Qatar Chemical Company II Limited
(Q- Chem II)

Safe Handling and Storage of

1-Decene

and

1-Dodecene

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OPERATIONAL EXCELLENCE POLICY

We will strive each day to conduct our business in a safe, secure, injury-free, and environmentally responsible manner. We are committed to comply with all laws and regulations applicable to our facilities and business activities and to comply with all voluntary programs to which we elect to subscribe such as Responsible Care® and International Organization for Standardization (ISO) etc. We will strive to make optimal use of the resources we consume and minimize emissions and waste. We will strive to limit the risks of our products throughout their lifecycle. We are committed to reducing risks in our operations to safeguard our employees, contractors, and the communities where we operate and engage in business activities. We are committed to protect information, critical infrastructures and information systems to maintain confidentiality, integrity and availability. We will openly communicate our results and welcome the input of our employees and contractors, regulatory agencies, our communities, our customers, and other interested stakeholders.

We will accomplish this by integrating safety, physical and cyber security, health, environmental, reliability, and quality into our management processes using our Operational Excellence System (OE). OE will be used facility wide to: set goals for continual improvement; provide alignment of activities and resources; assess and manage risks; gain stakeholder input; and, rigorously audit our performance against operational objectives and compliance requirements.

Chief Executive Officer
Q-Chem

OPERATIONAL EXCELLENCE SYSTEM

HSE-HGN-PCY-00-0001 Rev. 6

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PRODUCT STEWARDSHIP

Qatar Chemical Company II Ltd ("Q-Chem II") is committed to being a good product steward of the products we produce. We want anyone who comes in contact with one of our products to have access to information that will help them to understand its potential risk and how to use it safely. The thrust of our product stewardship program is the implementation of an Operation Excellence Management System (OEMS) initiative, which makes health, safety and environmental protection an integral part of our products. Successful implementation of this system must include a shared responsibility of all those who come in contact with a product throughout its life cycle. Qatar Chemical Company II Ltd will continue to work with customers and others to help ensure that all who use and handle our products follow safe and environmentally sound practices.

The information contained in this technical bulletin is not intended to, nor does it, amend or replace the Qatar Chemical Company II Ltd Safety Data Sheet (SDS) for 1-Decene and 1-Dodecene. The most current SDS can be obtained from Qatar Chemical Company II Ltd at www.qchem.com.qa or by calling (974) 4 484 -7110 and should be carefully examined prior to working with this product.

INTRODUCTION

Gulf Oil Chemicals commercialized the first production of alpha olefins in 1965, under the name of Gulftene® alpha olefins. Alpha olefin products are being produced by Qatar Chemical Company II Ltd (Q-Chem II) under licensed from Chevron Phillips Chemical Company (CPChem) and sold/distributed by Muntajat. This brochure covers the safe handling and storage of 1-decene and 1-dodecene. A brief description of typical applications of these products follows.

Oligomerization of 1-decene or 1-dodecene produces synthetic base fluids for high- performance lubricants and functional fluids. These oligomers or polyalphaolefin (PAO) fluids have excellent low temperature properties, high viscosity index and low volatility. These properties provide superior automotive, industrial and aerospace lubricants with greater efficiencies, longer service life and improved economics relative to mineral oil.

Qatar Chemical Company II Ltd's 1-decene and 1-dodecene are feedstocks for the production of surfactants (detergent alcohols and alkyl aromatics). Another use is in the production of linear alkyl benzene sulfonates, which are employed in dishwashing liquids, laundry detergents, all-purpose cleaners and lube-oil additives. Higher olefins, like 1-dodecene, are used to manufacture alkyl dimethyl amines (ADMAs), which are precursors to amine oxides, quaternary ammonium halides and betaines. The amine oxides are used as foam boosters in shampoos, bubble baths and dishwashing detergents. Quaternary ammonium halides are used as biocides, fungicides and antistatic agents, while betaines are mild amphoteric surfactants.

Other uses of 1-decene and 1-dodecene include the manufacture of C_{11} plasticizer alcohols and C_{13} synthetic detergent alcohols, respectively. Reaction with maleic anhydride produces alkenyl succinic anhydrides, which are used as dispersants in lube oils and automatic transmission fluids, and as pour-point depressants in lube and crude oils. Both 1-decene and 1-dodecene can be used in the manufacture of specialty chemicals such as epoxides and halogenated olefins. Also, 1-dodecene can be used to produce mercaptans and metal alkyls.

