that must be met. However, the requirements of the CSA Code prevail over the ASME Codes, and the requirements of the PESR prevail over all code requirements.

The owner may specify more stringent requirements for overpressure protection than the requirements specified in the PESR, this document, and/or codes and standards declared in force. However, if the requirements of prevailing documents contradict owner requirements, the requirements of PESR, this document, CSA and ASME codes govern.

When an owner, or an owner’s agent with the concurrence of the owner, is planning to use other means of overpressure protection in lieu of a PRV, the owner must demonstrate to the Administrator that the proposed overpressure protection system provides an equivalent or greater standard of safety than using a PRV.

If the owner, owner’s agent or designer of pressure equipment is in doubt regarding the use of a certain type of overpressure protection in Alberta, then it is recommended that they check with ABSA to determine whether the use of that overpressure protection philosophy is acceptable in any particular circumstance.

Figure 1 provides a flow chart on overpressure protection options. Owners and designers may use this flow chart to determine how a proposal for the use of OPPSD can be processed most readily.

### 5.1 Pressure Relief Valves

When pressure vessels and pressure piping are protected by PRVs in accordance with Section 38(1)(a) of the PESR, the PRVs must:

- provide overpressure protection for **all** overpressure events (scenarios) validated with an ORA, and
- meet all the requirements specified in the PESR, this document, AB-524 document, and the applicable CSA and ASME Code.

In cases when pressure vessels and pressure piping are protected by a PRV that does not provide overpressure protection (capacity or set pressure) for one or more of the overpressure events (scenarios) validated with an ORA, this combination of PRV and other means of overpressure protection requires specific acceptance in accordance with Section 38(1)(b) of the PESR and Section 5.5 of this document.
For such scenarios, the design submission must specify:

- PRV protection in accordance with Section 38(1)(a) of the PESR, and
- Other means of overpressure protection in accordance with Section 38(1)(b) of the PESR and Section 5.5 of this document.

Example: If a PRV provides overpressure protection for 4 of 5 overpressure events (scenarios), then the design submission needs to provide the scope of overpressure protection in accordance with Section 38(1)(a) of the PESR. For the fifth overpressure event (scenario), the design submission needs to provide how requirements are met for other means of overpressure protection in accordance with Section 38(1)(b) of the PESR and Section 5.5 of this document.

### 5.1.1 Cases where the Use of PRVs is Mandatory

The use of PRVs is mandatory for:

A. Boilers (for example: ASME BPV Codes, Section I and Section IV require safety valves and do not consider the OPPSD principals);
B. Boiler external piping as defined per ASME B31.1;
C. Pressure vessels designed in accordance with paragraph UW-2(c) or (d) of ASME BPVC, Section VIII, Div. 1
D. Pressure vessels in public occupancy;
E. Fired-heater pressure coils;
F. Thermal liquid heating systems; and
G. Systems which, by virtue of potential chemical reactions, are not self limiting with respect to pressure.

### 5.1.2 Design Registration Requirements When Overpressure Protection is Provided by PRV

When pressure equipment overpressure protection is provided by a PRV, the design submission\(^{(note\ 2)}\) must include a list of pressure relief valves on a numbered document with revision number, and be stamped by a Professional Engineer in accordance with Sections 16(1)(c),(i) and 16(2) of the PESR. As a minimum, this list shall provide the following information for each PRV:

- tag number or equivalent PRV identification;
- set pressure\(^{(note\ 1)}\);
- P & ID document number where this PRV is shown, and
- the equipment protected by this PRV\(^{(note\ 2)}\).
**Note 1:** According to Section 38(2) of the PESR, a pressure relief device must be set to open before the pressure in the pressure equipment exceeds the maximum allowable working pressure of the pressure equipment.

**Note 2:** It is a common and acceptable practice that pressure piping design submissions provide information on how overpressure protection is provided for both the piping and pressure vessels within that system. Pressure vessel design submissions typically do not provide information on how overpressure protection is provided. The pressure vessel drawings usually have a note stating that overpressure protection will be provided by the owner or by others. It is the responsibility of the owner to ensure that the pressure equipment overpressure protection is designed, registered, installed and maintained in accordance with the Act and Regulations (Section 38(3) of the PESR).

### 5.1.3 Installation of Valves in Pressure Relief Paths

The following requirements, in conjunction with AB-512 requirements, must be met for installation of valves in pressure relief device protected systems:

- The owner needs to ensure that pressure relief system designs with isolating valves in the path of pressure relief devices are accepted by ABSA prior to their installation.
- The installation of valves in systems protected by pressure relief devices does not constitute the requirement for an OPPSD case, provided the valves meet the definition of a Controlled Valve.
- ANSI/API 521 Annex B provides additional guidance on Controlled Valves and their use where a pressure relief device protects several pressure equipment components.
- ASME BPV Code, Section VIII, Division 1 Non-mandatory Appendix M also includes additional guidance on the use of block valves in the relief path.
- ASME BPV Code, Section I and Section IV do not allow installation of valves in the safety valve path. Controlled valves, as defined in this document, or any other type of valves can not be used in the safety valve path for boilers and boiler external piping specified in Section 5.1.1.A and B of this document.
- Controlled valves, as defined in this document, or any other type of valve shall not be used in the safety valve path for boilers, pressure vessels, fired-heater pressure coils and thermal liquid heating systems specified in Section 5.1.1.C, D, E, F and G of this document.
5.2 Rupture Disc and Pin Devices

Rupture discs and pin devices are deemed to be a means of overpressure protection according to Section 38(1)(b) of the PESR. When pressure vessels and pressure piping are protected by RDDs and/or PDs, the RDDs or PDs must:

- provide overpressure protection for overpressure events (scenarios) validated with an ORA, and
- meet all the requirements specified in the PESR, this document, AB-524 document, and the applicable CSA and ASME Code.

