

Environmental Protection for Onshore Oil and Gas Production Operations and Leases

API RECOMMENDED PRACTICE 51R
FIRST EDITION, JULY 2009

REAFFIRMED, DECEMBER 2015



AMERICAN PETROLEUM INSTITUTE

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Upstream Segment

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Contents

	Page
1 Scope	1
2 References	1
2.1 Normative References	1
2.2 References for Operations on Federal Lands	2
2.3 References for All Onshore Operations	2
3 Acronyms and Abbreviations	2
4 Government Agencies	3
4.1 General	3
4.2 Surface Owners and Users	3
5 Lease Roads	3
5.1 Introduction	3
5.2 Planning	3
5.3 Design and Construction	5
5.4 Primitive or Nonconstructed Roads and Routes	7
5.5 Maintenance	7
5.6 Reclamation and Abandonment	8
6 Producing, Injection/Disposal Wells	8
6.1 Completion, Stimulation, and Workover Operations	8
6.2 Well Operations	11
6.3 Well Testing	12
6.4 Plugging and Abandonment	13
7 Lease Gathering and System Lines	14
7.1 Introduction	14
7.2 Route Selection	15
7.3 Design	16
7.4 Construction and Installation	17
7.5 Operation and Maintenance	17
7.6 Abandonment of Gathering and System Lines	18
8 Production and Water Handling Facilities	18
8.1 Requirement Determination (Preplanning Considerations)	18
8.2 Site Selection Considerations	18
8.3 Facility Design	20
8.4 Construction Considerations	25
8.5 Operation and Maintenance	26
8.6 Waste and Residual Management	27
8.7 Spill Prevention, Response, and Cleanup	29
8.8 Environmental Assessment Before Purchase or Sale of Existing Fields and Leases	31
8.9 Closure and Abandonment of Facilities	31
Annex A Good Neighbor Practices	34

Environmental Protection for Onshore Oil and Gas Production Operations and Leases

1 Scope

This standard provides environmentally sound practices for domestic onshore oil and gas production operations. It is intended to be applicable to contractors as well as operators. Facilities within the scope of this document include all production facilities, including produced water handling facilities. Offshore and arctic areas are beyond the scope of this document. Operational coverage begins with the design and construction of access roads and well locations, and includes reclamation, abandonment, and restoration operations. Gas compression for transmission purposes or production operations, such as gas lift, pressure maintenance, or enhanced oil recovery (EOR) is included; however, gas processing for liquids recovery is not addressed. Annex A provides guidance for a company to consider as a “good neighbor.”

2 References

2.1 Normative References

This recommended practice (RP) includes by reference, either in total or in part, the following standards and publications. Users should investigate use of the appropriate portion of the most recent editions of the publications listed below.

API, *API Environmental Guidance Document: Onshore Solid Waste Management in Exploration and Production Operations*

API, *Guidelines for Commercial Exploration and Production Waste Management Facilities*

[API Bulletin E2](#), *Bulletin on Management of Naturally Occurring Radioactive Materials (NORM) in Oil and Gas Production*

[API Bulletin E3](#), *Environmental Guidance Document: Well Abandonment and Inactive Well Practices for U.S. Exploration and Production Operations*

API Specification 7B-11C, *Specification for Internal-Combustion Reciprocating Engines for Oil-Field Service*

API Recommended Practice 7C-11F, *Recommended Practice for Installation, Maintenance, and Operation of Internal-Combustion Engines*

[API Recommended Practice 11ER](#), *Recommended Practice for Guarding of Pumping Units*

API Bulletin 11K, *Data Sheet for the Design of Air Exchange Coolers*

API Specification 11N, *Specification for Lease Automatic Custody Transfer (LACT) Equipment*

[API Specification 12B](#), *Specification for Bolted Tanks for Storage of Production Liquids*

[API Specification 12D](#), *Specification for Field Welded Tanks for Storage of Production Liquids*

[API Specification 12F](#), *Specification for Shop Welded Tanks for Storage of Production Liquids*

[API Specification 12J](#), *Specification for Oil and Gas Separators*

[API Specification 12K](#), *Specification for Indirect Type Oilfield Heaters*

[API Specification 12L](#), *Specification for Vertical and Horizontal Emulsion Treaters*

[API Recommended Practice 12N](#), *Recommended Practice for the Operation, Maintenance and Testing of Firebox Flame Arresters*

[API Specification 12P](#), *Specification for Fiberglass Reinforced Plastic Tanks*

[API Recommended Practice 12R1](#), *Recommended Practice for Setting, Maintenance, Inspection, Operation, and Repair of Tanks in Production Service*

[API Recommended Practice 49](#), *Recommended Practice for Drilling and Well Servicing Operations Involving Hydrogen Sulfide*

[API Recommended Practice 53](#), *Recommended Practices for Blowout Prevention Equipment Systems for Drilling Wells*