PART 1

SPECIFICATIONS, PROPERTIES AND TEST METHODS

1-DECENE (C10H20) AND 1-DODECENE ($C_{12}H_{24}$) SALES SPECIFICATION

Please reference the Qatar Chemical Company II Ltd website for sales specifications at www.qchem.com.qa

PROPERTIES

	1-Decene	1-Dodecene
Aniline Point[1], °C (°F)	44.1 (111.4)	--
API Gravity[1], 15.6°C (60°F)	58.51	53.96
Appearance	Clear & Bright	Clear & Bright
Autoignition Temperature[2], °C (°F)	210 (410)	226 (439)
Boiling Point[3], °C		
Vapor Pressure, mm of Hg		
760	170.597	213.401
700	167.398	209.979
600	161.550	203.721
500	154.871	196.572
400	147.030	188.174
300	137.424	177.882
200	124.764	164.309
100	105.215	143.332
80	99.419	137.109
50	87.913	124.748
20	67.88	103.21
Coefficient of expansion at 60 °F per °F, Calculated[4]	0.00060	--
Color		
Saybolt	+30	+30
Critical Density[3]		
gm/cm^3	0.240	0.240
lb/ft^3	14.98	14.98
Critical Pressure[3]		

atmosphere	21.021	18.653
lb/in2	308.93	274.12
Bar	21.300	18.900
Critical Temperature[3]		
^{o}K	616.9	666.0
^{o}C	343.7	384.2
^{o}R	1,110.4	1,198.8
^{o}F	650.7	723.1
	1-Decene	**1-Dodecene**
Critical Volume[3]		
cm^3/gm-mole	584.5	700.5
ft^3/lb-mole	9.363	11.22
ft^3/lb	0.0667	0.0690
Critical PV/RT(ref 3)	0.243	0.232
Density of the Liquid[3], gm/cm^3		
Temperature, ^{o}C		
10	0.7486	0.7730
20	0.7408	0.7584
25	0.7369	0.7547
(Linear Least Squares Constants)[5] (for units of gm/cm^3)		
m	-0.777272	-0.733454
b	0.756360	0.773040
Entropy of Vaporization[3] at Boiling Point,		
cal K-1 mol-1	20.82	21.22
Flammability Limits[2], vol%	0.7 lower to 5.9 upper	0.6 lower to 5.4 upper (Estimated)
Flash Point[2], (TCC), ^{o}C (^{o}F)	48.9 (120)	77.2 (171)
Free Energy of Formation[3] at 25 ^{o}C, kcal/mole		

Gas, Ideal, State	28.64	32.76
Freezing Point[1], °C (°F)	-66.31 (-87.35)	-35.23 (-31.41)
Heat Capacity[3] at 25 °C, cal/gm-°C		
Gas	0.3775	0.3789
Liquid	0.5117	0.5121
Heat of Combustion of the Liquid[3] at 25 °C and Constant Pressure, Gross, kcal/mole		
H2O(l) +CO2(g)	1581.8	1894.3
H2O(g) +CO2(g)	1476.6	1768.1
Heat of Formation of the Gas[3] at 25 °C, kcal/mole	-29.80	-39.54
Heat of Vaporization at Boiling Point[3], kcal/mole	9.24	10.27

	1-Decene	**1-Dodecene**
Ideal Gas Thermodynamic Properties[3]	Heat Capacity,	Heat Capacity,
Temperature, °C	cal/gm-mole-oC	cal/gm-mole-oC
0	49.82	59.99
25	53.50	64.43
100	64.15	77.28
500	106.30	128.02
1000	133.26	160.24
	Enthalpy,	Enthalpy,
Temperature, °C	cal/gm-mole	cal/gm-mole
0	8,928	10,655
25	10,200	12,186
100	14,602	17,488
500	49,543	59,585
1000	110,280	132,703

Molecular Formula	$C_{10}H_{20}$	$C_{12}H_{24}$
Molecular Weight	140.27	168.32
Odor	Olefinic	Olefinic
Odor Threshold in Air[6], (ppm)	7	--
Refractive index[3],		
Temperature, °C	(N_D)	(N_D)
20	1.42146	1.43002
25	1.41913	1.42782
Relative Density (Specific Gravity)[7],	0.7493	0.7665
10 °C/15.6 °C		
20 °C/15.6 °C	0.7415	0.7592
25 °C/15.6 °C	0.7376	0.7554
Relative Vapor Density (Air = 1)[7]	4.8	5.8
Solubility of Product in Water[8] (ppmw), 20 °C (68 °F)	8.6	--
Surface tension[3], dynes/cm		
Temperature, °C		
0	25.84	27.38
25	23.54	25.15
50	21.24	22.92
70	19.41	21.14
100	16.65	18.47
	1-Decene	**1-Dodecene**
Vapor Pressure at 300 °F[3], mm Hg	422.1	121.9
Antoine Coefficients[9]		
A	6.93477	6.97607
B	1,484.98	1,621.11
C	195.707	182.449