For a specific case of overpressure protection where a design submission:

a) includes RDDs and/or PDs that provide overpressure protection for all overpressure events (scenarios) validated with an ORA, and
b) meets all requirements specified in section 5.2.1 of this document, this overpressure protection system with RDDs and/or PDs is considered as providing an equivalent level of safety to the use of pressure relief valves and therefore may be registered as a part of the design submission without applying for the specific approval from the Administrator.

Cases of overpressure protection with RDDs and/or PDs that are different than the specific case described in the paragraph above require specific acceptance in accordance with Section 38(1)(b) of the PESR and Section 5.5 of this document.

5.2.1 Design Registration Requirements When Overpressure Protection is Provided by RDD or PD

When pressure equipment overpressure protection is provided by RDDs and/or RDs, the design submission must include a list of pressure relief devices on a numbered document with revision number and be stamped by a Professional Engineer in accordance with Sections 16(1)(c),(i) and 16(2) of the PESR. As a minimum, the submission shall provide the following information for each RDD or PD:

- Technical justification
- Owner's letter accepting the use of RDD or PD
- List of RDD or PD including:
  - tag number or equivalent RDD or PD identification;
  - set pressure\(^{(\text{note }1)}\);
  - P & ID document number where this RDD or PD is shown, and
  - equipment protected by this RDD or PD\(^{(\text{note }2)}\).
• Statement by the P.Eng. that the ORA has been completed, including a summary of the results from it.

Notes 1 and 2 from Section 5.1.2 also apply to this section.

5.3 Piping OPPSD and Pressure Vessels protected by PRD

This section refers to the systems that consist of pressure piping and pressure vessels where pressure piping overpressure protection is provided by Piping OPPSD in accordance with Section 38(1)(b) of the PESR and pressure vessels overpressure protection is provided by PRD in accordance with either Section 38(1)(a) or (b) of the PESR. These systems are deemed to be other means of overpressure protection and require specific acceptance from the Administrator in accordance with Section 38(1)(b) of the PESR.

When a system that consists of pressure piping protected by Piping OPPSD and pressure vessels protected by PRD meets all the requirements of this Section listed below, this system is considered to provide an equivalent level of safety as the use of pressure relief valves and therefore may be accepted by ABSA without applying for a specific acceptance from the Administrator provided:

A. The owner must have an IMS in accordance with Section 5.3.1 of this document before the piping is put in to service.

B. The following three Piping OPPSD cases are considered to provide an equivalent level of safety as the use of pressure relief valves:
   i. Centrifugal pumps – Piping associated with a centrifugal pump and upstream of the last block valve not considered a Controlled Valve will be considered for registration as OPPSD (figures 2 and 3 provide typical cases of Piping OPPSD).
   ii. Centrifugal compressors - Piping associated with a centrifugal compressor and upstream of the last block valve not considered a Controlled Valve will be considered for registration as OPPSD (figure 4 provides a typical case of Piping OPPSD).
   iii. SAGD piping from well head to processing facilities - This piping is similar in nature to the centrifugal pump case and as such, the same requirements must be met.

C. Design submission must meet the requirements specified in section 5.3.2 of this document and is registered with ABSA, and

D. Construction is done in accordance with the registered design.
Figure 2: Centrifugal Pump System – Configuration I

Figure 3: Centrifugal Pump System – Configuration II
Figure 4: Centrifugal Compressor System – Configuration I

Figure 5: Centrifugal Compressor System – Configuration II
(Scope of piping and pressure vessels with OPPSD is shown in red)
A pressure letdown control system (stations) may be considered as a special OPPSD case that may be registered without applying for the individual case-by-case consideration provided:

- The higher pressure system (upstream of the control valve) is protected with overpressure protection system that meets the requirements of this document (Sections 5.1, 5.2, 5.3, 5.4, or 5.5);
- The specification break is located in the control valve, and
- The lower pressure system (downstream of the control valve) is protected with a pressure relief valve that meets the requirements of PESR, Section 38(1)(a), and this document.

Overpressure protection systems with Piping OPPSD and pressure vessels protected by PRD that do not meet all the requirements of this Section require specific acceptance in accordance with Section 38(1)(b) of the PESR and Section 5.5 of this document.

### 5.3.1 Owner IMS Requirements

The owner must have an IMS in accordance with Section 37(b) of the PESR. When an Owner is planning to use Piping OPPSD in accordance with section 5.3 of this document, the Owner’s IMS shall address the following items appropriate for the scope of piping systems protected by the Piping OPPSD:

- meet the Owner’s IMS requirements as specified in the PESR or has PEIMS in accordance with AB-512;
- have a system for documenting piping protected by OPPSD;
- specify responsibilities for operations, maintenance, inspection, and engineering for Piping OPPSD;
- ensure that the owner's operating procedures and documentation provide adequate instructions and information to ensure that
  - operators are informed about the systems safeguarded by Piping OPPSD, and
  - no changes to safe operating limits per PESR 37(e) will result in a scenario where maximum upset pressure is greater than the piping design pressure listed in the registered design.

It is particularly important to stress to the operators that the equipment is not provided with a PRV to protect it from overpressure;
• have a management of change (MOC) system to control any changes to the systems safeguarded by Piping OPPSD. Where a proposed change to a system safeguarded by OPPSD results with maximum upset conditions above already registered design conditions, the MOC process must ensure the design is reevaluated and submitted to ABSA for review and acceptance before the change is implemented;

• have a monitoring system to
  o confirm that the Maximum Upset Pressure continues to be within the registered piping design pressure, and
  o meet all requirements for monitoring as specified in this document.

• ensure that the owner’s maintenance procedures and documentation provide adequate instructions and information to ensure that
  o maintenance personnel are informed about the systems safeguarded by OPPSD,
  o maintenance procedures address the details of the Piping OPPSD system, and
  o no changes to the system are permitted without following the owner’s MOC requirements.

