

Date of Issue: June 2017

Affected Publication: API RP 754, *Process Safety Performance Indicators for the Refining and Petrochemical Industries*, Second Edition, April 2016

ERRATA

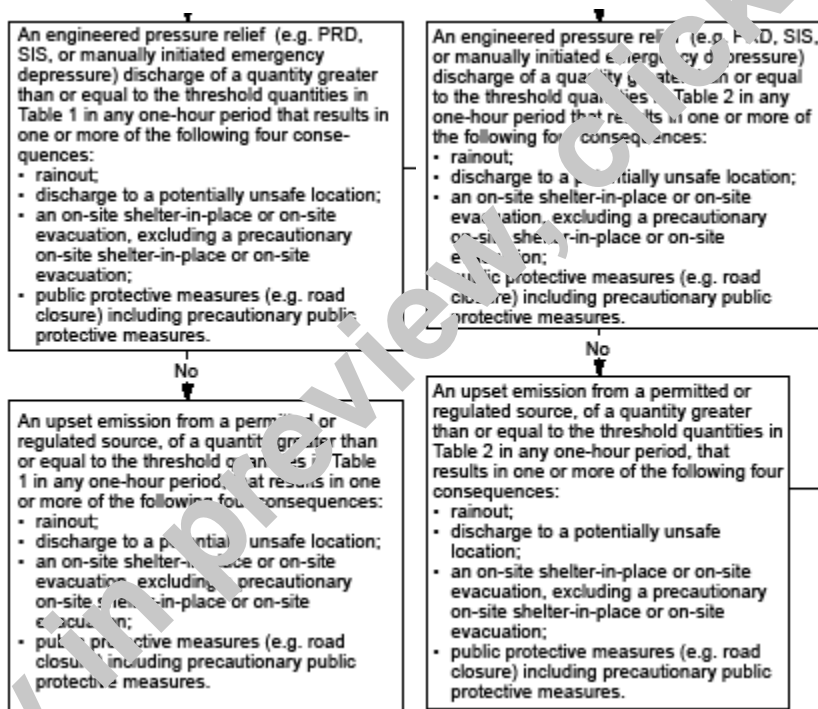
Page 49, Table E.3, Example 26, second paragraph, should read:

If the spill had been less than 2200 lb (7 bbl), but equal to or greater than 220 lb (1 bbl), it would be a minor 2 PSE.

Page 72, Annex G.7.1, header should read:

G.7.1 Liquid Streams with a Distinct Liquid Phase of Flammable Liquid

Page 74, Annex H, the following sections of the flowchart should read as follows:



Process Safety Performance Indicators for the Refining and Petrochemical Industries

ANSI/API RECOMMENDED PRACTICE 754
SECOND EDITION, APRIL 2016

ERRATA, JUNE 2017



AMERICAN PETROLEUM INSTITUTE



Special Notes

API publications necessarily address problems of a general nature. With respect to particular circumstances, local, state, and federal laws and regulations should be reviewed.

Neither API nor any of API's employees, subcontractors, consultants, committees, or other assignees make any warranty or representation, either express or implied, with respect to the accuracy, completeness, or usefulness of the information contained herein, or assume any liability or responsibility for any use, or the results of such use, of any information or process disclosed in this publication. Neither API nor any of API's employees, subcontractors, consultants, or other assignees represent that use of this publication would not infringe upon privately owned rights.

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to assure the accuracy and reliability of the data contained in them; however, the Institute makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any authorities having jurisdiction with which this publication may conflict.

API publications are published to facilitate the broad availability of proven, sound engineering and operating practices. These publications are not intended to obviate the need for applying sound engineering judgment regarding when and where these publications should be utilized. The formulation and publication of API publications is not intended in any way to inhibit anyone from using any other practices.

Any manufacturer marking equipment or materials in conformance with the marking requirements of an API standard is solely responsible for complying with all the applicable requirements of that standard. API does not represent, warrant, or guarantee that such products do in fact conform to the applicable API standard.

Copyright © 2016 American Petroleum Institute. All rights reserved. No part of this work may be reproduced, translated, stored in a retrieval system, or transmitted by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the publisher. Contact the Publisher, API Publishing Services, 1220 L Street, NW, Washington, DC 20005.

