FIND AND FIX:
JOB CREATION IN THE EMERGING METHANE LEAK DETECTION AND REPAIR INDUSTRY

Datu Research
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data for the big picture

ABOUT THIS REPORT

This research was prepared on behalf of Environmental Defense Fund
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ABOUT DATU RESEARCH

Datu Research is an international consulting firm established in 2012. We help decision makers create sustainable food systems, develop local economies, and increase climate resilience. Our core competencies are value chain analysis, economic analysis, and impact evaluation.
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The authors are grateful to the interviewees who generously contributed their time and expertise to this project.

COMPANIES AND POLICY VIEWS

Inclusion of company names in this report does not imply a position on federal or state policies regarding methane emissions.

None of the opinions or comments expressed in this study are endorsed by the companies mentioned or individuals interviewed. Errors of fact or interpretation remain exclusively with the authors. We welcome comments and suggestions.

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Contents

LIST OF FIGURES

LIST OF TABLES

Executive Summary

The following report introduces policy makers, companies, researchers, and the general public to the growing methane leak detection and repair (LDAR) services industry and analyzes its economic impact to date and future growth potential.

INDUSTRY PROFILE

LDAR service providers offer solutions to oil and gas companies across the United States by utilizing various technologies that identify and repair leaking equipment at industrial facilities. Research shows that this growing industry:

Creates U.S. Jobs: Companies in the industry offer well-paid employment opportunities across the country that require boots on the ground and cannot be offshored.

Saves Operators Money: Leak detection and repair minimizes waste by keeping otherwise lost product in the pipe.

Improves Environment and Climate: Finding and fixing natural gas leaks across the country reduces emissions of a highly potent greenhouse gas, while contributing to cleaner air in surrounding areas.

STATE OF THE INDUSTRY: KEY RESEARCH FINDINGS

Research was based on primary data collected from 60 LDAR firms in the U.S. Key findings include:

National Footprint: At least 60 companies provide methane leak detection and repair services to oil and gas companies in 45 states. Hiring these service firms makes it easier for oil and gas operators to address methane emissions by eliminating the need to purchase equipment and train their own staff.

Majority Small Business: 55% of American LDAR firms are small businesses. Over one-third were founded within the last 6 years, reflecting an emerging industry.

Growth Following Methane Rules: Rules requiring methane controls create jobs cutting methane emissions. Companies have already experienced 5–30% business growth in states with methane regulations.

Continued Growth Expected, But Rate Uncertain: The industry anticipates future growth and projects headcount increases to meet demand across the country. However, the rate of growth will vary based on the regulatory direction chosen at the national level and in key states.

Diverse Industry: More than one-fifth of firms have 40%+ workforce diversity.

Well Paying Jobs with Upward Mobility: The industry supports six job types with annual salaries ranging from $27,040 to $113,110. A common entry-level job, LDAR technician, offers opportunity for upward mobility.

Introduction

OBJECTIVE

The objective of this research is to further understand the growing industry of service firms that provide methane leak detection and repair (LDAR) services to the oil and gas industry. This involves profiles of the individual companies (firm size, age and technologies used) and the LDAR service economy workforce (roles, wages, diversity and upward mobility). Through this research, we seek to answer key questions such as: What kinds of jobs are created by LDAR? Where is the work performed? What kind of growth do these service firms anticipate as a result of existing and potential state and federal regulations?

This report is a follow-up to a 2014 Datu study, *The Emerging Methane Mitigation Industry*, which documented existing methane control technologies, analyzed the size and geographic distribution of the industry, and assessed future growth potential. In 2014, we found that the methane mitigation industry included at least 75 firms, with over 500 locations across the country, including more than 100 manufacturing and assembly locations. In this follow-up study, we focus on the specific service firms that perform LDAR.

METHODOLOGY

Using primary data collected from a sample of 60 LDAR service firms between May and August 2016, we analyzed this industry's contribution to job creation and its ability to provide LDAR services nationwide as demand grows. We identified firms through snowball sampling, referral sampling and online research. For the 60 firms that agreed to be included in this report, we conducted phone surveys. For two representative firms—CB&I and Dexter ATC Field Services—we created case studies by conducting interviews with managers, followed by several additional phone interviews to collect further information.