It is particularly important to stress to the maintenance personnel that the equipment is not provided with a PRV to protect it from overpressure;

• have a system to conduct ORA when the owner proposes changes of pressure equipment or process operation in the piping protected by Piping OPPSD;

• establish a process for a safe shutdown of plant equipment and / or reduction in pressure in the event that pressure exceeds safe operating limits per Section 37(e) of the PESR;

• have a system for investigating and reporting excursions when the piping maximum upset pressure exceeds the limits defined in Section 7 of the document;

• have a system for documenting, monitoring and maintaining the safety critical elements which impact each OPPSD case;

• have a system for maintaining records;

• establish a process for change of ownership that will meet the requirements of Section 8 in this document.

5.3.2 Design Registration Requirements When Piping is Protected by Piping OPPSD and Pressure Vessels are protected by PRD

In order to register a pressure piping design with Piping OPPSD, the pressure piping design submission must meet all the requirements of the Alberta Regulations, this document, and the Code of construction. The owner or owner’s agent is responsible
for submitting the information related to the proposed use of Piping OPPSD and provide compliance with this document. The information referred to in the design submission must bear the stamp or seal of a Professional Engineer in accordance with Sections 16(2) of the PESR. Submissions that are found to be acceptable will be registered with a specific notation\(^\text{(note 3)}\) in the acceptance letter. The specific note will:

- confirm that Piping OPPSD is allowed to be used in lieu of PRV for specific lines, and
- refer to the submitter’s document that defines the scope of pressure equipment protected by Piping OPPSD.

In addition to the pressure piping design submission requirements of Sections 14 and 16 of the PESR, a piping design submission that includes piping systems where piping overpressure protection is provided by Piping OPPSD and pressure vessels overpressure protection is provided by PRD must include:

a) **A statement from the owner** - a representative authority from the owner shall provide ABSA with a separate letter, on the owner’s letterhead, acknowledging their responsibility for OPPSD. The letter shall include statements that the owner accepts

   i) the Piping OPPSD principles used in the design submission;
   ii) all risks associated with it;
   iii) the commitment to have monitoring system proposed in the design submission; and
   iv) the commitment to meet and implement the IMS requirements specified in Section 5.3.1 of this document.

b) **A list of pressure relief devices protecting pressure vessels** - This list must meet all requirements of either Section 5.1.2 or Section 5.2.1 of this document.

c) **A detailed listing of lines protected by Piping OPPSD** - on a numbered document with revision number stamped and stamped by a Professional Engineer. As a minimum, this document must include:

   i) A list of lines protected by Piping OPPSD;
   ii) Maximum upset pressure for each line;
   iii) Design pressure for each line; and
   iv) Information about lethal service (if applicable). The lines intended for lethal service must be clearly identified. The designer is responsible to determine if pressure equipment contains lethal service

d) **Design basis**

   i) All sources of overpressure must be considered (ANSI/API 521 provides guidance on the causes of overpressure). For example: sources of overpressure shall include all operating and upset scenarios, start up, shutdown, those involving fire, operator error, and equipment and/or instrumentation malfunction, etc.;
ii) The Maximum Upset Pressure is validated with an ORA;

iii) The Maximum Upset Pressure at coincident temperature for each line must not exceed either the piping Design Pressure or the MAWP for vessels;

iv) The ANSI/API 521, paragraph 5.19 rule for a tube rupture case (also known as “10/13” Rule, or in the past “2/3” rule) will not be acceptable for design submissions of heat exchangers with OPPSD.

v) Overpressure allowance from ASME BPV, Section VIII, Division 1 or B31.3 302.2.4 shall not be utilized in the design.

e) **A summary of the ORA** - This document, as a minimum, must summarize overpressure cases considered, analysis conducted, results and conclusions obtained, people involved, and the process used. One of the purposes of conducting an ORA is to ensure the design pressure of the piping or the MAWP of the pressure vessel is greater than the highest pressure that can be achieved by the system. The ORA summary must be stamped and authenticated by a Professional Engineer and must have a signature of an owner’s authorized representative. The ABSA Design Surveyor does not necessarily need to receive the actual documents detailing these analyses; the summary will be sufficient. The complete ORA documentation is to be kept by the owner and updated through scheduled revalidation. The complete ORA documentation must be available for review to the ABSA Design Surveyor or the ABSA Inspector upon request.

f) **Details of the Monitoring System** - The Owner must have a monitoring system to validate that the Maximum Upset Pressure cannot exceed the registered piping Design Pressure or pressure vessel MAWP. The monitoring system can be either through the use of a continuous monitoring system in accordance with Section 5.3.3 of this document or an equivalent system (through calculation of the system pressure, through the revalidation of the ORA, etc.) acceptable to ABSA.

**Note 3:** The owner and applicant are responsible to ensure that ABSA’s acceptance letter includes the proper note(s) addressing the scope, details and type of pressure equipment overpressure protection to be used, before piping and pressure vessels protected by RDD, PD, OPPSD, or OMOPP are placed in service.

In the case where:

- ABSA is not properly informed on the AB-96 form and design documents that pressure equipment is protected by RDD, PD, OPPSD or other means of overpressure protection (OMOPP), and/or
- The design submission is registered without the specific reference in the acceptance letter table that RDD, PDD, OPPSD or OMOPP is accepted to be used in lieu of PRV,
the Administrator’s understanding is

- RDD, PD, OPPSD or OMOPP will not be used with this design,
- all pressure equipment within that design registration shall have PRV's as means of overpressure protection in accordance with Section 38(1)(a) of the PESR, and
- the reference to PRV requirements from the acceptance letter applies.

5.3.3 Requirements for Monitoring Systems

A monitoring program is required as a part of the OPPSD. A description of the monitoring program shall be provided and be acceptable to ABSA.

As a minimum, the monitoring program must address:

- Continuous recording of operating conditions of pressure piping or pressure vessels subject to OPPSD;
- Calibration, redundancy, maintenance and testing requirements and records for monitoring devices and instrumentation;
- Administrative procedures to initiate an internal investigation if the system pressure exceeds maximum operating pressure. The ultimate purpose of this investigation is to avoid such a scenario from ever recurring.