Foreword

Nothing contained in any API publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

Within the API naming convention, standards may be designated as “specifications”, “recommended practices”, or “standards”. A “specification” is a document written to facilitate communications between purchasers, manufacturers, and/or service suppliers. Specifications may include datasheets that may be used in industrial transactions. A “recommended practice” is a document that communicates recognized industry practices. Recommended practices may include both mandatory and non-mandatory requirements. A “standard” is a document that combines elements of both specifications and recommended practices.

Shall: As used in a recommended practice, “shall” denotes a minimum requirement in order to conform to the Recommended Practice (RP).

Should: As used in a recommended practice, “should” denotes a recommendation or that which is advised but not required in order to conform to the RP.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API standard. Questions concerning the interpretation of the content of this publication or comments and questions concerning the procedures under which this publication was developed should be directed in writing to the Director of Standards, American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005. Requests for permission to reproduce or translate all or any part of the material published herein should also be addressed to the director.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. A one-time extension of up to two years may be added to this review cycle. Status of the publication can be ascertained from the API Standards Department, telephone (202) 682-8000. A catalog of API publications and materials is published annually by API, 1220 L Street, NW, Washington, DC 20005.

Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, DC 20005, standards@api.org

Currently in preview, click buy full version

Contents

	Page
1 Scope	1
1.1 General	1
1.2 Applicability	1
1.3 Guiding Principles	2
1.4 Introduction	2
2 Normative References	3
3 Terms, Definitions, Acronyms, and Abbreviations	4
3.1 Terms and Definitions	4
3.2 Acronyms and Abbreviations	10
4 Leading and Lagging Performance Indicators	11
5 Tier 1 Performance Indicator—Process Safety Event (T-1 PSE)	12
5.1 Tier 1 Indicator Purpose	12
5.2 Tier 1 Indicator Definition and Consequences	12
5.3 Calculation of Tier 1 PSE Rate	14
5.4 Optional Tier 1 PSE Severity Weighting	14
6 Tier 2 Performance Indicator—Process Safety Events (T-2 PSE)	14
6.1 Tier 2 Indicator Purpose	14
6.2 Tier 2 Indicator Definition and Consequences	14
6.3 Calculation of Tier 2 PSE Rate	18
7 Tier 3 Performance Indicators—Challenges to Safety Systems	18
7.1 Purpose of Indicator	18
7.2 Examples of Tier 3 PSEs	19
8 Tier 4 Performance Indicators—Operating Discipline and Management System Performance	22
8.1 General	22
8.2 Purpose of Indicator	22
8.3 Examples of Tier 4 Indicators	22
9 Guidelines for Selection of Process Safety Indicators	23
9.1 General	23
9.2 Purpose of Indicators	23
9.3 Lagging versus Leading Indicators	24
9.4 Characteristics of Effective Indicators	24
9.5 Selection of Indicators	24
10 Reporting Performance Indicators	25
10.1 Format and Forum	25
10.2 Transparency	25
10.3 Stakeholders	25
10.4 PSE Data Capture	27
Annex A (informative) Application to Petroleum Pipeline and Terminal Operations	37
Annex B (informative) Application to Retail Service Stations	39
Annex C (informative) Oil and Gas Drilling and Production Operations	40
Annex D (informative) Tier 1 PSE Severity Weighting	41
Annex E (informative) PSE Examples and Questions	45
Annex F (informative) Listing of Chemicals Sorted by Threshold Quantity (Based on UN Dangerous Goods Hazard Class or Grouping)	68
Annex G (informative) Application of Threshold Release Categories to Multicomponent Releases	71
Annex H (informative) PSE Tier 1/Tier 2 Determination Decision Logic Tree	74
Annex I (informative) Guidance for Implementation of Tier 3 and Tier 4 Indicators	75
Annex J (informative) Tier 4 Example Indicators	95
Bibliography	107