[API Recommended Practice 55](#), *Recommended Practices for Oil and Gas Producing and Gas Processing Plant Operations Involving Hydrogen Sulfide*

[API Bulletin 75L](#), *Guidance Document for the Development of a Safety and Environmental Management System for Onshore Oil and Natural Gas Production Operations and Associated Activities*

[API Recommended Practice 2350](#), *Overfill Protection for Storage Tanks in Petroleum Facilities*

[API Publication 4663](#), *Remediation of Salt-Affected Soils at Oil and Gas Production Facilities*

NACE RP 0475 ¹, *Selection of Metallic Materials to be used in All Phases of Water Handling for Injection into Oil-Bearing Formations*

NACE Standard MR 0175, *Petroleum and Natural Gas Industries—Materials for Use in H₂S-containing Environments in Oil and Gas Production—Parts 1, 2 and 3*

2.2 References for Operations on Federal Lands

BLM ², *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, (The Gold Book)*, 2007

2.3 References for All Onshore Operations

IOGCC ³, *Adverse Impact Reduction Handbook*, 2007

3 Acronyms and Abbreviations

BOPE	blowout prevention equipment
E&P	exploration and production
EOR	enhanced oil recovery
ESD	emergency shutdown

¹ NACE International (formerly the National Association of Corrosion Engineers), 1440 South Creek Drive, Houston, Texas 77218-8340, www.nace.org.

² U.S. Department of the Interior, Bureau of Land Management, 1849 C Street, NW, Room 5665, Washington, DC 20240, www.blm.gov.

³ Interstate Oil and Gas Compact Commission, 900 NE 23rd Street, Oklahoma City, Oklahoma 73105, www.iogcc.state.ok.us/

IC	internal combustion
MSDS	material safety datasheet
NORM	naturally occurring radioactive materials
SOP	standard operating procedure
USDW	underground sources of drinking water

4 Government Agencies

4.1 General

Before drilling or construction, and, in some instances, before modification of onshore oil and gas production facilities, it may be necessary to obtain approvals from one or more government agencies. In addition to drilling and building permits, permits may be required because of air emissions, discharges to surface waters or sewer systems, injection activities, stormwater discharges (including during construction activities), impacts to threatened or endangered species or their critical habitat, impacts to wetlands and other environmental impacts, or impacts to other cultural resources. Operators should ensure that all necessary permits have been obtained before commencing operations. Operators should ensure that operations are conducted in accordance with local, state or federal regulatory requirements.

4.2 Surface Owners and Users

The footprint of drilling and production operations for oil and gas projects is variable and dependent upon the operator's equipment and operational needs, and the mutual objectives established by the operator, appropriate regulatory agencies, and the owner of the surface rights. Operators will need to be familiar with land use plans, regulations and ordinances that have been adopted by federal, state, and (in certain cases) local governments. Different land uses may require operators to adjust their approaches during site preparation, construction, development or production to avoid or minimize impacts to existing land uses. The development of surface use plans will allow for more efficient use of the land while balancing protection of important local resources, by minimizing surface disturbance and mitigating those impacts that are unavoidable.

Before drilling or construction on lands on which the surface estate is privately held, it is recommended that the operator communicate with land owners or surface users concerning activities planned for the site and measures to be taken for safety, protection of the environment, and for minimization of impacts to surface uses. Additional recommendations may be found in [API 75L](#), Annex B—"Good Neighbor Guidelines." Operators of federal oil and gas leases under private surface ownership are encouraged to consult the BLM publication, *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (The Gold Book)* for BLM guidance with respect to communication and recommended practices to address concerns of surface owners.

5 Lease Roads

5.1 Introduction

Lease roads are constructed and used to support various exploration and production (E&P) operations. The environmental impact of the construction of a roadway can have long lasting effects well beyond the limits of the right-of-way. Existing roads should be utilized, where feasible, to limit the extent of new road construction, when they meet regulatory standards, transportation and development needs, and safety and environmental objectives. When it is necessary to build new roadways, they should be developed in an environmentally acceptable manner consistent with landowner recommendations.

5.2 Planning

5.2.1 Road alignment and right-of-way selection is a multidisciplinary process. Goals of the planning effort should include affected resource values and safety, and avoidance of haphazard or unnecessary development of roads and

associated utility corridors. The total infrastructure that may later be developed should be considered during the selection process. Government agencies, landowners, tenants, and other users may need to be consulted during the planning process.

5.2.2 Standards should be established for the road based on its short-term and long-term function considering geography, traffic density, and load expectations.

