Emergency Action for Handling Leaking Compressed Gas Cylinders

处理压缩气体钢瓶泄露的紧急行动

General Precautions

一般防范

Gengas takes every reasonable precaution to see that its products come to you safely. This concern for safety doesn't end with delivery, but should be continued by you and all other customers by following seven general precautions.

通用气体采取了每一种合理的安全防范，以确保它的产品安全地到达你的手中。这种对安全的关注并不是随销售的结束而结束，而是要由你和所有其它用户通过遵守以下七个通用防范措施来继续。

1. Know and Understand Gas Properties

知道和理解气体的性质

Know and understand the properties, proper uses, and safety precautions of your gases before using them. Consult the Air Products Material Safety Data Sheets (MSDS) and/or Safetygrams for safety information about these gases.

在使用气体之前，知道和理解气体的性质、正确使用和安全防范。关于这些气体的安全资料，请参考Air Products的材料安全数据表（MSDS）和/或安全程序。关于你将要使用的气体和设备的安全资料，请参考Air Products的材料安全数据表（MSDS）和安全程序。

2. Know and Understand the Gas Package

知道和理解气体的包装

Know and understand the package for each of the gases you use. The package consists of two distinctive parts—the cylinder and the cylinder valve. Again, consult the appropriate MSDS materials and Safetygrams for your specific products. The following Safetygrams provide basic package information:

知道和理解你使用的每一种气体的包装。包装由两个明显不同部分—钢瓶和钢瓶阀门组成。关于你要使用的特殊气体，还是请参考通用气体的材料安全数据表和安全程序。下列的安全程序提供了基本的包装资料。

- Handling, Storage and Use of Compressed Gas Cylinders
  液化压缩气体钢瓶的操作、储存和使用
- Don't Turn a Cylinder In to a Rocket
  不要把钢瓶变成火箭
- Cylinder Pressure-Relief Devices
  钢瓶减压装置
- Cylinder Valves
  钢瓶阀门

The Compressed Gas Association (CGA) also offers helpful publications such as the "Handbook of Compressed Gases" and Pamphlet P-1, "Safe Handling of Compressed Gases In Containers," which provide information on the safe handling of gases and

their packages.
压缩气体协会（CGA）还提供有帮助的出版物，如“压缩气体手册”和小册子P-1，“容器内压缩气体的安全操作”，该书提供了关于气体及其包装的安全操作的资料。

3. Check Your Equipment
检查你的设备

Before lines and equipment are used, leak-check and evaluate their ability to contain full cylinder pressure. The leak check should be performed with an inert gas, and care should be taken not to over pressurize any components of the system. If the system is not rated for full cylinder pressure, a pressure-reducing regulator must be used and the system should be protected with a pressure-relief device. Leak-check the system at its working pressure. Be certain that materials of construction are compatible with the gases being used.
在管道和设备使用前，进行检漏并评估它们承受满瓶压力的能力。检漏应用惰性气体进行，注意不要使系统的任何组件过压。如果系统额定压力低于满瓶的压力，必须使用减压调整器，同时应该用减压装置来保护系统。在工作压力下对系统检漏。确信材料同正在使用的气体兼容。

4. Develop Emergency Plans
制定紧急情况计划

Federal law requires that all facilities using hazardous materials develop emergency plans. Be aware of the potential hazards of the gases being stored and used, and plan for emergencies. Practice implementing emergency plans so that all contingencies are covered. Assign responsibilities and lines of authority. Coordinate with local hospitals and fire departments and inform them of the gases in use so they can be prepared with the needed expertise, equipment, and medical support if an emergency occurs.
联邦法律要求所有使用危险材料的设施都要制定紧急情况计划。了解所储存和使用的气体的潜在危险，为紧急情况作好计划。练习实施紧急计划，以确定包括了所有的紧急情况。分配责任和权限。同当地医院和消防部门合作，把正在使用的气体通知它们，这样如果紧急情况发生的话，它们就已经准备好了所需的专门技术、设备和医疗支持。