Viscosity[3]

Temperature, °C	Absolute Viscosity, centipoises	Absolute Viscosity, centipoises
0	1.127	1.95
25	0.754	1.203
50	0.549	0.829
75	0.424	0.610
100	0.341	0.475

Temperature, °C	Kinematic Viscosity, centiStokes	Kinematic Viscosity, centiStokes
0	1.49	2.53
25	1.022	1.60
50	0.766	1.125
75	0.607	0.850
100	0.501	0.676

RECOMMENDED TEST METHODS

The following ASTM methods are recommended for the analysis of 1-decene and 1-dodecene:

1. ASTM D 56 Standard Test Method for Flash Point by Tag Closed Cup Tester
2. ASTM D 97 Standard Test Method for Pour Point of Petroleum Products
3. ASTM D 287 Standard Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)
4. ASTM D 1015 Standard Test Method for Freezing Points of High-Purity Hydrocarbons
5. ASTM D 4176 Standard Test Method for Free Water and Particulate Contamination in Distillate Fuels (Visual Inspection Procedures)
6. ASTM D 6045 Standard Test Method for Color of Petroleum Products by the Automatic Tristimulus Method
7. ASTM E 659 Standard Test Method for Autoignition Temperature of Liquid Chemicals
8. ASTM E 1064 Standard Test Method for Water in Organic Liquids by Coulometric Karl Fischer Titration

PART 2

SAMPLING AND HANDLING

TRAINING

In any workplace, training should be conducted before sampling and handling operations of 1-decene and 1-dodecene are undertaken. Several commercial websites provide access to the Code of Federal Regulations, NIOSH, and OSHA databases which may help in answering questions and setting up safety programs. The training program may include the following:

1. Properties and health hazards of 1-decene or 1-dodecene.

2. Safe work and good housekeeping practices.

3. The importance of protection from 1-decene or 1-dodecene contact; the proper clothing and cleaning requirements to ensure worker protection.

4. Signs and symptoms of 1-decene or 1-dodecene exposure and action to be taken.

5. The care that must be taken whenever and wherever 1-decene or 1-dodecene is used, handled, stored and transported.

6. Emergency procedures for leaks, spills and fires, including protective clothing to be worn in such instances. Check the product's MSDS for further information.

7. First aid measures to be used after exposure.

8. The availability of written 1-decene or 1-dodecene usage, health hazard and training program procedures.

It is recommended that this generalized sampling and handling training program should be part of a worker's initial instruction. Refresher training should be scheduled at least annually thereafter.

A summary of accidental release, fire, and health information is presented in PART 4 of this brochure.

RECOMMENDED PRACTICE FOR SAMPLING

This information is provided for use in establishing sampling and handling procedures. This information should only be utilized in conjunction with an existing health and safety program and cannot be used as a substitute for expert safety and medical advice.

SAMPLING:

If testing for water, peroxide or carbonyl contaminants, samples must be obtained using a gas cylinder. As a best practice, Qatar Chemical Company II Ltd uses cylinders specified by 49 CFR, Subpart C, Section 178.36 (3A or 3AX seamless steel cylinders). The charging of these cylinders must conform to Section 173.302. Purge the cylinder with product before collecting the final sample. Ensure the appropriate outage be left for the liquid. For all other testing procedures and before sampling 1-decene or 1-dodecene, the nitrogen atmosphere within the storage container or transport vessel should be depressurized safely. Samples may be taken through the sampling port (tank) or the manway opening (vessel) by means of a clean, dry 1-qt. (1-L) bottle held in a clean, dry sheath of nickel or stainless steel attached to a long rod or lightweight chain of the same material. Fit the bottle with a glass stopper to which is attached a light metal chain. Lower the bottle to near the bottom of the tank and pull out the stopper with a sharp jerk of the chain. Raise it at such a rate that it is about three-fourths full when it emerges from the liquid. Stopper the bottle before attempting to rinse the material from the outside. Label the sample bottle according to OSHA Regulations (refer to 29 CFR 1910.1200). Also as required by DOT, an emptied 1-decene or 1-dodecene cylinder or bottle must retain the same

markings and labels used during its initial transport until the container has been sufficiently purged.

