United States Energy Association
Caspian Environmental Regulatory Partnership Program

Presents

A FIELD INSPECTOR GUIDEBOOK

For

Oil Industry Exploration and Production Operations

Courtesy of
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Table of Contents

Introduction

The early years of oil industry development in the United States were interesting times. Much like gold, oil discoveries were big news and people of all types wanted to be involved, drawn by the lure of striking it rich. There was no education required, and most knew only that a well needed to be drilled in order to find black gold.

Because so much oil was discovered initially in areas like the Gulf Coast region, Oklahoma, and later in California, little thought was given to conservation. The oil business was poorly organization and tens of thousands of independent producers thought of only one thing; produce the maximum amount of oil as quickly as they could. Gradually, however, state lawmakers and politicians became concerned that this "unregulated" industry was wasting a lot of their resources. Eventually, oil producing states passed oil industry regulations. These first regulations forced the industry to develop better operations and waste management technologies. Gradually, concepts of reservoir management, maximum extraction, and waste system controls emerged as both oil companies and state regulators worked together to develop a safer, more cost effective business.

Concurrent with development of these regulations was the need for oil field inspections. Oil industry people were very independent and at first, most were either unaware or paid little attention to the new laws. State regulators needed a way to inform operators of the new industry regulations, so they sent trained inspectors out to the field to observe ongoing operations and advise operators of unacceptable practices. Initially, most operators didn't like the idea of politicians controlling their business practices, but eventually, they realized the advantages of conservation and began to cooperate with state regulators.

Both the oil industry and regulatory initiatives have changed considerably since those early days. Safety and environmental regulations have been added, and the pursuit of hydrocarbons, powered by constantly improving technologies, has evolved into a very sophisticated, global business. Most oil companies, driven by intense competition and a concern for their social and environmental reputation, have established strict internal operating standards that serve to effectively self regulate their oil field activities, no matter where they operate.

Monitoring of oil industry activities is still an important task. Most countries have established their own regulatory requirements, but constant changes and the lack of uniformity often makes compliance difficult. Field inspections are an essential component of this compliance process, but the goals and objectives have changed considerably from the early days.

This inspection guidebook is intended as a reference document for those training to enter the inspection field. Described within is the modern "western" approach to monitoring and inspecting oil and gas industry E&P operations to ensure regulatory compliance. Included are sections on inspection objectives, the different types of inspections, inspection guidelines for drilling, production, and pipeline operations, sampling techniques, tracking production and wastes, accident investigations, recording inspection data including example forms, and enforcement of regulatory guidelines.

Most of the information in this guidebook is applicable for both onshore and offshore operations. Certain situations specific only to offshore operations are not included, but will be mentioned during the course of the field training. The field inspection guidelines include only those inspection topics of primary importance. The majority of the information is presented in outline format.

Inspection Objectives

There are major differences between the western approach to monitoring oil industry operations and the monitoring style favored by regulatory agencies in most countries of the former Soviet Union. These differences often contribute to unnecessary scrutiny and a challenging business climate for the oil companies.

Western monitoring activities assume that both companies and regulatory agencies share responsibility for the integrity of operations. The goal of the regulatory agency is to ensure that oil company operations are in compliance with legal standards or permit requirements. Inspectors are training to observe a wide range of operational situations in a non-disruptive manner. Their primary objective is to help the company comply with regulations rather than penalize them for oversights. An important overriding concept is that there are acceptable levels of impact associated with industry operations.

The philosophy and objectives of industry monitoring in many countries of the former Soviet Union appear to be quite different. A fundamental assumption is that regulatory agencies are entirely responsible for the integrity of industry operations. Inspectors focus on process rather than results and attempt to control most if not all operations decisions. The inspection process is further complicated by frequently changing compliance objectives, questionable or conflicting safety and environmental standards, inspectors unfamiliar with western technologies, and general distrust of the companies. The result is frequent inspections, conflicting opinions about operational procedures, and constant measurement of emissions and discharges for the purpose of calculating fines and penalties, often based on how much they exceed background levels.