5. Provide Personal Protection
提供个人保护装备

It is necessary to define and provide personal protective equipment (PPE) for routine operations, as well as for emergencies. It is important to establish a policy that requires personnel to wear the proper PPE for each job. Gloves, face protection, and sensible work uniforms for routine tasks, as well as self-contained breathing apparatus (SCBA)and special protective clothing required for emergencies, should be made available. In addition, gas cabinets, eye washes, safety showers, and fire extinguishers should be considered when using hazardous materials. Everyone involved must be trained in the proper use of all necessary PPE. Train personnel to recognize when that equipment is needed.
无论是常规操作还是紧急情况，都有必要详细说明和提供个人防护装备（PPE）。要求员工每次工作都要穿戴适当的PPE，建立这样的原则是很重要的。常规任务时应备有手套、面罩和敏感的工作服，紧急情况下应备有自给式呼吸器（SCBA）和特殊防护服。另外，使用危险材料时，应当考虑到气体室、洗眼、安全淋浴和灭火器。每个相关人员都必须经过所有必需PPE的正确使用的训练。训练员工，使之能判断什么时候需要什么装备。

6. Follow the Regulations
遵守规定

Comply with all federal, state, and local regulations pertaining to the storage and use of compressed gases. CGA Pamphlet P-1 and the National Fire Protection Association (NFPA) codes provide excellent guidance.

遵守联邦、州和当地的所有关于压缩气体储存和使用的规定。CGA的小册子P-1和国家消防协会的规定提供了极好的指导。

7. When in Doubt
有疑问时

When in doubt about the handling or use of any Air Products' gases or equipment, or the hazards of a particular gas, contact your local sales office or call our Technical Information Center at +1 (800) 752-1597.

对任何Air Products的气体或设备或者特定气体的危险有疑问时，同当地的销售处联系，或者给我们的技术资料中心打电话：+1 (800) 752-1597。

Leaks
泄漏

Cylinder leaks usually occur at welded seams (on low-pressure cylinders) or at the cylinder valve. Proper quality control of materials and inspections, as required by the Department of Transportation (DOT), lessen the probability of cylinder leaks.

钢瓶泄漏通常发生在焊缝处（低压钢瓶），或者在钢瓶阀门处。正如交通部所要求的那样，材料的正确质量控制和检查降低了钢瓶泄漏的概率。

Compressed gas suppliers are required to inspect cylinders for visual damage each time the cylinders are filled. In addition, gas producers must make certain the cylinder closure is completely leak-tight, and that cylinders are internally inspected and hydrostatically tested at the prescribed time intervals. The purpose of these inspections is to verify that the cylinder is in sound condition and that it will be safe during transportation. In spite of such precautions, leaks can develop from handling in transit, during storage, and during use. The greatest leak potential is with the cylinder valve. There are four distinct areas where leaks at the cylinder valve can occur:

每次钢瓶灌装时，要求压缩气体供应商检查钢瓶是否有可见的损伤。另外，气体生产商必须确定钢瓶的密封是彻底防漏的，在指定时间间隔内要进行钢瓶内部检查和流体静力学测试。这些检查的目的是验证钢瓶处在完好状态且在运输过程中是安全的。尽管有这些防范措施，在运输、储存和使用中，泄漏还是可能发生。最大的泄漏可能点是钢瓶阀门。钢瓶阀门上有四个特殊区域可能发生泄漏:

1. Valve Threads
阀门螺纹

Leaks are possible at the valve threads where the valve screws into the cylinder; these are commonly referred to as "neck leakers." These types of leaks cannot and should not be repaired in the field. To do so is a violation of a very important safety practice—NEVER repair equipment under pressure. Leaks of this nature should only be handled with the assistance of the supplier.

在阀门旋进钢瓶的螺纹处可能发生泄漏，这些一般称为"颈部漏孔"。不能也不应该在现场修理这

种泄漏。这样做违背了一条非常重要的安全惯例——禁止带压修理设备。这种泄漏只能在供应商的帮助下来处理。

2. Pressure-Relief Device

减压装置

Leaks can occur at two points on the pressure-relief device—around its threads or through its relief channel. Again, leaks at the pressure-relief device cannot and must not be repaired in the field. To attempt field repair is a violation of two very important safety practices. NEVER attempt to repair equipment under pressure and NEVER tamper with pressure-relief devices. Tampering with the pressure-relief device compromises the safety of the cylinder. Leaks through the pressure-relief channel can become severe, and all personnel must be evacuated from the immediate area. Contact your supplier for immediate assistance.