NOTE: Fresh air and other personal protective gear may be required depending on exposure limits set in the individual workplace.

Emphasis should be placed on cleanliness and dryness. Both the sample bottle and its holder must be CLEAN AND DRY. Transfer the sample to another bottle for storage. A suitable bottle for storing the sample is one known as a "Boston Round." The closure should be a screw cap with a Teflon® or aluminum foil liner.

If new bottles are used, first rinse them thoroughly with acetone or methanol and then dry in a hot-air oven. Hold the bottles in a desiccator while cooling to ambient temperature. Protect them from dirt or moisture by enclosure in a polyethylene bag. Rinse used bottles very thoroughly with water, detergents and solvents. Treat the rinsed containers as new bottles.

The sampling device should be bonded to the tank manway (e.g., by resting the chain on the lip of the manway) prior to sampling.

REFERENCE DOCUMENTS:

ASTM E 300 –
Standard Practice for Sampling Industrial Chemicals

ANSI Z 288.1 –
Flammable and Combustible Liquids Code

API RP 500 –
Classification of Locations for Electrical Installation at Petroleum Facilities Classified as Class I, Division 1, and Division 2

OSHA Regulations –
29 CFR, Paragraphs 1910.1000 and 1910.2000

U.S. DOT Regulations –
49 CFR, Transportation Subchapters B and C, Parts 171-179

STATIC ELECTRICITY AND GROUNDING

Alpha olefins are characterized by high electrical resistivity (low conductivity), which can result in the buildup of excess static charge during transfer operations. Both 1-decene and 1-dodecene are classified as low vapor pressure products under the API RP 2003 Guidelines. However, a condition for ignition may exist if these products are handled at temperatures above their flash points or are contaminated with intermediate or high vapor pressure products. Likewise, in transporting these products, a condition for ignition can exist when the previous load contained a flammable vapor that was not flushed from the container. This type of loading is commonly called "switch loading".

Key operations which have the potential of generating a flammable atmosphere and/or static charge include tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing/agitation and vacuum truck operations. To minimize the hazard of static electricity during these operations, bonding and grounding may be necessary but may not by themselves be sufficient. For more information, refer to OSHA Standard 29 CFR 1910.106, "Flammable and Combustible Liquids", National Fire Protection Association (NFPA) 77, "Recommended Practice on Static Electricity" and/or the American Petroleum Institute (API) Recommended Practice 2003, "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents".

PRODUCT LOADING/UNLOADING REQUIREMENTS

Loading operations must be performed only by qualified personnel. These individuals must be properly instructed in the loading of hazardous materials and made responsible for careful compliance with 49 CFR, Parts 171 172,173, 174 and 177 through 180. Workers should refer to their site's fire and safety guidelines for required personal protective equipment. Due to the combustible nature of 1-decene and 1-dodecene, use caution to

avoid creating any sparks that could ignite the product. As the product is being loaded/unloaded, static buildup can occur. Therefore, a ground cable must be placed on the container to prevent the buildup of static electricity. Use only clean, oil- and dirt-free, spark-resistant tools and implements.

The importance of thorough pre-trip and post-trip safety inspections cannot be overemphasized. The process of physical inspection of the container is one of the best methods of minimizing human error, the principle cause of transportation incidents.

Take extreme care to prevent spills. In case material is spilled, wash contaminated areas thoroughly with large quantities of water and collect the liquid in the plant chemical waste system. Drums and trucks can be used for temporary storage until product can be recycled or disposed of properly. See PART 5 of this brochure for further information.

WHEN LOADING OR UNLOADING A VESSEL OR BARGE:

Requirements for shipments of combustible liquids over water are defined in 46 CFR. Additionally, barge shipments are regulated by the U.S. Coast Guard and the regulations are published in 46 CFR, Part 151. Refer to current International Safety Guide for Oil Tankers and Terminals (ISGOTT) and United States Coast Guard (USCG) rules (46 CFR, Part 153) for regulations governing transportation by sea-going vessels. Qatar Chemical Company II Ltd and independent inspectors ensure that 1-decene and 1-dodecene are loaded in uncontaminated tanks.