In this section, we present the important fundamentals that characterize the Western style approach to monitoring and inspections. Included are inspection objectives and responsibilities and some of the key elements that characterize a well trained, productive inspector. We support this style because it results in a constructive relationship with the oil industry and in the long term, is more productive.

Why Monitor the Industry and Conduct Inspections?

- Ensure regulatory compliance

- Ensure permit conditions or environmental management plan specifications are observed
- Monitor ambient environmental conditions to make sure expected levels of impacts are not exceeded.
- Alert operator about unexpected impacts and suggest operational modifications to prevent further problems
- Advise operator about new or modified regulations that may affect planned or ongoing operations

Inspector Responsibilities

- perform a variety of field inspections
- receive, record, and respond to complaints
- witness critical regulated activities
- background monitoring
- ensure proper record keeping by the companies
- oversee cleanup or remedial actions
- if necessary, assemble evidence for enforcement actions

Positive Inspector Characteristics

- Pays attention to *results,* (safety and environmental conditions within acceptable limits) not on how the operator achieves the results
- Knowledgeable about oil and gas field operations
- Consistency…holds everyone to the same standards
- Capable of inspecting a variety of safety and environmental issues
- Realizes that the companies are responsible and motivated to operate safely and in an environmentally conscious manner
- Interacts well with people
- Understands the reason for observed discrepancies before deciding on course of action
- Careful not to disrupt ongoing operations

Inspection Types and Scheduling

There are many factors that determine the types and frequency of inspections. Pre-scheduling of most inspections is seldom possible. Every planned operation involves specific risks and sensitivities, all of which influence how much attention will be required. One obvious risk is the company and its reputation. Additional factors include environmental sensitivity, and the potential toxicity of wastes and emissions.

Some types of operations or situations require periodic inspections such as once a year, or once every six months. Usually, however, inspections are more closely related to specific activities. For certain activities, inspections are somewhat predictable. For example, if the location of an exploratory drilling project is proposed near or within a sensitive habitat or very close to a local community, it is usually a good idea to inspect the site to ensure permit requirements are consistent with the risk. The vast majority of inspections, however, are not predictable. Many inspections occur as a result of the operator notifying the regulatory agency of a specific problem.

In this section, we summarize the basic situations or factors that influence the type and frequency of inspections for drilling, production, pipeline operations.

Drilling

Most western drilling operations employ time tested technologies and are conducted by highly trained crews. Drilling contractors must operate to at least the internal safety and environmental standards set by the oil company, which is often more stringent than local country standards. Most wells require about 6 months to complete although deeper wells may take up to a year to drill.

Normally, such an operation should undergo a *comprehensive, planned inspection once* during its duration. It is also recommended that the site closure and remediation activities be observed, preferably near completion. Additional factors may add to this normal inspection schedule. These include:

- Close proximity to environmentally sensitive areas including communities
- Potential for toxic releases such as H_2S
- Reported problems by the operator. Each problem usually requires an inspection
- Complaints to the inspection agency

Production

Normal activities leading up to establishing field production generally don't require any specially scheduled inspections. The same qualifying factors listed for drilling, however, also apply for these activities. Once production is ready to commence, there are two specific issues that usually are checked.

- Product flow and metering….the most important issue to inspect are detailed in the section on *Tracking Production and Wastes*
- Disposal of production wastes…the most important by far being produced water.

There is no best schedule for how often product flow and waste disposal activities should be checked. In the US, once production meters specifications have been confirmed and the meters installed, product flow is reported by the company *monthly*, but on average, inspected only *annually*. Factors that may influence this frequency include:

- Payment contract
- Sudden changes in reported production amounts
- Inconsistencies discovered during the course of normal inspections

- Frequently reported problems with metering equipment

Disposal of production wastes is generally inspected *annually* as well. However, factors such as toxicity of wastes, proximity to public drinking water supplies, or contamination reported or discovered during the course of normal inspections, can lead to greater inspection frequency.

Pipelines

Pipeline operations involve construction, testing, and operating phases. Prior to construction, environmental sensitivities, largely determine whether an inspection is prudent. These would be conducted prior to issuing the required permits.

During construction, most projects undergo at least one inspection. The risk to water supplies or critical habitat (endangered species) are the two most important factors for increasing inspection frequency.