在减压装置上有两个位置可能发生泄漏——螺纹附近或通过减压通道。再一次说明，不能在现场修理减压装置处的泄漏。试图现场修理违背了两条非常重要的安全惯例：禁止带压修理设备和禁止堵塞减压装置。堵塞减压装置会危及钢瓶的安全。来自减压通道的泄漏可能会变得很严重，所有人员必须马上撤离。立刻联系你的供应商，取得它的帮助。

3. Valve Stem

阀杆

Leaks can occur along the valve stem through the packing or diaphragms. Leaks of this type can be stopped by closing the valve and venting any pressure from the outlet. Leaks of this type should be reported to your supplier so they can advise you if that particular valve design will allow a packing adjustment to correct the problem or if arrangements must be made for a safe and proper return of the cylinder. Diaphragm valves cannot be repaired or adjusted in the field.

泄漏可能沿着阀杆通过衬垫或隔膜发生。关闭阀门，从排气口排出压力可以停止这种泄漏。应该把这种泄漏报告给你的供应商，这样他们能够建议你那个特定的阀门设计是否允许通过调整衬垫来纠正问题，或者安排你安全正确的返还钢瓶。不能在现场修理或调整隔膜阀。

4. Valve Outlet

阀门排气口

Leakage can occur at the valve outlet, due to leak-through at the seat. Many times this can be corrected or prevented by using proper valve operational techniques. When proper closing procedures fail to completely stop leakage, a pressure-tight outlet seal can be installed to stop the leak.

由于阀座泄漏，泄漏可能在阀门排气口发生。多数情况下这种泄漏可以通过使用正确的阀门操作技术来修正或预防。当正确的关闭程序不能彻底阻止泄漏时，可以安上防压排气口密封来阻止泄漏。

Leaks in the valve area are generally very small and do not normally change in size when the product in the cylinder is an oxidant, inert, or flammable compressed gas, or a mixture of these gases. When the leak involves a corrosive product, however, the leak will generally worsen because the corrosive material attacks the leak point.

当钢瓶内的产品是氧化剂、惰性气体、易燃压缩气体或这些气体的混合物时，发生在阀门区域的泄漏一般非常小，而且正常情况下不会改变大小。但是当泄漏同腐蚀性产品有关时，由于腐蚀性材料侵蚀泄漏点，泄漏一般会恶化。

Any hazardous material that is being released to the atmosphere in an

uncontrollable manner requires that proper actions be taken to minimize exposure to personnel and equipment. The following emergency procedures—though general—are extremely important in reducing the dangers of exposure to a hazardous materials leak.

必须对任何正在以无法控制的方式排放到空气中的危险材料采取正确的行动，以减少人员和设备的暴露。下列紧急情况应对程序尽管很粗略，在减少暴露于危险材料泄漏的危险方面是极端重要的。

Before any action can be taken, you must first properly identify the hazards. This is not always simple since most products have more than one hazard. Remember, the DOT shipping classification is of limited value because it may not define all of the hazards of a particular product. Anhydrous ammonia is an excellent example. In the United States, anhydrous ammonia is shipped as Nonflammable Gas, Class 2.1. However, anhydrous ammonia is also toxic, corrosive, and flammable. The best available reference for the quick identification of any product's hazards and properties is the MSDS sheet. In the event of a leak, the MSDS sheet will provide enough information for you to take the appropriate actions to immediately stabilize the situation. The final resolution of the problem should involve the supplier. No one knows a product and its package better than its supplier; the supplier has ultimate responsibility for the product and the package.

在采取任何行动之前，你必须首先正确鉴别危险。由于大多数产品有不止一种危险，鉴别并不总是很简单。记住，DOT的运输分类不可能详细说明特定产品的所有危险，因此它的价值有限。含水氨是一个很好的例子。在美国，含水氨的运输分类为不可燃气体2.1类。但是，含水氨还是有毒、腐蚀性和可燃的。MSDS表是迅速鉴别任何产品的危险和性质的现有的最好的参考。在发生泄漏的情况下，MSDS表会向你提供足够的资料，以采取合适的行动来立刻稳定局势。问题的最终解决应该包括供应商。没有人比供应商对产品和它的包装更加了解，供应商对产品和包装有根本的责任。