Plan and control the loading and unloading of 1-decene or 1-dodecene to limit personnel exposure and environmental releases. OSHA and the U.S. Coast Guard have published regulations applicable to personnel involved in the handling of these products. Some of the key elements are:

1. Employee Training
2. Personal Protective Equipment
3. Warning Signs

To reduce exposure of personnel to 1-decene or 1-dodecene, gauging on the barge should consist of a closed device for use during transfer of product and a restricted device to determine product quantity during transfer. At ambient temperatures, vapor return lines are not usually required.

Clean stainless steel tanks, rust-free mild steel tanks or suitably washed steel tanks are acceptable for transport of 1-decene or 1-dodecene. Select barges that ensure product quality is maintained during transport.

Qualified contractors should be used to inspect, clean and repair barges in which 1-decene and 1-dodecene are shipped. The contractor should have the capability to dispose of residual product in an acceptable manner.

WHEN LOADING OR UNLOADING TANK CARS:

General Purpose (GP) tank cars should be DOT 111A100W1 rated and are stenciled accordingly. They should be insulated, have exterior heating coils and shall be equipped with both top and bottom loading/unloading valves.

Loading

Erect track warning signs, set hand brakes, place wheel chocks, turn on track warning lights (if available) and connect ground cable. Inspect tank car exterior for any damage or deterioration and verify that all tank and valve test dates indicate compliance with the applicable regulations. Check tank cars for pressure. Loosen dome cover bolts slightly leaving two (2) bolts hand tight. Open dome carefully and inspect car interior for cleanliness and liquid heel. If a liquid heel exists, removal and cleaning may be required depending upon the previous cargo. Inspect to determine if dome cover bolts, gaskets, and seating surfaces can maintain a secure condition. Flush load filter and spout if necessary. Before removing bottom outlet cap or end plug, carefully open and close bottom outlet valve to ensure that the valve is not stuck in the open position. If valve operates properly and with valve closed carefully loosen the end plug to allow outlet chamber to drain. Any material from a previous load should be

recycled or disposed of in accordance with federal, state and local regulations. Close bottom outlet valve and leave bottom cap off. If car is equipped with interior steam coils, remove caps and leave caps off when loading to check for leakage. Open product line to tank car and start pump. Monitor tank car during entire time it is being loaded where product load can be stopped, if necessary. Frequently check bottom unloading valve for any signs of leakage during loading. If leakage occurs, stop loading immediately. Check steam coils for leakage and stop loading if evidence of coil damage. Tank cars must not be shipped if they do not fully comply with all applicable DOT regulations without receiving "movement authority" from the Federal Railroad Administration (FRA) office of safety. Do not exceed tank car stenciled load limit, ullage and/or maximum allowable gross weight.

After loading is completed, shut down pump, close block valves for product and purge line with nitrogen to clear spout. Remove spout, close and tighten dome with proper wrench and seal all top appliances/covers. Check to ensure that all plugs and fittings are tight, even those not used during loading. Secure loading ramp and spout and remove ground cable. Replace bottom cap and tighten with the proper wrench. Seal bottom unload valve. Secure heater caps if the car is internally coiled. Placard car accordingly on all four placard holders (see PART 5). Remove wheel chocks and warning signs. Turn off track warning lights and remove the tank car connected or men working sign, if all cars in that track have their valves and fittings properly secured, are no longer connected to loading lines and people are clear of the track.

Unloading

Erect the required track warning signs, set hand brakes, place wheel chocks, turn on track warning lights (if available) and connect ground cable. Relieve tank pressure gradually by slowly opening vent valve and loosening dome (manhole cover). Leave dome cover blocked open so air can enter tank while unloading without the danger of someone accidently falling into the car. Operate bottom valve rod handle to see that outlet valve in bottom of tank is seated before removing bottom cap. Loosen bottom cap and allow sufficient time to permit liquid in outlet chamber to drain. When chamber is fully drained and there is no leakage or only minor seepage from bottom cap and after inspecting the gasket, it should be safe to remove and connect the unloading line.. Open bottom valve and start unloading pump (it may be necessary to bleed vapors off pump).

After tank car is unloaded completely, close all unloading valves tightly and remove unloading line. Tighten all closures except heater coil inlet and outlet pipes, which must be left open for drainage. After inspecting the dome cover and gasket, plug or cap all openings and tighten with suitable wrench. Inspect and replace bottom outlet cap gasket and plug and securely tighten with suitable wrench. Leave appropriate placards in place or replace if necessary until tank car is cleaned. Remove wheel chocks, ground cable, and caution signs if all tank cars in track are secured and disconnected from unloading lines and persons are clear of the track. Turn off track warning lights.