When construction is finished, the pipeline must undergo hydrostatic testing. An inspection agency will usually want to observe this test(s) including disposal of the testing fluid.

Once product is flowing through the pipeline, pump stations require the most attention. Common issues include leaks, disposal of lubrication fluids, condensate dropout,(only with gas lines) and failures with associated spillage or emissions. Inspection frequency usually depends on:

- Equipment integrity
- Amount of pipeline compression
- Proximity to sensitive habitat, drinking water supplies, or communities
- Number of pump stations
- Frequency of reported accidents

Another potential issue in some regions like Georgia is human interference, usually by tapping the pipeline. Associated spillage, when detected, is often cause for inspection prior to cleanup and remediation.

Field Inspection Guidelines

The following is a summary, in outline format, of the most important inspection issues for drilling, production, and pipeline operations. This is not intended as a comprehensive guide or checklist for every possible situation that may require an inspector's attention. Rather, it is intended as a basic reference for those inspectors beginning their training as agents of an oil and gas regulatory agency. As more experience is gained, these guidelines can be expanded or modified to more closely parallel local regulations and the types of industry operations active in the region.

Drilling Operations

1. Pre-Drilling Activities

- Review Drilling Plans
  a. site plan
  b. drilling equipment/techniques
  c. casing/cementing plan
  d. mud/cuttings program including additives
- Review Environmental Management Plans
- Review Safety Management Systems
- Review Contingency Plans
- Arranging Inspections

2. Mobilization and Site Construction

- Drill Site Visit
  a. proximity to sensitive areas
  b. planned access
  c. site layout

3. Drilling the Well

- Monitoring the Operation
  a. bop installation and testing
  b. cementing operations/pressure tests
  c. equipment maintenance
  d. proper safety precautions as outlined in management system
  e. personnel safety
  f. emergency plan readiness
  g. handling of explosives (such as those used for well testing, string shots for stuck pipe, detonating caps, primer cord, etc)
  h. hydrocarbon testing
  i. handling of radioactive materials associated with certain types of well logs
  j. completion or plugging of well

- Environmental Factors
  a. drill site (general)
  + erosion control/site stabilization
  + ground and surface water protection
  + drill water source setup
  + fuel storage and containment
  + noise abatement
  b. management of drilling wastes
  + fluid collection system around rig
  + drilling fluids system

+ cuttings

Note: Air emissions from exploratory drilling are considered temporary and are usually not monitored. Emissions from drilling of production wells may or may not be monitored depending on the size of the operation and its proximity to human settlements.

c. management of additional operations related wastes
  + sanitary wastes
  + grey water
  + garbage
  + spent lubes and oils
  + equipment leakage (drip pans)
  + recyclable wastes (bottles, plastics, scrap metals)
  + hazardous wastes (batteries, solvents, etc)

4. Post Drilling

- Abandonment/Restoration/Reserve Pit Closures
  a. analysis of cuttings/sludge
  b. cuttings disposal
  c. plastic liners
  d. disposal sites
  e. re-contouring/restoration/re-vegetation

Production Operations

1. Operations Inspections

- Mechanical Integrity Review
  a. production well heads
  b. injection wells
  c. connecting lines
  d. pumping stations
  e. storage tanks
  f. spill containment
- Metering Systems/Calibration
- Environmental and Safety Issues
  a. handling of produced water
  b. emissions
  c. flaring
  d. safety related equipment (sufficiency/operability, training in use of same)
  e. noise
  f. leakage/remediation
  g. spill response readiness (equipment, training, drills)
- Well Abandonment/Remediation Plans

a. ground/surface water protection
b. wellbore fluid isolation
c. plug verification
d. pit closure
e. re-contouring/restoration/re-vegetation

Pipeline Operations

1. Pre Construction

- Plan of Development
  a. project duration
  b. pipeline route
  c. construction methodology
- Environmental Surveys
  a. wildlife
  b. threatened and endangered species
  c. communities water supplies
  d. archaeological
  e. recent cultural resources
  f. erosion control plans
- Access Corridors(including navigation restrictions in rivers or offshore)
- Engineering and Design Class Locations
- Required Permits