5.3.4 Thermal Relief

For piping, the design and requirement for thermal relief are the responsibility of the designer.

5.4 Piping and Pressure Vessels protected by OPPSD

In this section, OPPSD refers to the protection of pressure vessels and pressure piping systems against overpressure without the use of pressure relief devices. Systems consisting of pressure piping and pressure vessels solely protected by OPPSD are deemed to be other means of overpressure protection and require specific acceptance from the Administrator in accordance with Section 38(1)(b) of the PESR.
Figure 6: Centrifugal Pump System – Configuration III

Figure 7: Centrifugal Compressor System – Configuration III
When a system that consists of pressure piping and pressure vessels protected by OPPSD meets all the requirements of this Section as listed below, this system is considered as providing an equivalent level of safety to the use of pressure relief valves and therefore may be accepted by ABSA without applying for the specific acceptance from the Administrator provided:

A. The owner-user must have a PEIMS in accordance with Section 5.4.1 of this document before the piping and pressure vessels are put in service;

B. Pressure vessels must be designed and manufactured in accordance with ASME BPV Code, Section VIII, Division 1. Paragraph UG-140(a)\(^{(note 4)}\) may only be used with this type of OPPSD (See also Section 5.4.2.1 below).

**Note 4:** When overpressure protection principles specified in paragraph UG-140(b) are proposed, a design submission requires a specific acceptance in accordance with Section 38(1)(b) of the PESR and Section 5.5 of this document.

C. The following three OPPSD cases for systems that consist of pressure piping and pressure vessels are considered as providing an equivalent level of safety to the use of pressure relief valves:
   
   i. Centrifugal pumps – Piping and pressure vessels associated with a centrifugal pump and upstream of the last block valve not considered a Controlled Valve will be considered for registration as OPPSD (figure 6 provides a typical case of piping and pressure vessel OPPSD).

   ii. Centrifugal compressors - Piping and pressure vessels associated with a centrifugal compressor and upstream of the last block valve not considered a Controlled Valve will be considered for registration as OPPSD (figures 5 and 7 provide typical cases of piping and pressure vessel OPPSD).

   iii. SAGD piping from well head to processing facilities including pressure vessels - This piping is similar in nature to the centrifugal pump case and as such, the same requirements must be met.

D. Design submission must meet the requirements specified in section 5.4.2 of this document and shall be registered with ABSA, and

E. Construction is done in accordance with the registered design.

All proposed pressure equipment that use the OPPSD principle will be limited to operation only within the confines of the documentation required herein and conditions specified in the design registration.

All other cases that do not meet all the requirements of this Section require specific acceptance in accordance with Section 38(1)(b) of the PESR and Section 5.5 of this document.
5.4.1 Owner PEIMS Requirements

For an Owner to be considered for registration of piping and pressure vessel OPPSD systems in accordance with Sections 5.3 and/or 5.4 of this document, the owner must submit the PEIMS in a form acceptable to the Administrator, and must be acceptable to the Administrator. As a minimum, the Owner’s PEIMS shall:

- meet the Owner–User PEIMS requirements specified in the PESR and AB-512;
- have a system for documenting lines and pressure vessels protected by OPPSD;
- specify responsibilities for operations, maintenance, inspection, and engineering for OPPSD;
- ensure that the owner’s operating procedures and documentation provide adequate instructions and information to ensure that
  - operators are informed about the systems safeguarded by OPPSD, and
  - no changes to safe operating limits per PESR 37(e) will result that maximum upset pressure is greater than the piping design pressure or pressure vessel MAWP listed in the registered design.

It is particularly important to stress to the operators that the equipment is not provided with a PRV to protect it from overpressure;

- have a management of change (MOC) system to control any changes to the systems safeguarded by OPPSD. Where a proposed change to a system safeguarded by OPPSD results with maximum upset conditions above already registered design conditions, the MOC process must ensure the design is reevaluated and submitted to ABSA for review and acceptance before changes are made;
- have a monitoring system to
  - confirm that the Maximum Upset Pressure continues to be within the registered piping design pressure or pressure vessel MAWP, and
  - meet all requirements for monitoring specified in this document. In some cases, the PEIMS needs to address how redundancy and calibration of monitoring devices is maintained, and lists all records which are to be kept in relation to the monitored equipment and monitoring devices;
- ensure that the owner’s maintenance procedures and documentation provide adequate instructions and information to ensure that
  - maintenance personnel are informed about the systems safeguarded by OPPSD,
  - maintenance procedures address the specifics of the OPPSD system including how replacement, redundancy and calibration of monitoring devices is maintained, and
  - no changes to the system are permitted without following the owner’s MOC requirements.
It is particularly important to stress to the maintenance personnel that the equipment is not provided with a PRV to protect it from overpressure;

- have an ORA revalidation process and shall conduct ORA revalidations on a regular basis. The ORA revalidation frequency shall be defined in the design submission. The owner must keep the most recent ORA documentation on file;
- establish a process for a safe shutdown of plant equipment and/or reduction in pressure will occur in the event that pressure exceeds safe operating limits per PESR 37(e);
- have a system for investigating and reporting excursions when the piping or pressure vessel maximum upset pressure exceeds the limits defined in Section 7 of this document.
- have a system for documenting, continuously monitoring and maintaining the safety critical elements which impact each OPPSD case;
- have a system for maintaining records;
- establish a process for change of ownership that will meet the requirements of Section 8 of this document.

### 5.4.2 Design Registration Requirements When Piping and Pressure Vessels are protected by OPPSD

In order to register a pressure piping design that has piping and pressure vessels protected by OPPSD, the pressure piping design submission must meet all the requirements of the PESR, this document, and the Code of construction. The owner or owner's agent is responsible to submit the information related to the proposed use of OPPSD and provide compliance with this document. The information referred to in the design submission must bear the stamp of a Professional Engineer according to Sections 16(2) of the PESR. Submissions that are found to be acceptable will be registered with a specific notation\(^\text{note 3}\) in the acceptance letter. The specific note will:

- confirm that OPPSD for piping and pressure vessels are acceptable to be used in lieu of PRV, and
- refer to the submitter's document that define the scope of pressure equipment protected by OPPSD.