WHEN LOADING OR UNLOADING TANK TRUCKS

Open dome tank trucks are normally MC/DOT 307 or 407 type and are used to transport hazardous materials.

Loading

Place wheel chocks in front and back of truck's rear wheels allowing ¾" clearance for ease of removal. Connect ground cable. Close bottom valve leaving the cap off to monitor for leakage while loading. Open dome cover and inspect interior for cleanliness. Flush loading spout and filter, if necessary. Purge trailers with nitrogen. Visually inspect trailer exterior for damage and proper inspection dates.

Open product line and start pump. Check bottom unload valve for leakage. When loading is complete, shut down pump, close product block valves and nitrogen purge line to clear spout. Remove spout, secure dome lid and seal dome cover. Check all top openings or valves for tightness. Raise loading ramp and secure spout. Replace bottom unload cap

and ensure internal/external valves are in closed position. Seal bottom cap. Remove wheel chocks and ground cable. Apply proper placards to trailer for 1-decene and 1-dodecene shipments.

Unloading

Place wheel chocks in front and back of truck's rear wheels allowing ¾" clearance. Connect ground cable. Relieve all tank pressure by opening a vent valve or slowly loosening dome cover bolts. Block open dome cover or outlet cap so air can enter the tank during unloading. Check internal and external valves making sure they are closed and remove unloading valve cap slowly to relieve any pressure. Check gasket in loading hose and connect to unloading valve. Open internal and external valves and start unloading pump.

After product transfer is complete, shut off unloading pump, close internal and external valves and remove unloading hose checking for possible product in the line. Close, tighten and cap all fittings. Remove wheel chocks and ground cable. 1-Decene and 1-dodecene trailers retain placards until trailer is cleaned.

SAFETY REFERENCES

The following publications are excellent references for product handling, safety and fire control:

NFPA 10 –
Standard for Portable Fire Extinguishers

NFPA 11 –
Standard for Low-, Medium-, and High-Expansion Foam Systems

NFPA 30 –
Flammable and Combustible Liquids Code

NFPA 70 –
National Electrical Code®

NFPA 77 –
Recommended Practice on Static Electricity

Manual Sheet TC-4,
Chemical Manufacturer's Association
Recommended Practice for Unloading Flammable Liquids from Tank Cars.

PART 3

STORAGE DESIGN RECOMMENDATIONS

STORAGE TANKS

Storage tanks for 1-decene or 1-dodecene should be of welded steel construction. Underground storage tanks are not recommended because of the difficulty of locating leaks. However, some states require underground storage tanks. Diking, drainage and tank supports should be designed to conform to local regulations. A rule of thumb commonly used for determining the size of customer storage facilities suggests that storage facilities be 1½ times the size of shipments received. The secondary containment requirements, as well as tank layout and spacing requirements, should be in accordance with NFPA 30. Rotating equipment such as pumps should be kept outside of the secondary containment area.

The storage tank inlet should be located at the bottom of the tank. Should a top inlet be desired, the fill pipe should be extended to a depth no greater than the diameter of the fill pipe from the bottom of the tank in order to minimize static charge accumulating during filling. The fill pipe should be connected electrically to both the tank flange and the transfer pipeline. The purpose of this electrical connection is to dissipate any static charge that may build up during filling.

A nitrogen blanketing system is necessary for applications where the product is going to be stored for long periods of time and peroxides and/or carbonyls would present a problem in the process. A nitrogen system that maintains positive pressure and adds nitrogen as the product is withdrawn, and as the tank breathes, prevents the introduction of air that can cause peroxide buildup in the product and keeps moisture from condensing in the tank. Free water will settle out in the bottom of the tank and will normally not be seen until the tank is stripped. Dissolved water up to the saturation level may be found in the product. If water is a critical contaminant, an olefin sample should be tested periodically and withdrawn through the sump. When peroxide and carbonyl development is a concern, use a closed handling system that maintains a nitrogen atmosphere on the product through the loading, unloading and other handling activities to minimize exposure to atmospheric oxygen.

Qatar Chemical Company II Ltd's 1-dodecene has a freezing point of -35°C (- 31°F) and therefore does not normally require heating or an insulated tank. Heating or insulation is not necessary for 1-decene, since this product freezes at -66°C (-87°F).

All of the lines and valves, as well as the tank, can be carbon steel. However, carbon steel lines will accumulate rust if allowed to remain empty for long periods of time. In this situation the first few gallons of product moved down the line may have a yellow to orange color and particulates depending on the amount of rust that has accumulated. Unlined carbon steel tanks may also accumulate rust above the liquid level. This rust, along with the condensate, will settle to the bottom of the tank and may not be seen until the tank is stripped. Rust can be avoided by having storage tanks lined with zinc, epoxy or another coating that is compatible with these products.