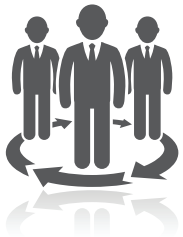
Why Methane?

Reducing methane is a win-win-win for the oil and gas industry, the American economy, and the environment.

WASTE

Methane emissions are wasted natural gas, which reduces industry sales. The primary component of natural gas, methane is released into the atmosphere from equipment leaks and malfunctions in oil and gas operations and infrastructure. Methane emissions represent lost product for the oil and gas industry. When captured, this resource can be sold, leading to an increase in the amount of gas available to power American homes, factories, and more. Reducing methane emissions capitalizes on previously lost revenue for the industry.

ECONOMY



Methane mitigation means jobs. Managing methane requires boots on the ground and in the air. Surveying for leaks largely requires workers to drive to, or fly over, well sites with leak detection technologies. As state and federal governments increasingly regulate oil and gas methane (See Regulatory Landscape, page 9), more Americans will be put to work finding and fixing methane leaks across the country.

ENVIRONMENT

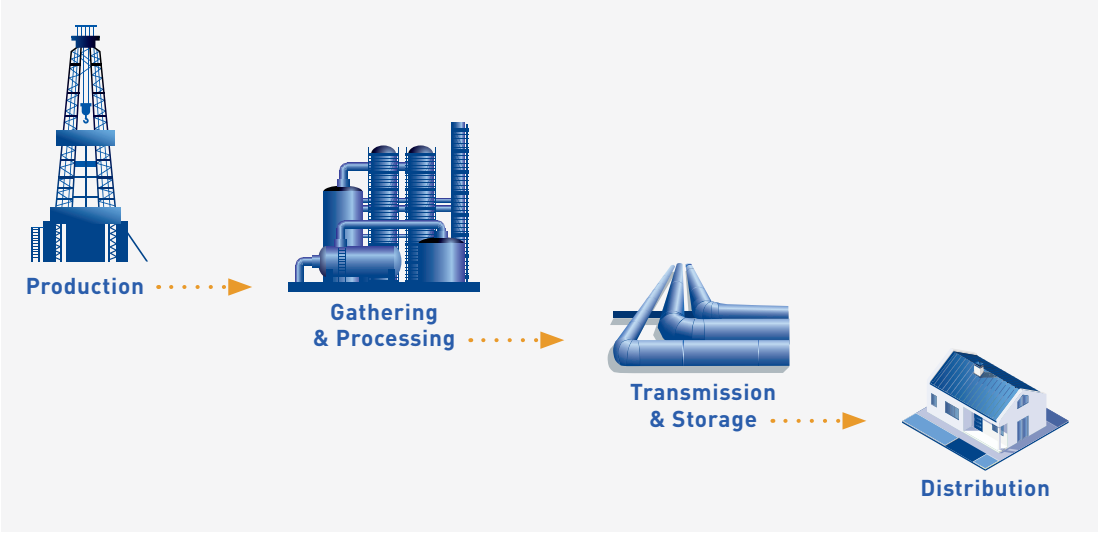
Methane and associated emissions contribute to climate change and air quality problems. Methane has an extraordinarily high heat trapping potential, making it a potent factor in global warming. In 2014, methane represented 11% of all greenhouse gas emissions in the United States, second only to carbon dioxide. However, in comparison to carbon dioxide, methane has a warming potential that is significantly higher: for the first 20 years after it is released into the atmosphere, methane has 84 times the heat-trapping effect of carbon dioxide and 28 times after 100 years (Myhre et al., 2013, p. 714; Stocker, Dahe, & Plattner, 2013, pp. 8–88). The largest industrial source of methane emissions is the oil and gas industry, accounting for 33% of all U.S. methane emissions (EPA, 2016). In addition to global warming, co-pollutants released by oil and gas operations contribute to smog formation and ozone, threatening public health on a global scale.