2. Construction

- Notices to Affected Communities
- Mobilization Plans
  a. route access
  b. timing
  c. storage of fuels/explosives
- Safety/training
- Excavation
- Blasting Plans
- Fire Prevention Plans
- Welding
- Back-filling/Covering of Pipeline
- Erosion Control Implementation
- Hydrostatic Testing (leaks, fluid disposal)
- Reclamation
  a. re-contouring/erosion control
  b. stabilization/re-vegetation
  c. weed control

- Pipeline Startup

3. Post Construction

- Emergency Response Plans
- Emissions
- Operating Records
  a. throughput
  b. pressures
  c. gas quality
- Corrosion Surveys
- Ongoing Reclamation

Environmental Sampling

Environmental sampling is conducted primarily to check for contaminants in water or soil. Routine inspections of exploratory operations seldom include sampling unless there has been an accident with an associated spill or release. Most sampling is associated with monitoring of production operations, and is conducted to ensure that disposal of produced water or other permitted waste releases are not posing a contaminant threat.

There are many uses for data obtained from the analysis of field samples. Examples include:

- Establish water and soil background levels prior to initiation of an operation. Usually in association with EIS/EIA's or permits.
- Investigating abandoned oil/gas sites as potential contamination sources
- Checking contaminant concentrations in a variety of permitted waste streams
- Investigating the extent and severity of an accidental release
- Remediation projects

Equipment

Field inspectors must be careful to follow the proper sample techniques to ensure that consistent, quality data is obtained. This includes having the right equipment to contain the samples, adequate sample storage prior to lab delivery, observing the proper chain of custody, and selecting a competent lab for analyzing the samples.

Basic equipment supplies should include:

- 500 ml glass bottles with white lid (phenols)
- 500 ml wide mouth glass bottles with foil lined, black lid (oil and grease, TPH)
- 40 ml teflon septa vial or 60 ml clear wide mouth bottle with septa cap (VOA's)
- 125 ml bacteriological containers

- Preservatives (nitric acid, hydrochloric acid, sulfuric acid, and sodium hydroxide)
- Submission sheets (single and multiple sample, and standard bacteriological sheets)
- Plastic bags (ziploc preferred)
- Legal seals

Sampling Procedures

A large variety of tests or analyses may be performed on water, soil, or waste stream samples. Sample collection procedures vary depending on the testing objective. Water samples are most commonly tested for chlorides or oil and grease, while soil is usually analyzed for petroleum hydrocarbons or toxic elements.

Only general sample collection procedures are provided in this field guide. More detailed procedures are available in a variety of publications including the "Quality Assurance Project Plan and Standard Operating Procedures for Environmental Sampling" document available from the Bureau of Oil and Gas Management of the Department of Environmental Protection, State of Pennsylvania.

General collection techniques and sample procedures are as follows:

- All samples should be stored in a cool environment (preferably 4 degrees Celsius or less) until received by the laboratory.
- Deliver samples to lab in advance of recommended holding times, preferably within one day of sampling.
- Deliver (rather than ship) samples to the lab accompanied by the sample submission sheets sealed in plastic bags.
- Maintain proper chain of custody depending on the purpose of sampling.
- For VOA samples, use vial or bottle with septa cap, use appropriate preservative, and make sure all air bubbles are eliminated from the container
- Samples collected for *dissolved metals* analysis should be filtered prior to filling the sample container.
- Samples of *surface waters* should be collected directly from the water body. Collectors should stand downstream of the collection spot, and bottles should be submerged to get a representative sample.
- For *soil samples*, try to obtain from an undisturbed area at least 6 inches below the surface, use appropriate container depending on the test to be run, and fill the container completely.
- For samples collected from *groundwater monitoring wells*, purge well water prior to collection, use a clean "bailer" or one dedicated to the well, and try to avoid agitating the water in the well during sample collection.
- When collecting samples from a *treatment facility*, try to get the samples from a discharge pipe or sampling chamber by placing the container directly into the discharge flow.

Tracking Production and Wastes

There are three important procedures to follow when an inspector evaluates the handling and flow of production and associated wastes. They include careful review of the proposed system design, field inspection(s) to ensure the operator is constructing the system as designed, and occasional inspections to ensure that the system is adequately maintained.