Figures

1	“Swiss Cheese (Static) Model” and “Spinning Disk (Dynamic) Model”	3
2	Process Safety Indicator Pyramid	12
3	Example of Safe Operating Limit for Tank Level	19
D.1	Tier 1 PSE Severity Weighting	44
D.2	Tier 1 PSE Trend	44
F.1	Inhalation Toxicity: Packing Group and Hazard Zones	70
G.1	Flammability Limits of Methane, Nitrogen, Oxygen Mixtures	71
H.1	PSE Tier 1/Tier 2 Determination Decision Logic Tree	74
I.1	Personal Safety/Process Safety Graphic	77
I.2	Illustration of Process Safety Elements Relating to Equipment	78
I.3	Daily Indicator Listing Example	79
I.4	Illustration of Data Flow and Need for Categorization	84
I.5	Example of Data Funneling Flow Diagram	87
I.6	Example PSE Tier 3 Other LOPC Graph	88
I.7	Example PSE Tier 3 Other LOPC Graph by Plant and Process Unit	89
I.8	Example PSE Tier 3 Other LOPC Graph for Plant 1 FCC and Alkylation Units by Equipment Involved	90
I.9	Example PSE Tier 3 Other LOPC Graph by Plant and Equipment Involved	90
I.10	Example PSE Tier 3 Other LOPC Graph by Plant and Management System Root Causes	91
I.11	Example PSE Tier 3 Other LOPC Graph by Plant and Mode of Operation	91
I.12	Example of Moving Average for Demands on Safety Systems	92
I.13	Example of Moving Average for Demands on Safety Systems- Separated into Stages	92

Tables

1	Tier 1 Material Release Threshold Quantities	15
2	Tier 2 Material Release Threshold Quantities	17
3	Stakeholder Report Information	26
D.1	Tier 1 Process Safety Event Severity Weighting	42
E.1	PSE Examples and Questions: Injury	45
E.2	PSE Examples and Questions: Fire or Explosion	46
E.3	PSE Examples and Questions: Loss of Primary Containment	48
E.4	PSE Examples and Questions: A Release Within Any One-hour Period	53
E.5	PSE Examples and Questions: Mixtures and Solutions	55
E.6	PSE Examples and Questions: Pressure Relief Device	56
E.7	PSE Examples and Questions: On Company Premises, PSEs with Multiple Outcomes, Pipelines	58
E.8	PSE Examples and Questions: Marine Transport	58
E.9	PSE Examples and Questions: Truck and Rail	59
E.10	PSE Examples and Questions: Downstream Destructive Devices	61
E.11	PSE Examples and Questions: Vacuum Truck Operations	62
E.12	PSE Examples and Questions: Direct Cost	62
E.13	PSE Examples and Questions: Officially Declared Evacuation or Shelter-in-Place	64
E.14	PSE Examples and Questions: Routine Emissions	64
E.15	PSE Examples and Questions: Ancillary Equipment	65
E.16	PSE Examples and Questions: Responsible Party	66

Introduction

The purpose of this recommended practice (RP) is to identify leading and lagging indicators in the refining and petrochemical industries for nationwide public reporting as well as indicators for use at individual facilities including methods for the development and use of performance indicators. A comprehensive leading and lagging indicators program provides useful information for driving improvement and when acted upon contributes to reducing risks of major hazards (e.g. by identifying the underlying causes and taking action to prevent recurrence). This RP may augment a Company's existing practices and procedures.

This RP cannot and does not preempt any federal, state, or local laws regulating process safety. Therefore, nothing contained in this document is intended to alter or determine a Company's compliance responsibilities set forth in the Occupational Safety and Health Act of 1970 and/or the OSHA standards themselves, or any other legal or regulatory requirement concerning process safety. The use of the term or concept "process safety" in this document is independent of and may in fact be broader than the term or concept "process safety" contained in OSHA regulatory requirements, or as the term may be used in other legal or regulatory contexts. In the event of conflict between this recommended practice and any OSHA or other legal requirements, the OSHA or other legal requirements should be fully implemented.

Notes to the Second Edition

As part of the revision process, the drafting committee gathered input from companies that had adopted this RP. The committee sought comments regarding the utility and usefulness of the Tier 1 and Tier 2 indicators to drive performance improvement, as well as any comments regarding suggested improvements. The result of the input gathering exercise was a desire for continuous improvement rather than any need for fundamental change.

Although the RP was written for the U.S. Refining and Petrochemical industries, it has been widely adopted around the globe and by additional industry segments. The revision committee benefited from broad participation by parties with a direct and material interest from academia, trade associations, engineering and construction, regulators, and owner/operators both domestic and international.

The purpose of this RP is to identify leading and lagging process safety performance indicators for the refining and petrochemical industries for nationwide public reporting as well as indicators for use at individual facilities including methods for the development and use of performance indicators. A comprehensive leading and lagging indicators program provides useful information for driving improvement and when acted upon, contributes to reducing risks of major hazards (e.g. by identifying the underlying causes and taking action to prevent recurrence).