Leak Detection and Repair in the Oil and Gas Industry

METHANE EMISSIONS IN THE SUPPLY CHAIN

Methane is emitted throughout the oil and gas supply chain (see Figure 1). Within each stage, numerous pieces of equipment and components are at risk for methane leaks. To proactively identify and minimize leaks and their resulting atmospheric impact, oil and gas companies can implement leak detection and repair (LDAR) programs.

FIGURE 1. Four Stages of the Natural Gas Supply Chain

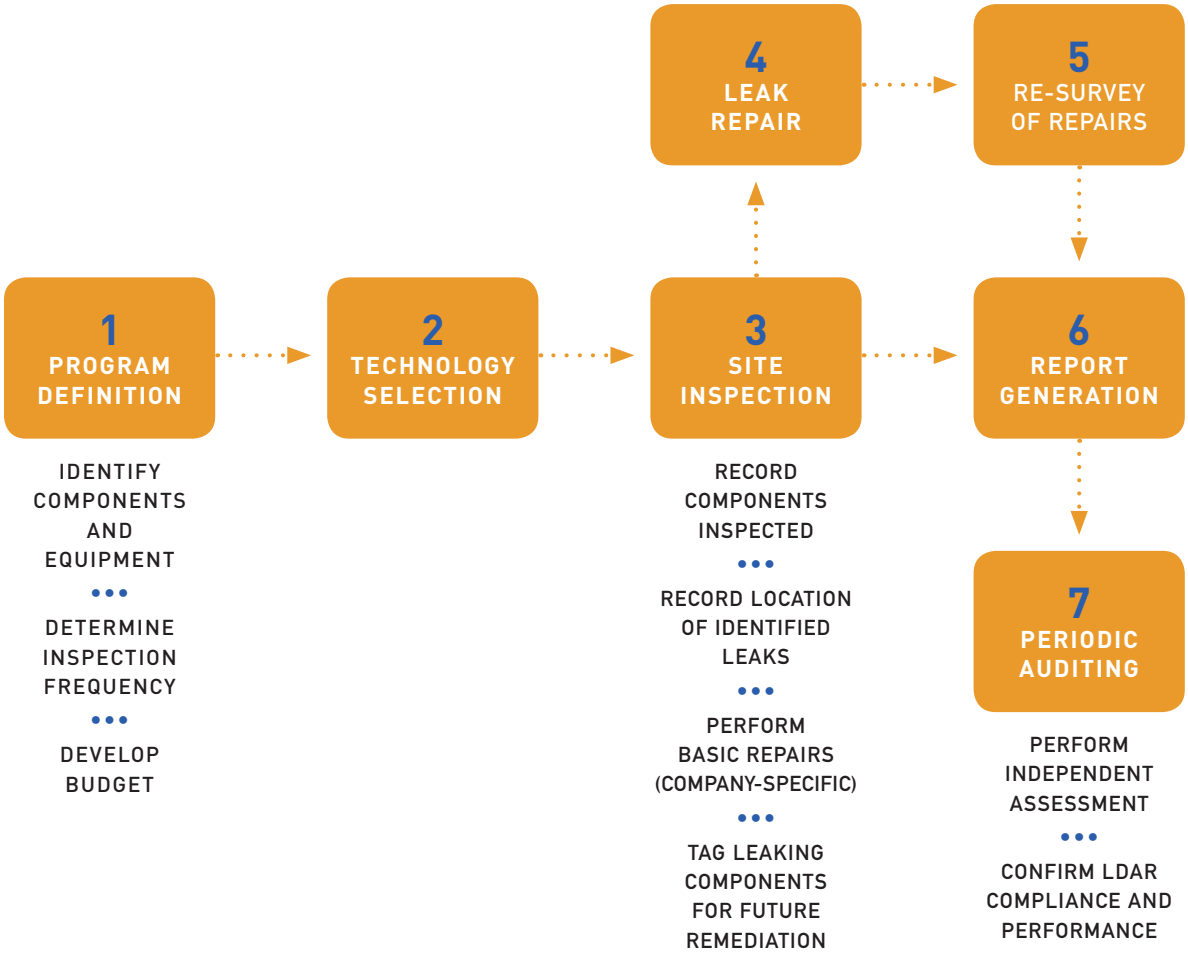


SOURCE: EPA, 2014

LEAK DETECTION & REPAIR PROCESS

The LDAR process involves seven main stages (see Figure 2). In the first two stages, the LDAR program's objectives are laid out, including target components and equipment, optimal inspection technology and associated budget. After the program has been defined, technicians are deployed to the field to conduct site inspections, during which technicians identify and record leaks. In the event of a leak, it is common practice to perform basic repairs, while tagging components for future attention. In some cases, work crews are needed to conduct equipment maintenance and more extensive repairs. To conclude the process, technicians will conduct a resurvey of any components that have undergone repair. Additional follow-up steps include report generation, to summarize the inspection, and periodic auditing to assess whether implementation meets the expectations and objectives initially set during program definition and scoping.

FIGURE 2. Main Stages and Associated Steps for an LDAR Program



NOTE: Adapted from "Leak Detection and Repair: A Best Practices Guide" by U.S. Environmental Protection Agency, 2007.

LEAK DETECTION & REPAIR TECHNOLOGY

Six primary, commercialized technologies are used for detecting leaks, the most common of which are portable analyzers and optical gas imaging (OGI) cameras (see Table 1, next page). The choice between technologies often demands prioritization between equipment cost and survey time, as well as pure leak identification and leak quantification. For example, in the case of a relatively inexpensive device such as a portable analyzer (hand-held devices that are placed in front of a component to measure gas concentration levels), the technology requires direct inspection of each well site component, resulting in