5.2.3 Alternative alignments should be developed considering the following parameters as appropriate:

- a) topography;
- b) hydrology, drainage, and watercourses, whether intermittent or permanent;
- c) engineering properties of soils, erodible soils;
- d) location and amounts of excavation and fill materials;
- e) type and location of materials for road construction;
- f) air, water, and noise pollution;
- g) wetlands and wetland drainage;
- h) consistency with community character and local government needs and plans;
- i) proximity to dwellings or other permanent structures occupied or used by the public;
- j) visual sensitivity;
- k) power lines and pipelines;
- l) other geotechnical factors, particularly in areas of complex terrain, such as landslide areas, subgrade conditions indicating a need for surfacing, potential cut slope problems, and subsurface or surface water problem areas.

5.2.4 Road alignments and potential environmental impacts should be reviewed. Routes and alignment should be selected to minimize erosion. Environmentally significant areas should be identified and avoided to the maximum extent practical, including:

- a) sensitive wildlife and critical habitats;
- b) areas with endangered and threatened animals and plants;
- c) cultural and historical sites;
- d) federal, state, or local areas of concern;
- e) areas with the potential for flooding or snow drifting;
- f) wetlands.

5.2.5 When required, mitigation strategies should be developed in the planning process, including:

- a) road operation schedules and/or use of special designs to minimize any adverse impacts in areas with sensitive wildlife and fish habitats, wetlands, existing facilities, crops;

- b) plans to take appropriate action on cultural and historic resources before changes are made;
- c) maintenance of existing traffic patterns on highways and local access roads.

5.2.6 Interim reclamation plans and final restoration plans should be developed and incorporated into the planning process.

5.2.7 Stormwater and air (dust) permit requirements should be considered during the planning phase of the roadway.

5.3 Design and Construction

5.3.1 The design and construction of a road should be site-specific. Each road will have its own unique terrain, safety, operation, and maintenance requirements. Each area within a route will support a distinct ecology. When site conditions are appropriate, where suitable for the types of drilling or production operations anticipated, and where compatible with safety and operational concerns, primitive roads may be considered for use as a means to reduce resource impacts.

5.3.2 Design and construction documents, including plans and drawings, should be prepared during the planning and design phases before the construction of the project. Plans will enable proper and timely review of items of environmental concern. They will also be beneficial for later restoration work.

5.3.3 Construction work should be scheduled and the use of special designs and local construction practices should be considered to minimize or avoid undesirable effects on sensitive wildlife and fish habitats, wetlands, and designated federal, state, or local recreational areas. Seasonal restrictions such as freeze-thaw cycles, potential flooding, and wildlife migration should be considered.

5.3.4 The operator should confirm that the construction contractor has implemented an environmental and safety program, including the training of construction personnel. This program should include, where applicable, written procedures for a hazard communication program, hazardous material handling, spill reporting, emergency response, stormwater management, special environmental requirements within the project area, and blasting. The contractor should supply material safety datasheets (MSDSs) for all hazardous materials brought on site. Regulatory agencies often require performance bonds when roads are to be constructed in environmentally sensitive areas.

5.3.5 The operator should hold a preconstruction meeting with the contractor(s) to establish environmental and safety responsibilities along with desired objectives of the project.

5.3.6 Field inspections and lab analysis of soil samples may be used to assess soil erosion hazards and slope stability. Properties of soils, length and gradient of slopes, and vegetative cover contribute to soil stability. Fitting the profile to topography, locating roads on moderate slopes, providing adequate drainage, and stabilizing slopes decreases surface disturbance and reduces erosion and sedimentation.

5.3.7 Means and methods for erosion control are numerous and often site-specific. Revegetation with local species, rip-rap, gabions, woven jute, and energy dissipators are effective measures that may be used to reduce erosion.

5.3.8 The use of geotextiles and geosynthetics should be considered in road planning and construction. These materials offer a variety of applications, aid in stabilizing the road, and minimize the utilization of road bed and surface materials.

5.3.9 An adequate drainage system should be incorporated into the design and construction of the road. This system should efficiently intercept, collect, remove, and discharge water from roads. A drainage system that is inadequate or blocked will result in excessive erosion, failures, and higher maintenance costs.

5.3.10 The number of river, stream (including ephemeral streams), lake, and wetland crossings should be minimized, where possible. Bridges, culverts, and other drainage structures should be incorporated to ensure the free flow of water when drainage ways are intersected. Different flood stages should be considered for the design and construction of the crossings.

5.3.11 The use of snow fences should be considered in areas with snow drifting characteristics. Minimization of snow buildup will reduce the use of deicers on the roadway and will also reduce the problems associated with the disposal of the bladed snow/salt mix during maintenance operations.

5.3.12 Clearing widths should be kept to a minimum. These limits should be delineated and marked in the field. Sensitive areas or features should be marked or fenced as required.

5.3.13 Where practical, topsoil should be salvaged and stockpiled in a safe and accessible location and be protected from erosion. The stockpiled material should be utilized for revegetation and reclamation purposes.