Exercise care in selecting the gasket and seal materials to be used. White Canadian Asbestos, Teflon® and glass impregnated Teflon®, have proven to be compatible with these products.

Coat storage tanks with reflective paint to reduce temperature fluctuations.

Specific bulk storage designs must conform to insurance underwriter's codes and local fire and building regulations. Critical design, placement, installation and maintenance requirements are usually addressed in these codes and regulations and must be followed.

Tanks should be periodically inspected for leaks and serviced in accordance with the principle of API Standard 653.

Workers should never be permitted to enter an empty tank which has been used for 1-decene or 1-dodecene until the requirements of the OSHA Confined Space Standard (29 CFR 1910.146) and the Safe Entry Recommendation of API Standard 2015 have been met, including, but not limited to, required concentrations for oxygen and limitations on concentrations of 1-decene or 1-dodecene.

API AND ANSI DESIGN REFERENCES

American Petroleum Institute
1220 L Street, NW
Washington, DC 20005

Part I - Design

API RP 520: *Sizing, Selection, and Installation of Pressure-relieving Devices in Refineries*

Part II - Installation

API Standard 601: *Metallic Gaskets for Raised-Face Pipe Flanges and Flanged Connections (Double-Jacketed Corrugated and Spiral-Wound)*

API Standard 620: *Design and Construction of Large, Welded, Low-Pressure Storage Tanks*

API Standard 650: *Welded Steel Tanks for Oil Storage*

API Standard 653: *Tank Inspection, Repair, Alteration, and Reconstruction*

API Standard 2000: *Venting Atmospheric and Low-Pressure Storage Tanks; Nonrefrigerated and Refrigerated*

API Standard 2015: *Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks*

API RP 2003: *Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents*
API RP 2028: *Flame Arresters in Piping Systems*

API RP 2210: *Flame Arresters for Vents of Tanks Storing Petroleum Products*

API RP 2350: *Overfill Protection for Storage Tanks in Petroleum Facilities*

American National Standards Institute
25 West 43rd Street, 4th Floor
New York, New York 10036

ANSI B16.21: *Nonmetallic Flat Gaskets for Pipe Flanges*

ANSI B31: *Interpretations of Code for Pressure Piping*

PARTICULATE MATTER

Qatar Chemical Company II Ltd's 1-decene and 1-dodecene should be free of particulate matter when shipped. However, some particulate matter may originate from outside contamination via the receiving-transfer system.

Particulate matter may be avoided by:

1. Paying careful attention to cleanliness.

2. Filtering product to remove particulate matter before use.

FILTERS

Since small amounts of foreign matter may enter storage tanks and transport vessels from various sources, a filter in the transfer piping between the storage tank and processing equipment is recommended. This can be accomplished by inserting a corrugated cellulose filter paper (5 μm) inside a woven polyester fiber (10 μm mesh) cartridge-type filter. Other types of product-compatible filters might also be used. Flow rates and pressures should be used to determine the proper filter for specific situations. Inspect and renew filter cartridges periodically.

HOSES

Hard piping is preferred to the use of hoses where possible and practical. If hoses are needed for loading or unloading operations, they should be inspected and pressure tested at the intervals required by the various regulations. A satisfactory type hose is SW-309 PETRO-VAC 150 Tank Truck Hose (seamless nitrile tube with multiple plies of polyester with helix wire and a one piece nitrile blend cover) or SP-483 modified X-link chemical hose (seamless X-link polyethylene tube with multiple plies of polyester which is supported by a PVC rod helix and a 1-piece blue synthetic cover). Viton® and Teflon® are also recommended. U.S. Coast Guard regulation 33 CFR, Part 154.500 applies to hoses used for bulk transfers to and from tank vessels.

PUMPS

Liquid product can be transferred by pump or vacuum. For most product handling, centrifugal pumps with mechanical seals perform satisfactorily. The pump manufacturer can make recommendations regarding the proper type of pump if the following parameters are known: 1) flow rate, 2) size and length of suction and discharge lines, 3) suction and discharge pressures, and 4) range of product temperatures during transfer. A drain valve should be installed at the lowest point in the system so that the pump and all piping can be completely drained and washed before any maintenance work is done. Totally enclosed fan cooled (TEFC) motors are recommended. However, local fire and insurance codes should be consulted to determine if an explosion-proof motor must be used. Pump seals must be capable of meeting EPA emission standards - this requires tandem or double seals. Tandem seals enhance safety when pumping flammable or combustible materials and reduce vapor emissions of product at elevated temperatures into the atmosphere. Demisting systems should be used to keep pump bearings lubed.

