

Controlling Fugitive Emissions In Valves

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Outline

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- Fugitive Emissions in Valves – Industry Update
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 - Current Consent Decree Requirements
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 - EPA Recognized “Low Emissions” Packing Test Protocols
 - Type Testing for “Low Emission Valves”
 - Packing Specification
 - Repaired and Repacked Valves
 - Valve OEM’s - Response to “Low Emission Technology”
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 - “Chesterton Total Solutions Approach to Low Emissions
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Who is A.W. Chesterton Company

- Chesterton is a leading international manufacturer of industrial fluid sealing systems, advanced polymer composites, cleaners, lubricants and industrial specialty products
- Leveraging state-of-the-art technology and environmentally acceptable alternatives along with strict quality processes; we work to lower your operating and acquisition costs.
- *“Our vision is to be the primary choice of our customers for products and services that improve reliability, productivity and performance.”*

Historic Factors Impacting Low Emission Packing



Fugitive Emissions in Valves: Industry Update



**NOT SINCE THE CLEAN AIR ACT
OF 1990 HAS THERE BEEN SUCH
AN EMPAHSIS PLACED ON
FUGITIVE EMISSION CONTROL**

Historic Factors Impacting the Improvement of Low Emission Valve Packing

- Packing manufacturers are Constantly Challenged by the Increased Regulation of Fugitive Emissions to Continually Research and Develop Materials to Meet Mandates Set Forth by the EPA in Enhanced LDAR Consent Decrees.
- As these Mandates become More Stringent, Manufacturers are required to Improve Packing Designs to Meet Customer Demands, both Technically and Commercially.

Historic Factors Impacting the Improvement of Low Emission Valve Packing

- The replacement of Asbestos
 - PTFE & Graphite packing products
- Clean Air Act of 1990
 - Increased emission regulations
- PERF (Petroleum Environment Research Forum)
 - Collaboration between users to define emission packing performance
- Consent Decree's
 - LDAR
 - Enhanced LDAR
- API 622 Rev 2
- API 624
- 641 (In process through API Task Group)
- API RP 621

EPA: Consent Decree Data



2014 - 2016 EPA National Enforcement Initiatives



Announcing EPA's Selection of National Enforcement Initiatives for FY 2014-2016

National Enforcement Initiative: Cutting Hazardous Air Pollutants

Problem

Leaks, flares, and excess emissions from refineries, chemical plants and other industries emit hazardous air pollutants (HAPs), or air toxics, that are known or suspected to cause cancer, birth defects, and seriously impact the environment.

- Leaking equipment is the largest source of HAP emissions from petroleum refineries and chemical manufacturing facilities.
- Recent monitoring shows that facilities typically emit more HAP emissions than they actually report.
- Improper operation of an industrial flare can result in hundreds of tons of excess HAP emissions.

Goal

EPA will target and reduce illegal emissions of toxic air pollutants from leaks and flares, as well as target and reduce excess emissions, at facilities that have a significant impact on air quality and health in communities.

Enforcement Cases

- 03/20/2014 – [Flint Hills Resources, Port Arthur](#)



Air pollution from an improperly operated flare

Fast Fact

Enforcement actions in 2010 resulted in reducing lifetime air toxics cancer risk to less than 1 in a million for more than 900,000 people.

EPA: Consent Decrees and Enhanced LDAR

- EPA Enforcement Offices Rely on Plant Audits
- Analysis Easier with Documentation moving to Electronic Databases
- Consent Decrees Negotiated for Plant Violations
- Consent Decree defined: A settlement of a lawsuit or criminal case in which a person or company agrees to take specific actions without admitting fault or guilt for the situation that led to the lawsuit.
 - Over 90% of Refineries have a Consent Decree
 - Chemical Plants are a new focal point – DuPont, Dow, Formosa, Sabic, Solutia, Ineos,



Implementation of Enhanced Leak Detection, Prevention and Repair



- Purpose of consent decree requirements is to mitigate past environmental harm
- Establish work practices that can carry forward after the consent decrees are over
- Encouraging industry to look towards preventing leaks, not just fixing them early
- Use of Low Emission Packing/Valves and other products where possible
- Work practices that proactively reduce likelihood of developing leaks

EPA Definition of “Certified Low-Leaking Valve Packing Technology”