In addition to the pressure piping design submission requirements of Sections 14 and 16 of the PESR, a piping design submission that includes systems where piping and pressure vessels overpressure protection is provided by OPPSD must include:

a) **A Statement from the owner** - A representative authority from the owner shall provide ABSA with a separate letter, on the owner's letterhead,
acknowledging their responsibility for OPPSD. The letter shall include statements that the owner accepts
i) the piping and pressure vessel OPPSD principles used in the design submission;
ii) all risks associated with it;
iii) the commitment to have a monitoring system proposed in the submission; and
iv) the commitment to implement the PEIMS requirements specified in Section 5.4.1 of this document; and
v) responsibilities specified in paragraphs UG-125 and UG-140(a) of the ASME BPV Code, Section VIII, Division 1.

b) **A list of pressure vessels protected by OPPSD** - This list, as a minimum, needs to include, for each pressure vessel, the:
   i) CRN;
   ii) Serial number;
   iii) MAWP for each pressure chamber as specified in ASME BPV Code, Section VIII, Div.1 (heat exchanger shell or tube side, jackets, etc.). This MAWP value needs to match the MAWP values on the registered design (see ABSA's acceptance letter or stamped registered drawing), Manufacturer's Data report and the vessel nameplate;
   iv) Maximum upset pressure for each chamber obtained from an ORA. The Maximum Upset Pressure at coincident temperature for the each pressure chamber of the pressure vessel must not exceed the MAWP specified in the registered design (See the ABSA's acceptance letter or stamped registered drawing for this pressure vessel); and
   v) Information about lethal service (if applicable). Pressure vessels intended for lethal service need to be clearly identified. The designer is responsible to determine if pressure equipment contains lethal service.

c) **P&ID’s** shall show all pertinent elements of the system associated with the pressure vessel;

d) **Design basis** – In addition to the requirements specified in Section 5.3.2(d) of this document, the design basis need to include the requirements of paragraph UG-140(a) of ASME BPV Code, Section VIII, Div.1.

e) **A summary of the ORA** - In addition to the requirements specified in Section 5.3.2(e) of this document, the ORA needs to include the analysis required in UG-140(a)(3)(c) and other requirements of UG-140(a).

f) **The requirements specified in Sections 5.3.2(c) and (f)** of this document must be met for each piping line and pressure vessel.
5.4.2.1 Design Registration Requirements for Pressure Vessels protected by OPPSD

In Alberta, a piping design submission shall provide design details of the overpressure protection approach used for both the piping and pressure vessels included in the system. When a piping design is registered, the registration includes details of overpressure protection for both the piping and pressure vessels in that system. Pressure vessel design registrations do not typically include details of the overpressure protection used for the vessel. In practice, pressure vessel design registrations, pressure vessel fabrication and the Manufacturer's Data Reports are typically finished long before the owner completes the ORA and decides what type of pressure vessel overpressure protection (PRV or other means of overpressure protection) is to be used. In some cases, Manufacturers may be reluctant to indicate “overpressure protection is provided by system design” on the Manufacturer's Data Report because they are providing the pressure vessel, not the entire system.

When a pressure vessel is to be protected by OPPSD per Section 5.4 of this document or other means of overpressure protection per Section 5.5 of this document, the following must be met:

- the pressure vessel design must be registered in accordance with Sections 14 and 15 of the PESR and, separately,
- the pressure vessel overpressure protection shall be registered according to Section 16 of the PESR within the piping design that includes the pressure vessel (regardless of the fact that pressure vessel design registration may or may not provide compliance with UG-140 of the ASME BPVC, Section VIII, Div. 1).

5.4.3 Design Registration Requirements for small volume piping (less than 500 litres)

Small volume pressure piping systems having an aggregate internal volume not exceeding 500 litres with overpressure protection in accordance with Section 5.1, 5.2 or 5.3 of this document are exempt from the requirement to have the design registered by the Administrator according to Section 14(6) of the PESR.

According to Section 14(6) of the PESR, a pressure piping system having an aggregate internal volume not exceeding 500 litres with overpressure protection in accordance with Section 5.4 or 5.5 is only exempt from the requirement to have the design registered by the Administrator, but it must meet all other requirements from the PESR including Section 38(1)(b) of the PESR. Because of this, systems that
consist of both pressure piping and pressure vessels protected by OPPSD (Section 5.4) or systems that have other means of overpressure protection (section 5.5 of this document) must be acceptable to the Administrator in accordance with Section 38(1)(b) of the PESR and therefore those systems require registration regardless of piping volume.

5.5 Other Means of Overpressure Protection for Pressure Vessels and Pressure Piping That Require Individual Case-by-case Consideration

When proposed means of overpressure protection for pressure vessels and pressure piping do not satisfy all the requirements of either section 5.1, 5.2, 5.3 or 5.4 of this document, those design submissions will be considered on a case-by-case basis, and shall meet all the requirements of this section.

The following are some examples of other means of overpressure protection that require individual case-by-case consideration:

- High Integrity Protection System (HIPS) providing overpressure protection of systems (Further information on HIPS can be found in Annex E of ANSI/API 521);
- Systems with positive displacement compressors or pumps;
- Other overpressure protection cases that are not included in Sections 5.1, 5.2, 5.3 or 5.4 of this document;
- The Owner does not have PEIMS in accordance with section 5.4.1 of this document and is planning to use one of the three OPPSD cases listed in Section 5.4.1 above.
- Systems where pressure vessels are constructed in accordance with
  - ASME BPV Code, Section VIII, Division 1, paragraph UG-140 (b)
  - ASME BPV Code, Section VIII, Divisions 2 and 3
  - ASME BPV Code, Section X
- Pressure letdown control systems (stations) that does not meet the requirements of Section 5.3.1
- Systems with indirect fired heater coils (IFHC) that are identified in ERCB Directive 077.