The following practices are recommended to minimize the possibility of pump leakage:

1. Mechanical seals in conformance with API Standard 682.

2. Pumps in conformance with API Standard 610.

3. Pumps designed so that pump bearings will be able to carry thrust at no flow. Consider selecting non-metallic (PEEK) wear rings to minimize damage if the pump runs dry.

4. The pump shaft should be highly polished.

5. Pumps should not be subjected to forces beyond specified pump tolerances.

6. Vibration monitoring with automatic pump shutdown may be applicable in certain situations.

VALVES

Full-bore ball valves are preferred for pigged pipelines. Gate valves, butterfly valves, or ball valves may be used for pipelines that are not pigged. These valves should be made of cast iron, case steel, or other recommended materials. Valves should be packed with the following graphite materials:

Garlock® EVSP Simplified (#9000/98)[(1)]
Garlock® 70# / 98 (-400 to 1200 °F; 10,000 psi)[(2)]
Garlock® 1303 (good for steam)[(2)]
Slade® 3300G (-400 to 1200 °F; 10,000 psi)[(2)]

[(1)] Most efficient packing is flexible die-formed rings with flexible braided end-rings.
[(2)] Used for field repacking.

PIPELINES

The following are recommended practices in engineering pipelines for 1-decene or 1-dodecene:

1. A minimum of flanged connections should be used to avoid potential leaks.

2. Lines should not be buried because of the difficulty of checking for leakage.

3. All lines should be sloped with drain valves at appropriate locations so that they can be completely drained for maintenance.

4. All newly installed pipelines should be pressure tested by an approved method before use.

5. Bellows valves for 2-inch and smaller lines are recommended to eliminate emissions from packing glands.

VAPOR CONTROL SYSTEMS

Evaporative emissions from 1-decene and 1-dodecene are not regulated by the Federal Clean Air Act. However, some states and localities may regulate emissions of these materials. Check local regulations in the facility's state.

PART 4

HEALTH, ENVIRONMENT, FIRE, AND ACCIDENTAL RELEASE INFORMATION

Safety Data Sheets (SDS) for NAO products are available from Qatar Chemical Company II Ltd to help customers satisfy safe handling and disposal needs and OSHA Hazard Communication Standard requirements. Such information should be requested and studied prior to working with these products. The most current SDS's can be obtained from Qatar Chemical Company II Ltd at www.qchem.com.qa or by calling (974) 44847110. Specific questions about SDS's can be sent to marketing@qchem.com.qa.

PART 5

TRANSPORTATION INFORMATION AND REGULATORY PROFILES

Safety Data Sheets (SDS) for NAO products are available from Qatar Chemical Company II Ltd to help customers satisfy safe handling and disposal needs and OSHA Hazard Communication Standard requirements. Such information should be requested and studied prior to working with these products. The most current SDS's can be obtained from Qatar Chemical Company II Ltd at www.qchem.com.qa or by calling (974) 44847110. Specific questions about SDS's can be sent to marketing@qchem.com.qa.

PART 6

APPENDIX

GLOSSARY OF TERMS, ABBREVIATIONS, AND ORGANIZATIONS

ANSI	American National Standards Institute
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
Bonding	The connection of two or more conductive objects by means of a conductor (most commonly a wire or metal plate).
CEIC	Chevron Emergency Information Center
CFR	Code of Federal Regulations
CHEMTREC	Chemical Transportation Emergency Center
Confined Space	An area that by design has limited openings for entry and exit. A confined space has unfavorable natural ventilation and is not intended for continuous worker occupancy.
DOT	Department of Transportation
EPA	Environmental Protection Agency
FDA	Food & Drug Administration
Flash Point	The minimum temperature at which a liquid gives off vapor in sufficient concentrations to form an ignitable mixture with air near the surface of a liquid.
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
Peroxides	Compounds containing the -O-O linkage. They occur as impurities in many organic compounds, where they have been slowly formed by the action of oxygen.
SDS	Material Safety Data Sheet
Vapor Pressure	The pressure exerted by a volatile liquid while under defined equilibrium conditions. A common way to measure vapor pressure is in millimeters of mercury (mm Hg).