- **“Certified Low-Leaking Valve Packing Technology” shall mean valve packing technology for which a manufacturer has issued either: (i) a written guarantee that the valve packing technology will not leak above 100 ppm for five years; or (ii) a written guarantee, certification or equivalent documentation that the valve packing technology has been tested pursuant to generally-accepted good engineering practices and has been found to be leaking at no greater than 100 ppm.**

EPA Definition of “Certified Low Leaking Valves”

- **“Certified Low-Leaking Valves” shall mean valves for which a manufacturer has issued either: (i) a written guarantee that the valve will not leak above 100 parts per million (ppm) for five years; or (ii) a written guarantee, certification or equivalent documentation that the valve has been tested pursuant to generally-accepted good engineering practices and has been found to be leaking at no greater than 100 ppm.**

LDAR Penalties



Company Name	Number of Sites	EPA Region	Date of EPA Action	Enhanced LDAR Required	Final Penalty Amount	LDAR-only Violations Alleged?
Plaskolite	1	Region 5	12/1/2009	No	3,000	Yes
Solutia Incorporated	1	Region 5	6/29/1905	No	23,794	No
Koppers Inc.	1	Region 3	2011	No	27,000	Yes
Kinder Morgan Liquids Terminal, LLC	1	Region 2	8/10/2010	No	134,270	Yes
Hercules Incorporated	1	Region 5	2008	No	22,500	Yes
Bristol Myers Squibb	1	Region 2	7/24/2008	No	52,000	No
LDH Energy Olefins, LLC	1	Region 6	2010	No	70,000	Yes
Schering Plough Products	1	Region 2	2011	No	260,000	Yes
Hercules Incorporated	1	Region 7	2011	No	245,521	Yes
Dow Reichhold Specialty Latex LLC	1	Region 3	2009	No	300,000	Yes
Koppers Incorporated	1	Region 3	2011	No	301,000	Yes
Sunoco, Inc.	1	Region 5	2009	No	400,000	Yes
Eastman Kodak Company	1	Region 2	2011	No	\$367,685 proposed	Yes
Pfizer	1	National	2008	No	975,000	Yes
Vertellus Agriculture & Nutrition Specialties LLC	1	Region 5	8/21/2009	Yes	425,000	No
Dow Chemical	1	Region 5	2011	Yes	2,500,000	No
Formosa Plastics	2	Region 6	2009	Yes	2,800,000	No
LyondellEquistar	7	National	2007	Yes	2,500,000	No
Ineos ABS USA/Lanxess	1	Region 5	2009	Yes	3,100,000	No
CITGO Petroleum Corporation (East Plant) (National Case)	6	National		Yes	3,600,000	No
Hovensa LLC	1	Region 2	1/26/2011	Yes	5,125,000	No
Shell Chemical, LP (National Case) Shell Chemical LP/Shell Chemical Yabucoa, Inc.	Multiple	National	3/31/2010	Yes	1,806,630	No
Westlake Calvert City	1	Region 4	2010		800,000	No
Invista	12	National	2009	Yes	1,700,000	No

2014 - 2016 EPA National Enforcement Initiatives

- **Cutting Toxic Air Pollution that Affects Communities' Health:** In 1990, Congress identified hazardous air pollutants (HAPs), currently totaling 187, that present significant threats to human health and have adverse ecological impacts (<http://www.epa.gov/ttn/atw/188polls.html>). The CAA and EPA's regulations impose strict emission control requirements (known as "Maximum Achievable Control Technology" or "MACT") for these pollutants, which are emitted by a wide range of industrial and commercial facilities. The EPA will target and reduce emissions of toxic air pollutants in three areas where the agency has determined there are high rates of noncompliance: (A) leak detection and repair; (B) reduction of the volume of waste gas to flares and improvements to flare combustion efficiency; and (C) excess emissions, including those associated with startup, shut down and malfunction. Through this Air Toxics Initiative, the EPA will undertake compliance monitoring