In revising this document, the drafting committee maintained a focus on indicators of process safety performance versus indicators of health, personal safety or environmental performance. Each is important and each should have its own performance indicators as part of a comprehensive and robust Safety, Health, and Environmental program. Process safety hazards can result in major accidents involving the release of potentially dangerous materials. Process safety incidents can have catastrophic effects such as multiple injuries and fatalities, as well as substantial economic, property, and environmental damage; and can affect workers inside the facility and members of the public who reside or work nearby.

Numerous issues including process safety indicator definitions, chemical release thresholds, data capture, statistical validity, and public reporting were again considered; this time with the benefit of four years of implementation experience. One of the most significant revision proposals was the adoption of the Globally Harmonized System for Classification and Labeling of Chemicals (GHS) for threshold release categorization. After numerous and lengthy debates, the drafting committee chose to reaffirm the U.S. DOT version of the *United Nations Dangerous Goods (UNDG)* hazard classification system as the most appropriate. This system is unique in the treatment of toxic chemicals in terms of both relative toxicity and relative volatility that produces a more accurate ranking of relative process safety hazards.

Other significant continuous improvement changes include:

- the addition of informative annexes specifically defining the applicability of this RP to Petroleum Pipelines and Terminals, Retail Service Stations, and Oil and Gas Drilling and Production Operations;
- the addition of an informative annex for Tier 1 PSE Severity Weighting;
- extensive additions to the informative annex of PSE Examples and Questions;
- the addition of informative annexes for Guidance for Implementation of Tier 3 and Tier 4 Indicators and Tier 4 Example Indicators;
- the revision of the Tier 1 threshold for Direct Cost Damage from Fires and Explosions from \$25,000 to \$100,000 to better align with the severity of the other Tier 1 consequence categories.

Process Safety Performance Indicators for the Refining and Petrochemical Industries

1 Scope

1.1 General

This recommended practice (RP) identifies leading and lagging process safety indicators useful for driving performance improvement. As a framework for measuring activity, status or performance, this document classifies process safety indicators into four tiers of leading and lagging indicators. Tiers 1 and 2 are suitable for nationwide public reporting and Tiers 3 and 4 are intended for internal use at individual facilities. Guidance on methods for development and use of performance indicators is also provided.

1.2 Applicability

NOTE At joint venture sites and tolling operations, the Company should encourage the joint venture or tolling operation to consider applying this RP.

This RP was developed for the refining and petrochemical industries, but may also be applicable to other industries with operating systems and processes where loss of containment has the potential to cause harm (see note). Applicability is not limited to those facilities covered by the OSHA Process Safety Management Standard, 29 *CFR* 1910.119, or similar national and international regulations.

NOTE To enable consistent application of this RP to other refining and petrochemical industry sub segments, informative annexes have been created to define the Applicability and Process Definition for those sub segments. The user would substitute the content of those annexes for the referenced sections of this RP: Annex A—Petroleum Pipeline and Terminal Operation, Annex B—Retail Service Stations, Annex C—Oil and Gas Drilling and Production Operations.

This recommended practice applies to the responsible party. At collocated facilities (e.g. industrial park), this recommended practice applies individually to the responsible parties and not to the facility as a whole.

Events associated with the following activities are outside the scope of this RP and shall not be included in data collection or reporting efforts:

- a) releases from transportation pipeline operations outside the control of the responsible party;
- b) marine transport operations, except when the vessel is connected or in the process of connecting or disconnecting to the process;
- c) truck or rail transport operations, except when the truck or rail car is connected or in the process of connecting or disconnecting to the process, or when the truck or rail car is being used for on-site storage;

NOTE Active staging is not part of connecting or disconnecting to the process; active staging is not considered on-site storage; active staging is part of transportation.

- d) vacuum truck operations, except on-site truck loading or discharging operations, or use of the vacuum truck transfer pump;
- e) routine emissions from permitted or regulated sources;

NOTE Upset emissions are evaluated as possible Tier 1 or Tier 2 PSEs per Section 5.2 and Section 6.2.

- f) office, shop, and warehouse building events (e.g. office fires, spills, personnel injury or illness, etc.);