A system that consists of pressure equipment protected by other means of overpressure protection, as a minimum, shall provide the following:
A. The owner-user must have a PEIMS in accordance with Section 5.5.1 of this document or equivalent acceptable to the Administrator before the piping and/or pressure vessels are put in service; and

B. The design submission must meet the requirements specified in section 5.5.2 of this document and must be registered by ABSA, and

C. Construction is done in accordance with the registered design.

If, in the opinion of an ABSA's Design Surveyor or ABSA's Inspector, the complexity of a design or project involving other means of overpressure protection for pressure equipment may give rise to safety concerns, then the ABSA's Design Surveyor or ABSA's Inspector may require that the owner submit an application for a Variance to the Administrator.

5.5.1 Owner PEIMS Requirements

For an Owner to be considered for registration of a system protected by other means of overpressure protection in accordance with sections 5.5 of this document, the owner must submit the PEIMS in a form acceptable to the Administrator, and it must be acceptable to the Administrator. As a minimum, the Owner’s PEIMS shall:

- meet all the requirements specified in Section 5.4.1 of this document. When reading Section 5.4.1, the term “OPPSD” shall be substituted for “other means of overpressure protection”;  
- meet all the additional requirements specified in design of the system and the design registration.

5.5.2 Design Registration Requirements Where Piping and Pressure Vessels are protected by Other Means of Overpressure Protection

In addition to the pressure piping design submission requirements of Sections 14 and 16 of the PESR, a piping design submission where piping and pressure vessels are protected by other means of overpressure protection must bear the stamp of a Professional Engineer in accordance with Sections 16(2) of the PESR, and shall include:
a) **A Statement from the owner** – The owner shall address all the requirements of Section 5.4.2(a) above. In addition, the owner’s correspondence shall include statements that the owner accepts:

i) technical justification for the use of other means of overpressure protection as proposed in the design submission; and

ii) the commitment to meet and implement additional PEIMS requirements that are specific for the use of other means of overpressure protection proposed in the design submission.

b) **Technical justification** for the use of other means of overpressure protection in lieu of PRV that is acceptable to the ABSA Design Surveyor. Justification for other means of overpressure protection must be related to safety, ensuring equivalent or greater level of safety performance as that which can be provided for by the use of a PRV. The justification shall not be based on convenience, scheduling, or budgeting.

c) **Detailed description** of the proposed overpressure protection approach.

d) **The requirements specified in Sections 5.3.2(c),(f) and 5.4.2(b),(c),(d),(e),(f)** of this document also must be met for each piping line and pressure vessel.

e) **Any other information** that is necessary for the ABSA Design Surveyor to survey the design and determine whether it is suitable for registration.

For pressure vessels protected by other means of overpressure protection, the additional requirements of Section 5.4.2.1 of this document shall be met.

**5.6 Change to a Design**

According to Section 22 of the PESR, a person that proposes to make a change to a pressure equipment design that has been registered must submit drawings, specifications and other information concerning the change to ABSA for review and registration of the change.

If the scope of design change (revision) includes changes in the overpressure protection approach for pressure piping or pressure vessel design previously registered, the revised design must meet all the requirements specified in the PESR, this document, and the applicable CSA and ASME Code, and must be submitted to ABSA for review and registration for either piping or pressure vessel when:

- The design conditions have changed and the new maximum upset pressure for:
  - piping is higher than the piping design pressure listed in the line designation table that is registered with ABSA or
  - the pressure vessel is higher than the pressure vessel MAWP stated in the acceptance letter and/or on the nameplate.
• The overpressure protection approach is changed. For example, the change includes the replacement of one of the OPPSD cases (that is included in Sections 5.3 or 5.4 of this document) with HIPS, or the change includes the removal of pressure relief devices where a system will now be protected by OPPSD.

A design re-registration is not required when:
• The new Maximum Upset Pressure is validated with an ORA and remains below
  o the piping design pressure as listed in the line designation table that is registered with ABSA, and
  o pressure vessel MAWP stated in the acceptance letter and on the nameplate.
• If PRV will be added to a existing system that consists of pressure piping and pressure vessels protected by OPPSD, the owner must ensure that all requirements from Section 5.1.2 are met.

5.6.1 Change to a Pressure Piping Design

When the scope of pressure piping design change (revision) includes changes in overpressure protection approach as specified in 5.6 above, the piping design submission (modification of already registered piping design submission) must be submitted to ABSA for review and registration and shall include the change in the overpressure protection approach in accordance with this document.

5.6.2 Change to a Pressure Vessel Design

When the scope of pressure vessel design change (revision) includes changes in the overpressure protection approach, the piping design submission (new piping design submission or modification of already registered piping design submission) must be submitted to ABSA for review and registration and shall include the change in the overpressure protection approach in accordance with this document.

When the scope of pressure vessel design change (revision) includes both (i) the rerate of uncompleted new pressure vessels (Manufacturer’s Data Report has not been signed off yet) and (ii) changes in overpressure protection approach, the following two separate design submissions must be submitted to ABSA for review and registration:
the revised pressure vessel design submission\(^{\text{note 5}}\) shall include rerate of that pressure vessel, and

B. the piping design submission (new piping design submission or modification of already registered piping design submission) shall include the change in the overpressure protection approach in accordance with this document.

When the alteration of existing pressure vessel includes a vessel rerate and changes in overpressure protection approach, two separate submissions must be submitted to ABSA:

A1. the alteration procedure submission in accordance with AB-513 shall include the rerate of that pressure vessel, and

B1. the piping submission shall include the change in the overpressure protection approach in accordance with this document.