2014 - 2016 EPA National Enforcement Initiatives



- **Assuring Energy Extraction Sector Compliance with Environmental Laws**
Vast natural gas reserves, unlocked through technological advances in horizontal drilling and hydraulic fracturing, are a key part of the nation's clean energy future. The full promise of this resource will be realized only if it is developed responsibly and the new technologies are controlled in a manner that protects the nation's air, water and land. For example, an unprecedented acceleration of natural gas development has led to a significant rise in air pollution throughout the intermountain West. Geospatial analysis suggests that a similar rise in air pollution is possible elsewhere as unconventional gas development grows in other shale plays. Meanwhile,

EPA – Enhanced LDAR Program (ELP) Elements

A: Applicability

B: Facility-Wide Document

C: Monitoring Frequency

D: LDAR Action Levels

E: Repairs

F: Delay of Repair

G: Low Emission Technology

H: Management of Change

I: Training

J: QA/QC

K: LDAR Audits

L: Compliance Certification

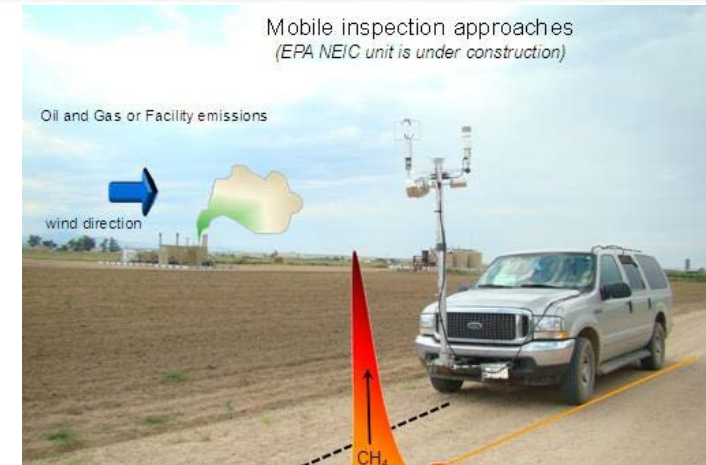
M: Recordkeeping

N: Reporting



National Emission Standard for Hazardous Air Pollutants (NESHAP)

- The EPA has identified advancements in monitoring technologies for detecting fugitive emissions.
- The EPA is proposing an annual average benzene concentration standard at the refinery fence line, measured using 2-week integrated samples placed around the refinery fence line perimeter.
- The EPA is also proposing to require monitoring of air concentrations at the fence line of refinery facilities to ensure proposed standards are being met and that neighboring communities are not being exposed to unintended emissions.
- The provisions in this rule will result in a reduction of 5600 tons per year of toxic air pollutants, and 52,000 tons per year of volatile organic compounds (VOC).



What Does this Mean to All of Us?



- EPA Pressure on Valve Leaks to Continue on Refiners and Chemical Companies
 - 100ppm performance goal established
- Natural Gas Processing Facilities Implementing LDAR programs
- Opportunities in the area of Low Emission Valves, Valve Sealing and Valve Repair
- Increased Technology and Expertise are required
 - **The old way is no longer the best way**
- Plant personnel are relying on their suppliers to support them
 - **“We want our suppliers to be proactive and not reactive”**

EPA Recognized “Low Emissions” Packing Test Protocols

- **API 622 Rev. 2**
 - Developed to Establish a Uniform Procedure to Evaluate Graphite Packing
 - Establishes Requirements and Parameters For
 - Fugitive Emission Levels
 - High Temperature and Low Temperature Corrosion
 - Packing Material Composition and Properties Including Weight Loss Testing
 - Applies to packing for use in on-off valves with stem motion(s):
 - Rising Stem & Rising Rotating Stem
 - Rate: 3 mm to 5 mm (0.12 in. to 0.20 in.) per second.
 - Stroke: 102 mm \pm 3 mm (4 in. \pm 0.12 in.).
 - Number of Rotations (to be confirmed with manufacturer based on 4” Class 300)
 - Rotating Stem
 - Rate: 10° to 15° per second.
 - Rotation: 90° \pm 5°.