5.3.14 Revegetation should be done with local plants, seeds, and grasses species. Means and methods will be dependent upon seasonal considerations, the specific project area, and government agency requirements.

5.3.15 Areas of excavation should be approved before the start of construction. Permits are required for opening pits on federal land and may be required on other public lands. Pit layout and restoration should be planned before opening of the pit.

5.3.16 Environmental impacts during coarse/fine borrow material extraction should be minimized. The following should be considered:

- a) use of recycled road surface material from abandoned roads and locations,
- b) use of existing mineral material sites,
- c) selecting new sites that minimize environmental impacts,
- d) developing upland sites to maximize potential for revegetation and minimize adverse visual impact and possible erosion,
- e) maintaining a buffer of undisturbed vegetation between borrow pits and highways or other sites.

5.3.17 Warning signs should be provided to comply with local requirements. The signs may include road crossings, animal crossings, speed limit, road hazards, pipelines, etc.

5.3.18 Existing pipelines and other subsurface facilities should be identified before construction. These facilities should be protected to prevent accidental damage during the construction and operation of the road.

5.3.19 Measures should be taken to ensure proper and adequate procedures for waste disposal, general housekeeping. An effective emergency response plan should be in place before initiating construction. The plan may simply be a listing of telephone numbers to call should a utility or product line be damaged. Many times, the existing emergency response plan for the field area may be adequate. Construction personnel should be familiar with these plans.

5.3.20 Construction activities should be carried out as described in the construction documents, including plans and specifications.

5.3.21 Construction supervision should be provided throughout operations. Many potential problems associated with incorrect interpretation of construction documents, spills, waste disposal, poaching, and hunting can be avoided through proper supervision.

5.4 Primitive or Nonconstructed Roads and Routes

5.4.1 Where site conditions are appropriate, and where approved by a surface owner or surface management agency, the establishment and use of "primitive," two-track roads or overland route corridors may be appropriate for an operator's needs and to facilitate later reclamation of the site. Primitive roads and route corridors may serve as appropriate access to exploration drilling locations where it is not certain if the well will be productive, or to producing wells where vehicle traffic is infrequent due to the use of off-site production facilities and automated well monitoring. Traffic and load expectations for primitive roads should be evaluated. If the expectations are exceeded during the project, the road should be evaluated for upgrades.

5.4.2 The appropriateness of primitive roads and routes is both site-specific and use-specific and is typically based on many factors, such as anticipated dry or frozen soil conditions, seasonal weather conditions, flat terrain, low anticipated traffic, service company's/driller's/operator's access needs.

5.4.3 Primitive roads or routes necessitate low vehicle speeds and are typically limited to four-wheel drive or high-clearance vehicles. They can consist of existing or new roads with minor or moderate grading; two-track roads created by the operator's direct vehicle use with little or no grading; overland routes with a defined travel corridor leaving no defined roadway beyond crushed vegetation; or any combination along the route. Operators should not flat-blade roads. Drainage must be maintained, where appropriate, to avoid erosion or the creation of a muddy, braided course of vehicular travel.

5.4.4 Primitive or two-track roads and routes must be used and established in a safe and environmentally responsible manner and are not intended for use as all-weather access roads. Resource damage must be repaired as soon as possible and the operator must consult with the surface management agency to determine if all or a portion of the road needs to be upgraded to an all-weather access road. When used and maintained appropriately, nonconstructed roads and routes have the advantage of reducing construction, maintenance and reclamation costs and reducing resource impacts.

5.4.5 Approval of a surface resource agency is generally required for use of nonconstructed roads on other than privately owned lands.

5.5 Maintenance

5.5.1 Proper road maintenance is critical for the performance of the road and to prevent and control erosion and sedimentation. Maintenance personnel should be made aware of environmentally difficult and sensitive areas.

5.5.2 Maintenance work should be scheduled and the use of special designs and maintenance programs should be considered to minimize undesirable effects on sensitive wildlife and fish habitats, wetlands, and designated federal, state, or local recreational areas.

5.5.3 When performing scraping and leveling operations, care should be exercised to avoid disrupting ditches and shoulders, and creating undesirable berms with the bladed material.

5.5.4 Ditches, culverts, and drains should be regularly cleaned of debris and sediment to allow the free passage of water. Periodic inspections of all culverts should be conducted. Culverts found to be blocked should be cleared.

5.5.5 Borrow and surface materials should be readily accessible to be utilized during maintenance operations. Pits opened during construction should be used as a source for maintenance material, where feasible.

5.5.6 The use of dust control materials or measures should be evaluated before their utilization. The materials should not be detrimental to health, vegetation, wildlife, or water quality.

5.5.7 Cutting back weed and hedge growth is essential for road safety. This maintenance operation should be done with light equipment. Critical review should occur before herbicides or other chemicals used for weed control are applied.