<u>Review Designed System</u>

- Safety systems (fire fighting, pressure control, leak detection)
- Meter engineering (can meters handle the flow)
- Product metering
  a. coming on
  b. leaving the field

<u>Pre-Startup Field Inspection</u>

- Sensors properly installed
- Inspect meters (design/capacity)
- Trace the product flow. Is it as designed?
- Check meter installations
  a. fluid buildup prevention
  b. leakage (meter integrity)
  c. no restricted flow through meter
  d. proper oriface plate
  e. calibration

<u>Post Production</u>

- Check calibration schedules (AGI-3 standards)
- Check oriface plate
- Compare total field production to total leaving the site. Correct difference should be total field minus product used at site.[ie flaring or used to operate equipment]
- Review any systems modifications
- Review waste disposal
  a. review disposal reports
  b. compliance with waste permit
  c. injection wells if used (integrity of surface facilities, proper pressure, no leaks in downhole system)

Accident Investigations

Despite good engineering, the right equipment, appropriate safety procedures, competent training programs, and adequate environmental precautions, unexpected failures and accidents do occur. Western oil companies are accustomed to reporting spills or equipment failures/accidents, notifying affected parties, and immediately initiating actions to contain, control, and correct the situation. The regulator's responsibility is to first make sure the company has initiated an appropriate response, then investigate the incident, and finally, approve and monitor remediation of spills or releases.

Why would a company report its own mistake? Why not keep silent and hope that regulators never discover the accident? One fundamental reason comes to mind. Most western enforcement policies are designed to punish deceitful or negligent company practices, not unexpected accidents. Failure to report an accident or incident would be interpreted as a deliberate attempt to circumvent regulations and, if discovered, would result in an automatic penalty of severe proportions.

Accident Documentation

Oil companies usually report an accident by telephone, especially if the incident triggers implementation of an emergency response plan. Notifying the regulatory agency also initiates the inspector's first responsibility, which is to document the accident and make sure the company has corrected the problem or is responding properly. This includes collecting the following information:

- What happened
- When and where did the incident occur
- Cause (if known)
- Is incident ongoing
- Are personnel injured or killed
- Is there a possible threat to nearby communities
- Who has the company notified
- What are the local weather/environmental conditions
- Area affected
- What actions has the company taken, and what further actions, such as remediation, may be necessary

The incident information is most often recorded on an *accident report form* and distributed to the appropriate agencies.

Accident Investigation

The second phase of an inspector's responsibility is to investigate the incident. The purpose of these investigations and their normal progression is as follows:

- Review incident details carefully. Verify information that the company has provided including a field visit if necessary. Did the company provide complete information?
- Determine the specific conditions that contributed to the incident. Notify other operating companies so that similar conditions may be corrected.
- Evaluate whether company actions or policies contributed to the incident.
- Generate a written incident report including what happened, the probable cause, and whether company policies or personnel contributed to the situation. Recommendations may include assessment of penalties or specific process/equipment changes to prevent similar accidents from occurring. These changes should be discussed with company officials, because companies often revise their operating process and/or emergency response plans to prevent an incident recurrence.

Such an incident report is generated for internal review by management. If the recommendations include harsh fines or penalties, the regulatory agency's leadership will usually arrange a meeting with company officials to discuss the matter before making a final decision.

Spill Remediation

If the incident also involves a spill or release, the company is expected to respond to the spill, and remediate the affected site. For onshore operations, this is true for almost all spills, regardless of size. For offshore operations, spill response is not automatic. Determining factors include the size of the spill, proximity of sensitive habitat and potential for damage, oil dissipation, and weather conditions at the time of the spill. For all incidents involving significant spillage, regulatory agencies usually require companies to submit a remediation plan for approval.

Inspectors must evaluate whether the company's remediation plan, including target cleanup levels, is sufficient. Field tests may be necessary to confirm certain information. Factors to consider include:

- The type and amount of product spilled
- Surrounding environmental sensitivities
- What resources have been affected
- The extent of affected area.