Inerts惰性气体

An inert gas is one that exhibits great stability and extremely low reaction rates under normal temperature and pressure conditions. Two principal hazards exist in dealing with inert gases: asphyxiation and pressure. Inert gases, when released in sufficient quantity, can displace the oxygen in the atmosphere and introduce the potential hazard of asphyxiation. OSHA sets a minimum limit of 19.5% oxygen for work areas. Working in concentrations below this level requires use of a supplied air source. Consult Air Products'Safetygram-17, "Dangers Of Oxygen Deficient Atmospheres. "

惰性气体是在常温和常压下非常稳定且反应率极低的气体。涉及惰性气体时存在两个主要的危险：窒息和压力。当释放出足够数量时，能够取代空气中的氧气，从而带来窒息的危险。OSHA规定工作区域的最低氧浓度为19.5%。在低于这个水平下工作要求使用空气补给源。

Second, compressed gas cylinders represent a potential hazard due to the energy they contain at pressure. Improper handling can result in a high-pressure energy release. Isolate any leaking cylinders of inert gases in a well-ventilated area. Move leaking cylinders only if it can be done safely. Once the leaking cylinder is isolated, contact your supplier for help in resolving the problem. Clearly identify the problem

and return all problem cylinders to the supplier for proper repair.
第二，由于它们在压力下储存的能量，压缩气体钢瓶是一个潜在的危险。误操作可能导致高压能量的释放。要把任何正在泄漏的惰性气体钢瓶隔离在通风良好的区域。只有确信安全时才能移动正在泄漏的钢瓶。一旦泄漏的钢瓶被隔离，马上同供应商联系，请他们帮助解决问题。清楚地说明问题，然后把所有问题钢瓶返还给供应商正确维修。

Flammables
易燃物

Flammable gas as defined by the DOT is any compressed gas that either forms a flammable mixture with air at a concentration of less than 13% by volume, or has a flammable
range in air wider than 12%, regardless of the lower explosive limit (LEL).
Flammable gases have the potential for the same hazards as the inert gases, for example, pressure and asphyxiation, plus the potential for fire and/or explosion. If it can be done safely, move and isolate any problem cylinder in a well-ventilated area free from any ignition sources.
DOT对易燃气体的定义是：在体积浓度小于13%的情况下同空气形成易燃混合物的任何压缩气体，或者不考虑较低的爆炸极限（LEL），在空气中的易燃范围大于12%的任何压缩气体。易燃气体既有同惰性气体一样的潜在危险，如压力和窒息，又有起火和/或爆炸的潜在危险。如果确信安全的话，把任何问题钢瓶移动和隔离在没有任何火源的通风良好的区域。
Post prominent signs in such an area that warn of potential fire hazards and the need for elimination of any ignition sources. If ignition takes place at the source of the leak, do not try to extinguish the flame unless the supply of flammable gas can be stopped. Extinguishing a fire without eliminating the flammable gas supply can result in an accumulation of the gas and a possible explosion. If the flammable gas source cannot be stopped, action must be taken to cool and to protect nearby equipment and cylinders from the fire. Contact your supplier immediately for support.
在这样的地方张贴醒目的标志，警告该地方存在起火的危险和需要消灭任何火源。如果泄漏的源头起火，除非能够切断易燃气体供应，否则不要试图灭火。没有切断易燃气体供应而灭火可能导致气体的积累和可能的爆炸。如果易燃气体源头不能切断的话，必须采取行动来冷却和保护负荆的设备和钢瓶，以防它们起火。立刻联系你的供应商，请求他们的支持。

Oxidants
氧化剂

Oxidants are substances that support combustion and enhance the combustibility of other materials. The principal emergency action to take with oxidizers is isolation of the leaking cylinder in a well-ventilated area free from any combustibles and ignition sources. The area should then be posted to prevent access and to alert personnel to the hazard. As always, contact your supplier for help and to advise them there is a problem with one of their products. In many cases, oxidant materials may also be corrosive and/or toxic. The following sections address these hazards.
氧化剂是支持燃烧和提高其它材料的可燃性的物质。处理同氧化剂有关的紧急情况应该采取的行

动是把正在泄漏的钢瓶隔离在没有任何可燃物和火源的通风良好的区域。在这样的地方张贴标志，以防止人员接近和警告存在危险。象总是做的那样，联系你的供应商请求帮助，通知他们他们的产品有问题。在许多情况下，氧化剂材料还是有腐蚀性和/或毒性的。下文说明这些危险。

Corrosives
腐蚀剂

Corrosives are substances that erode and deteriorate materials on contact, including metals, fabrics, and human tissue. As mentioned, leaks from cylinders containing corrosives may escalate because the corrosive material may attack the leak point, making it larger. Corrosives are generally toxic, so follow the precautions cited in the following section on toxics.