**Note 5:** When a person is constructing a new pressure vessel and is planning to use an existing CRN (the pressure vessel design has already been registered), it must comply with one of the following two scenarios:

A2. if no pressure vessels have been constructed (Manufacturer’s Data Report has not been signed off) under that CRN, that design submission for the rerate (change) of the pressure vessel design may be considered as a revision of an already registered design according to Section 22(1) of the PESR. In this case, the owner of design shall issue a statement in writing that no vessels were built under this CRN, submit the revised design to ABSA for review and registration in accordance with Section 14 and 15 of the PESR, submit other information concerning the change to the ABSA Design Surveyor for review and registration of the change. If the ABSA Design Surveyor considers the change to a design not sufficiently extensive, those revised designs that were found acceptable for registration will be registered under the existing CRNs. After the new revision of the design is registered under the existing CRN, it must only be used in the future, and the previous revision of the registered design is void and cannot be used in the future.

B2. If the proposed scope of changes (revisions) does not meet all of the requirements in A2 above, or if one or more pressure vessels were constructed (Manufacturer’s Data Reports have been signed off) under that CRN, that design submission for the change or rerate of the pressure vessel design is considered sufficiently extensive according to Section 22(2) of the PESR and the existing CRN cannot be revised. In this case, the design submission shall be submitted as a first application for registration of the design, and a new CRN will be issued.
5.7 Requirements for Tying in a New System to Existing Systems

New construction or plant changes which tie into existing systems require a revalidation of the ORA including the scope of new construction and the existing overpressure protection approach. The scope of this review is the pressure equipment included in the overpressure protection case being considered and does not include the remainder of the process unit.

If new construction or plant changes which tie into existing systems will:

A. have their own overpressure protection system independent from the overpressure protection of the existing system, the overpressure protection of the new (added) system must meet the requirements specified in either Section 5.1, 5.2, 5.3, 5.4, or 5.5 above including design registration, or

B. use the overpressure protection of the existing system, the new (added) system must meet the requirements specified in Section 5.7 of this document.

If the existing OPPSD systems which is being tied into has utilized in design the overpressure allowances of ASME B31.3 302.2.4, 322.6.3 or ASME BPV Code, Section VIII, Division 1, paragraph UG-125, then the owner shall have a monitoring system in place to track overpressure events and is responsible to ensure that occasional overpressure events remain within the limits of code paragraphs listed in this section.

The owner shall not use the overpressure allowances of ASME B31.3 302.2.4, 322.6.3 or ASME BPV Code, Section VIII, Division 1, paragraph UG-125 except when the owner:

- establishes a monitoring system, acceptable to ABSA, to track future overpressure events and accepts responsibility that occasional overpressure events will remain within the limits of code paragraphs listed in this section, or
- rerates the existing piping and/or pressure vessels. The rerated piping design pressure and/or pressure vessel MAWP shall be equal or higher than the maximum upset pressure that includes overpressure allowances.

5.7.1 Owner PEIMS Requirements

For new construction or plant changes which tie into existing systems, the owner’s integrity management system must meet the requirements of:
A. Section 37(b) of the PESR for systems with overpressure protection in accordance with Sections 5.1 or 5.2 of this document;

B. Section 37(b) of the PESR and Section 5.3.1 of this document for systems with overpressure protection in accordance with Section 5.3 of this document;

C. Section 42 of the PESR and Section 5.4.1 of this document for systems with overpressure protection in accordance with Section 5.4 of this document;

D. Section 42 of the PESR and Section 5.5.1 of this document for systems with overpressure protection in accordance with Section 5.5 of this document;

E. Section 38(1)(b) of the PESR where the owner does not have IMS as required above but the owner has an IMS that provides equivalent safety acceptable to the Administrator.

### 5.7.2 Design Submission Requirements for Tying into Existing Systems

In addition to the requirements of Sections 14 and 16 of the PESR, the pressure piping design submissions of new (added) system or plant changes that will:

- be tied into the existing system, and
- use the overpressure protection of the existing system according to Section 5.7(B) above,

shall meet the requirements of this section, AB-524 document, and the applicable CSA and ASME Code.

According to Section 38(3) of the PESR, the owner is responsible to ensure that overpressure protection approach used for the existing system is designed and maintained so that it provides overpressure protection for the both existing and new (added) system.

The design submission for the new (added) system shall meet the requirements of:

- Section 5.1.2 or 5.2.1 of this document if the existing system has overpressure protection by PRD. In addition, the list of PRDs shall include every existing PRD that provides overpressure protection for the new (added) system, existing PRD’s set pressure, P&ID document number that shows the existing PRD, and information what is protected with the existing PRD.

- Section 5.3.2 of this document if the existing system has Piping OPPSD and pressure vessels protected by PRD. In addition, new construction or plant changes which tie into existing piping protected by Piping OPPSD and pressure vessels protected by PRDs require a revalidation of the ORA including the scope of new construction and the existing OPPSD scope. The scope of this
review is the pressure equipment included in the OPPSD case being considered and does not include the remainder of the process unit.

- Section 5.4.2 of this document if the existing system has piping and pressure vessels protected by OPPSD. For pressure vessels protected by OPPSD, see the specific requirements of Section 5.4.2.1 of this document. In addition, new construction or plant changes which tie into existing piping protected by OPPSD (see figure 8) require a revalidation of the ORA including the scope of new construction and the existing OPPSD scope. The scope of this review is the pressure equipment included in the OPPSD case being considered and does not include the remainder of the process unit.

- Section 5.5.2 of this document if the existing system is protected by other means of overpressure protection. For pressure vessels protected by other means of overpressure protection, see the specific requirements of Section 5.4.2.1 of this document. In addition, new construction or plant changes which tie into existing piping protected by other means of overpressure protection require a revalidation of the ORA including the scope of new construction and the existing OPPSD scope.