Companies should be required to provide periodic reports including test data to substantiate the effectiveness of ongoing remediation, and to verify when the project is complete.

Recording Inspection Data

In general, written records are kept for all types of inspections. Field inspectors utilize a variety of paper forms to document inspection activities and record specific types of information. Although the format of these forms varies considerably from agency to agency, the information recorded is remarkably similar. Example forms from several state agencies are included with this guide.

Usually, the greater the frequency or seriousness of the violation, the more details are required to document the situation. *Standard inspection forms* are sufficient to document routine inspections. Inspectors usually complete a "*notice of violation" form* to document minor infractions or violations that don't require immediate resolution, but do require some sort of corrective action. More serious problems, especially those that pose an immediate threat to surrounding life forms, often require a *special incident/violation report*. Although there is no standard format, these reports usually contain information about the:

- Operator and facility involved
- Type of accident or violation (fire, major release or spill, injury, etc)
- Description of the violation (when, where, how and why)
- Immediate actions by operator and inspection agent
- Recommended corrective actions

Violations and Enforcement

There have been significant advancements in safety and engineering technology in the past several decades, especially among major, western oil companies. These companies possess the capacity and resources to comply with reasonable regulatory requirements, and have developed comprehensive, internal management plans to ensure operational excellence. With intense competition, stockholder responsibility, and worldwide reputations at stake, there is ample motivation to operate within government regulatory guidelines.

Most non-compliant situations are the result of miss-interpretation of local regulations or the use of equipment or operational processes that are unfamiliar to government field inspectors. From a progressive enforcement perspective, it is important for regulators to distinguish between unintentional violations, and situations where companies willfully ignore the guidelines.

Enforcement Action Options

Utilization of *progressive enforcement* as a means of ensuring regulatory compliance is becoming increasingly popular among regulatory agencies. Regulatory agencies employ enforcement options of increasing severity, depending on the seriousness of the violation and how responsive the company is to correcting the situation. These options include:

- notices and citations
- administrative orders
- penalty assessment
- suspension or revocation
- cessation of operations
- forfeiture
- imprisonment

Decision to Penalize

Regulatory compliance in the United States is not a problem, especially with the larger oil companies, so the majority of violations are either unintentional or associated with an accident. Most regulatory agencies reserve penalty actions for those situations where a company has willfully or deliberately tried to circumvent normal operating requirements.

If an inspector discovers regulatory violations during a site visit, or if the company reports an incident, the regulatory agency must decide whether to impose fines or penalties. A number of factors should be considered in reaching an appropriate decision. These include:

- Does the company have a poor record of compliance? Have previous inspections revealed numerous violations?
- Has the company been advised, repeatedly, about certain violations but fails to make the necessary adjustments?
- Is there evidence that the company has deliberately tried to circumvent regulatory requirements? This may include:
  a. use of substandard equipment
  b. poorly maintained equipment at the site
  c. improper or unsafe setup of operations….for example, drilling without a blowout preventer
  d. contamination of surrounding surface water via untreated waste discharges
  e. indications of spillage or previous accidents that have not been reported
  f. high amount of incidents for a particular operation
- Has substantial damage occurred because of an accident? Examples include contamination of drinking water, large fish kill incident, or rendering a portion of land useless.

Penalty Calculation

If the regulating agency determines that a company or operator should be penalized for a violation and/or behavior, regulators should consider the following factors in order to decide how large the penalty should be:

- How much money has the company saved as a result of the observed non-compliance?
- Has the company knowingly ignored the regulation(s)?
- Is this the company's first offense, or are they chronic offenders?
- How much damage has been done to the surrounding resources?
- How quickly has the company acted to correct the problem following notification?
- How much has the incident cost the company? In the case of an accident with spill, this would include the response and remediation costs plus lost production and equipment repairs. However, company costs should not be considered if it is shown that the company was deliberately trying to circumvent normal procedures.

Appeals Process

Regulatory enforcement should be fair and consistent with all companies. Occasionally, companies and regulators disagree about violations or whether a proposed penalty is consistent with the seriousness of the situation. In these cases, there should be an appeals process that allows for both an administrative and/or judicial review of individual cases.