腐蚀剂是腐蚀和损坏所接触到的包括金属、纺织品和人体组织在内的材料的物质。如上所述，因为腐蚀材料会侵蚀泄漏点，使之越来越大，装有腐蚀剂的钢瓶的泄漏会逐步加剧。腐蚀剂一般来说是有毒的，所以请遵守下文关于毒品的防范措施。

The initial stabilization for a leaking cylinder containing corrosives is isolation in a well-ventilated area. Move the cylinder only if it can be accomplished in a safe manner. Contact the supplier before taking any steps such as disposal, or containment and diversion. Specific PPE, including acid suits and self-contained breathing apparatus (SCBA),may be required if the cylinder must be approached. Do not use any of this equipment unless you are trained in its use. Further steps to collect and direct the escaping gas to a disposal medium will limit exposure of people and equipment to the product. Steps should also be taken to eliminate moisture from the leak point. Take such action only with supplier assistance.

第一步是把装有腐蚀剂的钢瓶隔离在通风良好的区域。只有能够安全地完成时，才移动钢瓶。在采取任何步骤，如处理或围堵和转移之前同供应商联系。如果必须接近钢瓶，要求穿戴特殊的PPE，包括防酸服和自给式呼吸器（SCBA）。收集和把逃逸气体导入处理媒质的进一步工作要限制人员和设备在产品中的暴露。还应该采取步骤来祛除来自泄漏点的水蒸汽。只有在供应商的帮助下才能采取这些行动。

Toxics and Poisonous Materials
毒物和有毒材料

Leaks involving toxics and poisonous materials also require immediate evacuation of the contaminated area. Isolate the cylinder in a well-ventilated and secure area. However, move the cylinder only if it can be done in a safe manner. Direct escaping gas to either an appropriate disposal unit or a forced ventilation system where it can be safely diluted and remotely vented. Personnel working with toxic and/or poisonous gases should have self-contained breathing equipment available and must be trained in its proper use. Many poisonous gases also have other hazardous properties, for example, corrosivity and flammability. It is important to recognize all the hazards of a material so that proper action can be taken without risk to anyone.

同毒物和有毒材料有关的泄漏还要求马上撤离污染区域。把钢瓶隔离在通风良好的安全区域。但是，只有能够安全地完成时，才移动钢瓶。直接把逃逸气体导入合适的处理装置，或者导入强制通风系统，在那里能够安全地稀释气体并排放到远处。同毒物和/或有毒气体一起工作的员工应该备有自给式呼吸器并经过正确使用的训练。许多有毒气体还有其它的危险性质，例如腐蚀性和

易燃性。认清材料的所有危险是很重要的，这样才能采取正确的行动，而不会危及任何人。

The above procedures describe the type of action to take when the leak is of a minimal size and corrective action can be taken without risk to personnel. Leaks of a large nature require more sophisticated response efforts. Emergency plans must be based upon the nature of the product and should include:

上述程序描述了微量泄漏时应采取的行动的类型和不会危及人员的补救行动。大量的泄漏要求更加复杂的努力来应对。紧急计划应该以产品的本质为基础，应该包括:

•Evacuation of personnel.

人员的撤离。

•Rescue of injured people by crews equipped with the necessary PPE for their own protection and who have been trained in the proper use of PPE.

伤员的救援。救援人员要装备有保护自己的PPE，并且经过正确使用PPE的训练。

•Corrective action to minimize the leak or at least minimize exposure to people and equipment.

减少泄漏或者至少减少人员和设备的暴露的补救行动。

• Assuring that all necessary resources are available for the final resolution of the situation. These may include the deployment of customer teams, police, fire departments, and supplier assistance.

确保最后解决问题的所有资源就位。这些可以包括用户的人员、警察、消防部门和供应商的援助的部署。

•Fire-fighting action.

救火行动。

•Decontamination.

排出污染。

•Written documentation and critique.

书面文件和鉴定。