Figure 8: Centrifugal Pump System

Tie-in and new scope with OPPSD is shown in red

If the existing OPPSD systems which is being tied into has utilized in design the overpressure allowances of ASME B31.3 302.2.4, 322.6.3 or ASME BPV Code, Section VIII, Division 1, paragraph UG-125, then this information must be provided in the design submission for new (added) piping and/or pressure vessels and needs to meet the requirements specified in Section 5.7 in this document.
5.7.3 Design Registration Exemptions for Tie in of Small Volume Piping in to Existing Systems

A piping design is exempt from the requirement to have the design registered by ABSA when new construction or plant changes that will be tied in to the existing piping system:

- has an aggregate internal volume not exceeding 500 litres according to Section 14(6) of the PESR,
- meets all other requirements from the PESR and code of construction, and
- uses the overpressure protection of the existing system according to Section 5.7(B) above that is
  - PRD that has adequate capacity, set pressure and location of installation to provide overpressure protection of the existing and new (added) system, or
  - Piping OPPSD and pressure vessels are protected by PRD that provide overpressure protection of the existing and new (added) system (approach presented in Section 5.3 above).

5.7.4 Hot Tapping

If hot tapping is used to tie in a new construction or plant changes to an existing system, then the hot tapping must meet the requirements of the AB-513 and the design must be registered regardless of piping volume or overpressure protection approach.

6.0 Documentation of Existing OPPSD Systems

It is recognized that OPPSD systems and systems protected by other means of overpressure protection are in place at many operating facilities in the province of Alberta. According to Section 38(3) of the PESR, the owner of pressure equipment must ensure that the overpressure protection system is designed and maintained so that the maximum pressure in the pressure equipment does not exceed the prescribed limit of overpressure.

When an existing system has the overpressure protection provided by PRDs in accordance with Sections 5.1 and/or 5.2 described above, this existing system is not to be submitted\(^{\text{note 6}}\) to ABSA for registration.
When an existing system has one of the overpressure protection approaches described in Sections 5.3 or 5.4 above, this existing system is not to be submitted (Note 6) to ABSA for registration provided the owner:

- identifies and documents all existing OPPSD systems, and
- updates its:
  - IMS to include the Piping OPPSD requirements listed in Section 5.3.1 of this document for Piping OPPSD approaches described in Section 5.3, or
  - PEIMS to include the piping and pressure vessel OPPSD requirements listed in Sections 5.3.1 and/or 5.4.1 of this document for piping and pressure vessel OPPSD approaches described in Sections 5.3 and 5.4. This update is to be done on a schedule established by the owner and acceptable to ABSA. This update is to be reviewed with ABSA through regular PEIMS audits. During those audits, the auditor is not accepting the OPPSD, the auditor is only accepting the process that is in place to operate and maintain the existing OPPSD.

When an existing system has the overpressure protection provided by other means of overpressure protection described in Section 5.5 above, this existing system is not to be submitted (Note 6) to ABSA for registration provided the owner:

- identifies and documents all existing systems protected by other means of overpressure protection, and
- updates its PEIMS to include the other means of overpressure protection requirements listed in Section 5.5.1 of this document for systems protected by other means of overpressure protection described in Sections 5.5. This update is to be done on a schedule established by the owner and acceptable to ABSA. This update is to be reviewed with ABSA through regular PEIMS audits. During those audits, the auditor is not accepting the means of overpressure protection used, the auditor is only accepting the process that is in place to operate and maintain the existing system protected by means of overpressure protection used. If, in the opinion of an ABSA auditor, the complexity of an overpressure protection approach involving pressure equipment may give rise to safety concerns, the safety codes officer may require that the owner submits design of the overpressure protection system to ABSA for review and registration.

**Note 6:** If the owner decides to submit the design for the existing system with OPPSD approach or other means of overpressure protection that does not require registration according to Section 6 of this document, then the design submission needs to meet all the requirements from the PESR, this document and the code of construction.
7.0 Requirements for Reporting Overpressure Excursions

For systems with overpressure protection in accordance with Sections 5.1 or 5.2 of this document, the PRDs shall be designed, constructed, located, installed, and maintained to prevent the pressure from rising above the piping design pressure and/or pressure vessel MAWP listed in the registered designs by ABSA. When PRD is relieving pressure, the system pressure limit may be higher than design pressure for the amount or percentage allowed in the code of construction (i.e. UG-125(c) of ASME BPVC Section VIII, Div.1). The owner must conduct an investigation identifying root causes and corrective actions when maximum upset pressure exceeds the pressure limit specified in the code of construction. This type of pressure excursion constitutes a reportable unsafe condition per Section 35 of the PESR, and the owner of pressure equipment must forthwith report to the Administrator under Section 59 of the Act.

For systems with overpressure protection in accordance with Sections 5.3, 5.4 and 5.5 of this document, the owner must conduct an investigation identifying root causes and corrective actions for any excursion of the maximum upset pressure above:

- the piping Design Pressure listed in the registered design, or
- the pressure vessel MAWP listed in the registered drawing. The overpressure allowance of UG-125 does not apply to OPPSD systems.

In the event of such an overpressure event where the maximum upset pressure exceeds the piping design pressure or pressure vessel MAWP listed in the registered designs by ABSA, this pressure excursion constitutes a reportable unsafe condition per Section 35 of the PESR, and the owner of pressure equipment must forthwith report to the Administrator under Section 59 of the Act.

Where necessary, the ORA must be conducted in order to include the new overpressure scenarios, and the design needs to be reregistered accordingly.

8.0 Change of Ownership

According to Section 36 of the PESR, the owner must notify the Administrator when pressure equipment change ownership and must provide the equipment records to the person who acquires it.

The person who acquires pressure equipment must:

- meet the requirements of Section 36(4) of the PESR,
- have an integrity management system\(^\text{note 7}\) acceptable to the Administrator,
ensure that the acquired pressure equipment meets the requirements of the PESR and this document, and
is in safe operating condition before using it or placing it in service.

Note 7: The new owner shall have an integrity management system that meets the requirements from A to E specified in Section 5.7.1 of this document.

9.0 Revision Log

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<th>Date</th>
<th>Description</th>
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