longer inspection times. In contrast, an OGI (infrared) camera has a higher upfront purchase cost, but visualizes any methane emissions appearing within the line of sight, thus making for shorter inspection times and allowing for a common industry practice, bundling. Bundling allows service firms to visit several well sites in one day, thus spreading equipment and travel costs over multiple sites. Most LDAR providers that deploy this technology (60%) use this practice to detect leaks at 2 - 15 sites per day.

TABLE 1. Leak Detection Technologies and Methods Used in the Natural Gas Industry

TECHNOLOGY		DESCRIPTION	CHARACTERISTICS		
			Identifies Leak Presence	Pinpoints Leak Location	Quantifies Leak Concentration
Optical Gas Imaging (OGI)	 Source: FLIR	Infrared camera providing real-time visualization of gas emissions and leaks.	•	•	
Portable Analyzers	 Source: PINE	Hand-held device measuring gas concentration through photoionization detection (PID), flame ionization detection (FID), infrared absorption, or combustion.	•	•	•
Laser Spectroscopy	 Source: Heath Consultants	Laser shooting a specific wavelength that identifies methane presence.	•	•	•
Ambient Mobile Monitoring	 Source: Apogee Scientific	Mobile or stationary platform equipped with methane measurement instrumentation and GPS measuring ambient gas concentration.	•		•
Acoustic Leak Detection	 Source: Physical Acoustics	Method to identify leaks by detecting the sound of leaking gas.	•		
Audio-Visual-Olfactory (AVO)	 Source: Team Industrial Services	Combines three inspection methods: audio inspection (to hear leaking gas), visual inspection (to see visible ruptures in equipment) and olfactory inspection (to smell odor added to methane for safety).	•		

Additional technologies such as laser spectroscopy and ambient mobile monitoring offer shorter survey times while, in many cases, enabling a technician to quantify methane concentrations. However, these technologies are newer to the market and therefore have not been used as extensively as portable analyzers and OGI to detect leaks in oil and gas facilities.

Two additional methods, acoustic leak detection and audio-visual-olfactory (AVO) inspection, can be performed by oil and gas company employees during routine site visits—usually as a complement to the high-accuracy technologies described above.