Industry recognizes sealing these types of stem movements in high cycle testing protocols as the most difficult therefore providing the most accurate method for interpreting packing performance in the widest range of valves

EPA Recognized “Low Emissions” Packing Test Protocols

- **API 622 Rev. 2**
 - 1510 Mechanical Cycles and 5 Thermal Cycles over 5 Days
 - Packing Adjustments are Allowed
 - Test is Terminated if After a Packing Leakage has Exceeded 500ppm a Second Time
 - Uses EPA Method 21 Monitoring Guidelines
 - **New Task Group formed to Develop Rev. 3 to Include PTFE and Elastomers**
- **ISO 15848-1 (with Methane and Method 21 monitoring)**
 - Valve type test for evaluation and qualification of fugitive emissions
 - Although a valve type test, prior to API 622 commonly used to evaluate valve packing
 - Stem Seal Adjustments allowed but documented
 - Adjustments allowed based on Endurance Class Chosen
 - Various performance classes based on type test
 - Tightness Class (Defined only for stem sealing)
 - A – Typically achieved using a Bellows Seal
 - B – Typically achieved using PTFE
 - C – Typically Achieved using Graphite

EPA Recognized “Low Emissions” Packing Test Protocols

- **ISO 15848-1 (with Methane and Method 21 monitoring)**
 - Endurance Class
 - Manual Valves
 - » CO1 – 500 Cycles CO2 – 1500 Cycles CO3 – 2500 Cycles
 - Control Valves
 - » CC1 – 20,000 Cycles CC2 – 60,000 Cycles CC3 – 100,000 Cycles
 - Temperature Class
 - 200 C & 400 C
- Typical Leakage rates are reported in (mg.s-1.m-1) not ppm
 - *This can be difficult if ppm’s are a criteria needed for evaluating and understanding actual leakage rates .*
 - No true way to correlate Helium leakage from vacuum detection method to ppm leakage rate as recorded with Method 21
- Example of a test classification looks like
 - *B – CO1 – SS1 – T (200) – CL150*

ISO 15848-1 has been rewritten and the current version has been sent out for ballot to be completed in 2014

Type Testing for “Low Emission Valves”

- **API 624**
 - Type Testing of Rising & Rotating Stem Valves
 - Valve must be packed with API 622 Rev. 2 Certified “Low Emissions” Packing
 - Published in January of 2014
 - API Valve Specifications (600, 602, 623 etc.) will require 624 testing as part of the specification
 - Most End Users will adopt this standard as the minimal acceptable criteria for all valves, regardless of the service, to be used in their facilities
- **API 641**
 - Type Testing of Quarter Turn Valves
 - Valve must be packed with API 622 Rev. 2 Certified “Low Emissions” Packing
 - In Task Group process
 - API Valve Specifications (609, etc.) will require 641 testing as part of the specification
 - Most End Users will adopt this standard as the minimal acceptable criteria for all valves, regardless of the service, to be used in their facilities

Valve OEM Response



Valve OEM's: Response to “Low Emission Technology”

- Only a few proactive OEM's have addressed current EPA “Low Emission” standards
- Many valves advertised as “Low Emission” do not actually meet **Current** EPA standards for “Low Emissions”
- Strong message from Users to OEM's is needed
 - API 624 is driving change
 - The publication of API 641 will drive additional change
- Many End User purchases focus on Unit Valve Cost, not Total Cost of Ownership
 - OEM's are afraid to increase their unit costs
- Sales, Marketing, Engineering and Procurement are generally not in sync
 - Most OEM's do not understand how to take advantage of EPA requirements and market their valves
 - Promoting and selling “Low E Valves” does not mean increased total cost to user
 - Reduce monitoring costs
 - Less leak repair costs
 - Eliminating fines
 - Reduce product loss
 - Can increase meantime between turnarounds

Packing Specification



- Develop a valve packing specification that ensures “Low Emission” packing will be used in all OEM, Repaired/Reconditioned, and Repacked On/Off valves
 - This can be done by utilizing API 622 Rev. 2 as the performance standard and requiring every on/off valve to be fitted with this packing
- *To ensure success, Chesterton recommends the specification require API 622 Rev. 2 results to have had no leakage readings above 50ppm and no packing adjustments*
 - Every reputable packing manufacturer has a product that will meet this specification
- Valve OEM’s must meet API 624 to be in Compliance with API 600, 602 & 623
 - Specify packing leakage results to meet 50ppm max leakage rates without packing re-torque
- Many valve packing products advertised as “Low Emission” do not actually meet **Current** EPA standard for “Low Emissions”
- Communication from End User Corporate Level to Plant Level Personnel is extremely important
 - Many times the plant level continues to use old specifications and are not made aware of corporate updates