The leak detection technology landscape is rapidly evolving, with low technology cost becoming a key focus of public and private initiatives to support innovation. The U.S. Department of Energy's ARPA-E "Methane Observation Networks with Innovative Technology to Obtain Reductions" (MONITOR) program provides seed grants for the development of early stage technologies to detect leaks from the wellhead to the consumer. In the Environmental Defense Fund's Methane Detectors Challenge (MDC), technology entrepreneurs Sensit and Quanta3 receive support for product testing and pilots. The MDC applies specifically to emissions from compressors, well pads and associated equipment, focusing on continuous detection (EDF, 2014).

REGULATORY LANDSCAPE

FEDERAL REGULATIONS

At the federal level, both the Environmental Protection Agency (EPA) and the Bureau of Land Management (BLM) introduced methane regulations with LDAR requirements in 2016 (see Table 2). These federal standards represent critical steps towards realizing the Obama Administration's target to reduce methane emissions from the oil and gas sector by 45% before 2025 (White House, 2015). As this report went to print, the future of America's federal methane reduction targets was uncertain.

TABLE 2. Federal Methane LDAR Regulations Applicable to the Natural Gas Industry

JURISDICTION	REGULATORY AGENCY	REGULATION NAME	REGULATION STATUS	WELL TYPE ADDRESSED	LDAR TESTING FREQUENCY	CURRENT REGULATORY LEAK DETECTION TECHNOLOGY	PATHWAY TO USE INNOVATIVE LEAK DETECTION TECHNOLOGIES
Federal (All Lands)	Environmental Protection Agency	New Source Performance Standards (NSPS) subpart 0000a	Introduced	New & Modified facilities	Semi-Annual	Various	Yes
Federal (Federal and Tribal Lands)	Bureau of Land Management	Waste Prevention, Production Subject to Royalties and Resource Conservation (43 CFR Parts 3100, 3160, and 3170)	In effect; status pending at time of report release	New & Existing facilities	Semi-Annual	Various	Yes

SOURCES: U.S. Bureau of Land Management and U.S. Environmental Protection Agency

STATE REGULATIONS

Prior to the federal methane standards, the first regulatory efforts to limit the environmental impacts of oil and gas industry emissions were at the state level, focusing broadly on volatile organic compounds, including methane (see Table 3). In California, local Air Districts have restricted oil and gas emissions for over 25 years as a way to reduce ground level ozone, often controlling methane in the process (Bay Area Air Quality Management District, 1990). Methane from oil and gas production facilities was first directly regulated in 2014, when the Colorado Department of Public Health and Environment, environmental groups and several oil and gas producers came together to draft the first regulations mandating, among other requirements, periodic LDAR inspections of Colorado facilities (Oldham, 2014). Today, momentum continues at the state level, creating new and increased markets for LDAR service companies.

TABLE 3. State Methane LDAR Regulations Applicable to the Natural Gas Industry

JURISDICTION	REGULATORY AGENCY	REGULATION NAME	REGULATION STATUS	WELL TYPE ADDRESSED	LDAR TESTING FREQUENCY	CURRENT REGULATORY LEAK DETECTION TECHNOLOGY	PATHWAY TO USE INNOVATIVE LEAK DETECTION TECHNOLOGIES
California	California Environmental Protection Agency and various local Air Pollution Control Districts	California Code of Regulations, Title 17. Also see BAAQMD, SCAQMD and SJVAPCD local rules (among others) arising under California	Statewide regulations receiving public comments at time of report release, local rules formally adopted and in effect	New & Existing facilities	Quarterly	OGI and Portable Analyzers; mandates to measure leak concentration using portable analyzer technology	No
Colorado	Colorado Department of Public Health and Environment	Regulation 7, Section XVII	Established (2014)	New & Existing facilities	Frequency of inspection varies depending on facility type and size	OGI or Portable Analyzers	Yes
Pennsylvania	Pennsylvania Department of Environmental Protection	General Permit 5	Published (February 2017)	New & Modified facilities	Quarterly; frequency of inspection varies	OGI; allows use of AVO detection methods	No
Wyoming	Wyoming Department of Environmental Quality	Oil and Gas Production Facilities Chapter 6, Section 2: Permitting Guidance	Established (2014)	New facilities in the Upper Green River Basin; existing facilities that emit certain levels of emissions in the Upper Green River Basin	Quarterly	Various; excludes AVO and other non-instrument-based methods	Yes
Ohio	Ohio Environmental Protection Agency	Ohio Administrative Code (OAC) Chapter 3745-77-11	Established (2014)	New & Modified facilities	Quarterly with stepdown provision based on number of leaking components	TBD	NA

SOURCES: California Environmental Protection Agency, Colorado Department of Public Health and Environment, Ohio Environmental Protection Agency, Pennsylvania Department of Environmental Protection, Wyoming Department of Environmental Quality

PENNSYLVANIA QUICK FACTS

- 2nd largest U.S. producer of natural gas
- 115,000 tons of methane emissions annually from unconventional operations alone—enough to power 48,628 homes for one month
- As of February 2017, state will require LDAR and additional best practices for reducing emissions in new and modified facilities
- The Department of Environmental Protection announced it will develop regulation for existing sources for consideration by the Environmental Quality Board

Notably, Pennsylvania's Governor, Tom Wolf, made oil and gas methane emissions a key facet of his environmental protection plan in 2016, announcing a Methane Blueprint to cut methane emissions across the natural gas value chain. In the final months of 2016, the Wolf Administration released two draft permits for new and modified well sites, compressor stations, transmission facilities, and processing facilities, which included requirements for quarterly LDAR inspections. Pennsylvania's new general permits will reduce previously wasted, saleable product for the state's oil and gas infrastructure while protecting air quality and lowering Pennsylvania's greenhouse gas emissions.

"We are uniquely positioned to be a national leader in addressing climate change while supporting and ensuring responsible energy development, creating new jobs, and protecting public health and our environment."

—Pennsylvania Governor Tom Wolf

Characteristics of Methane Leak Detection and Repair Firms

For a complete list of firms and their characteristics—including locations, employees, revenues and technology used—see Appendix on page 26.

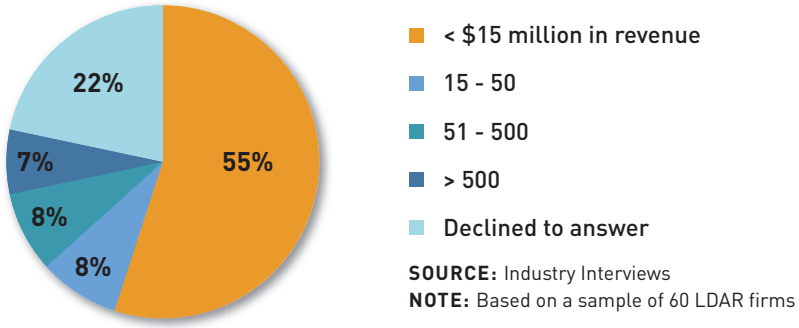
Our research identified 60 firms that perform methane leak detection and repair services for the natural gas industry across the United States. These consist primarily of small firms such as Amerigo, which offers one technology (OGI) to serve clients in two states (Colorado and Texas), but also include large firms such as CB&I, which offers three technologies (PA, OGI, AVO) to serve client sites in 23 states.