Repaired and Repacked Valves

- Many End Users require their repaired valves to be brought back to the OEM like new standards or follow API 621 Recommended Practice – Reconditioning of Metallic Gate, Globe, and Check Valves
- ***This Practice Has Flaws when Fugitive Emissions are a Concern***
 - In most cases the OEM packing sets are not readily available
 - If so, is the OEM packing set a “Low Emissions” product?
 - Most likely the valve is dated and was not originally designed to meet today’s EPA guidelines for “Low Emissions”
 - API 621 requires graphite packing with no emission performance criteria
 - It is common for valve repair companies to utilize the lowest cost packing they can for the repair
 - » To be fair without specific direction can you blame them?
- As with the repair procedure, when repacking valves in the field there is often no specification to ensure “Low Emissions” packing should be utilized

API RP 621 is in re-write at this time and the new Revision will include a section for the repair of valves required to meet “Certified Low Leaking Technology” requirements. As part of this packing used will be required to have successfully complete API 622 without re-torques and no leakage above 100 ppm

Technical Aspects of Low Emission Valve Sealing and Repair



3 P's: Procedure, Processes & Products



What is driving the CHANGES?

- EPA Consent Decrees
 - “Certified Low Leaking Packing Technology”
 - “Certified Low Leaking Valve Technology”
- Required LOW LEAKAGE levels
- Five Year Compliance
 - Effective product selection
 - Warranty/Performance statement
 - Effective corrosion inhibitors
 - Use of torque wrenches
 - Use of effective anti-seize (Chesterton 783 or 772)
 - Proper installation procedures
 - Trained/Certified installers

Proper Packing Selection



End User Demand

- AML placement of “Certified Low Leaking packing Technology”
- End User Pipe Codes
- Line Class:
 - 1) Temperature
 - 2) Pressure
 - 3) Process
- Cyclic Nature of Process
- Live Load for High Cycle Applications
- Project Purchase
- Consent Decree
- Valve Modifications to Upgrade Current In-stock Inventory
- Field Modifications/Upgrades of Installed Valve Population

Proper Packing Selection



- Required Testing
 - API 622 (Leakage below 100 ppm without re-torque)
 - API 624 Valve Type Testing (deadline for compliance)
 - ISO 15848-1 (200° C or 400°C)
 - TA Luft
- Five Year Warranty based on EPA Consent Decree Definition of “Certified Low Leaking Valve Packing Technology”
- Valve OEM Certification/Approval
 - API 624 Testing Completed
- Braided Packing vs. Traditional Die Formed Packing
- API RP 621 vs. End User Repair Specifications

Proper Installation Procedures

- Trained/Certified Installers Required as Part of 5 year Warranty
- Proper Visual Inspection of Valve Prior to Performance of Work
 - Potential Gland Flange Stud Bolt Replacement
 - Corrosion (Pitting, Gland Flange Flatness, Stem Wear, etc.)
- Installation of Hardened Washers
- Effective Selection and Use of Anti-Seize (Chesterton 783)
 - Friction Factor the Same, Wet vs. Dry
- Use of Torque Wrenches Required
 - Torque Values Calculated by Valve Type and Class
 - Re-Torque Values Supplied for Ongoing Maintenance of Valves to Maintain Warranty as Required and Supplied



Proper Installation Procedures

- Cycling of Valve Required for Packing Break In and Consolidation Reduction
- Field Re-Torques to be Performed by Valve Type and Class
- “Low E Tags” Installed for Proper Identification of Valves
- Valve List Completed and Supplied to Valve Owner/End User and Packing Manufacturer for Warranty Validation (Signed Off by Authorized Installer)



API Standards

- API 622 (New Task Group formed to Create Rev. 3)
- API 624 (Published in 2014)
- API RP621 (Second Ballot Ready to Send Out For Vote & Comments)
- API 641 (In Task Group Now, First Draft Released for Comment)
- API 600 (Newest Edition Published in 2014; Requires Valves to be API 624 Approved)
- API 602 (Latest Revision In Final Stages of Review for Publication; Requires Valves to be API 624 Approved)
- API 603
- API 623
- API 607 (Fire Test)
- API 598