FIRM SIZE, AGE, ANTICIPATED GROWTH, TECHNOLOGIES AND GEOGRAPHIC REACH

FIRM SIZE

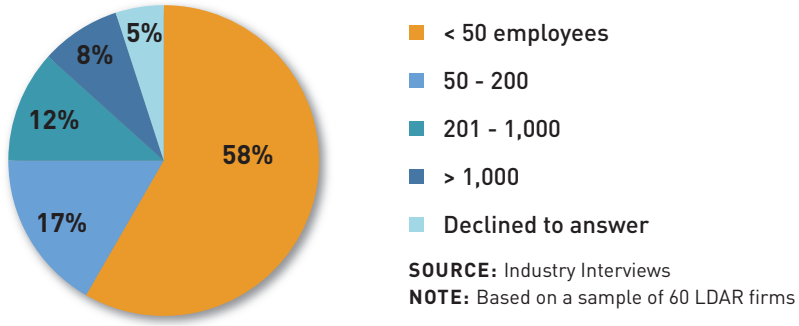
More than half of the 60 firms we identified (55%) are small businesses, according to the U.S. Small Business Administration (SBA), which sets definitions by industry. For this particular industry—engineering, surveying and mapping services—the SBA defines a small business as one that earns less than $15 million in average annual receipts (SBA, 2016). Many firms in our sample are also small in terms of staff, with 58% reporting they have fewer than 50 employees (see Figures 3 and 4).

FIGURE 3. Annual Revenue, Leak Detection and Repair Firms in $ Millions



SOURCE: Industry Interviews
NOTE: Based on a sample of 60 LDAR firms

FIGURE 4. Number of Employees, Leak Detection and Repair Firms

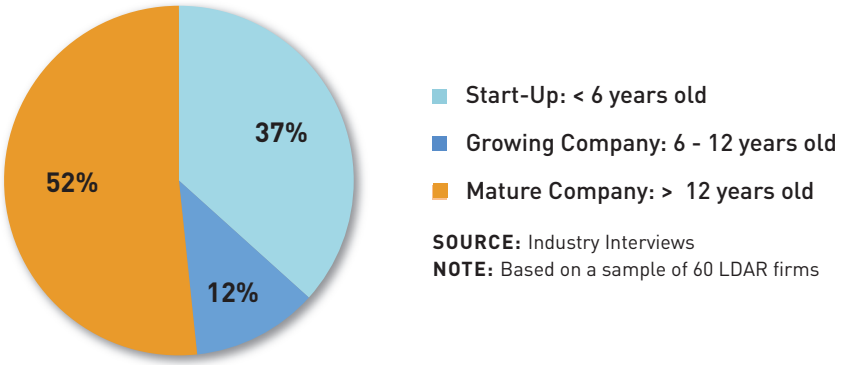


SOURCE: Industry Interviews
NOTE: Based on a sample of 60 LDAR firms

FIRM AGE

Of the firms sampled, over one third are start-ups, while more than 50% are considered mature companies (12+ years old) (Bulan & Yan, 2009). To meet demand for services, new firms are emerging in states where the natural gas industry is prevalent. Since 2010, 10 new firms have opened in Texas alone, accounting for 17% of our total sample. Pennsylvania, a state that previously had no LDAR firms, gained two firms after the state began requiring LDAR for general compression station permits in 2013.

FIGURE 5. Maturity Stage, Leak Detection and Repair Firms



SOURCE: Industry Interviews
NOTE: Based on a sample of 60 LDAR firms

ANTICIPATED GROWTH

The methane LDAR service industry anticipates steady growth in coming years, though the pace of growth can be dependent on factors such as natural gas prices and implementation of regulations. When asked whether new state and federal regulations will catalyze additional business opportunities, 32 firms chose to answer. Of these, 13 firms reported having already seen positive impact; 11 anticipated positive impact; 8 anticipated no impact. This is consistent with the experience of firms that provide LDAR services in Colorado, Ohio, and Wyoming—three states that have introduced their own methane LDAR requirements since 2014. Seven firms that serve clients in these states have seen business growth in that period ranging from 5% to 30%.

TECHNOLOGIES OFFERED

Technological innovation is considered a main differentiator by 20% of firms, including both start-ups and well-established firms. 12 firms use helicopter and drone technology with OGI cameras or lasers, greatly improving physical access to well sites and pipelines while reducing survey time. Of these, 7 are start-ups created exclusively to serve the helicopter, light aircraft and drone markets. Kairos Aerospace, founded in 2014, is currently developing a proprietary airborne leak detection technology.

KAIROS AEROSPACE

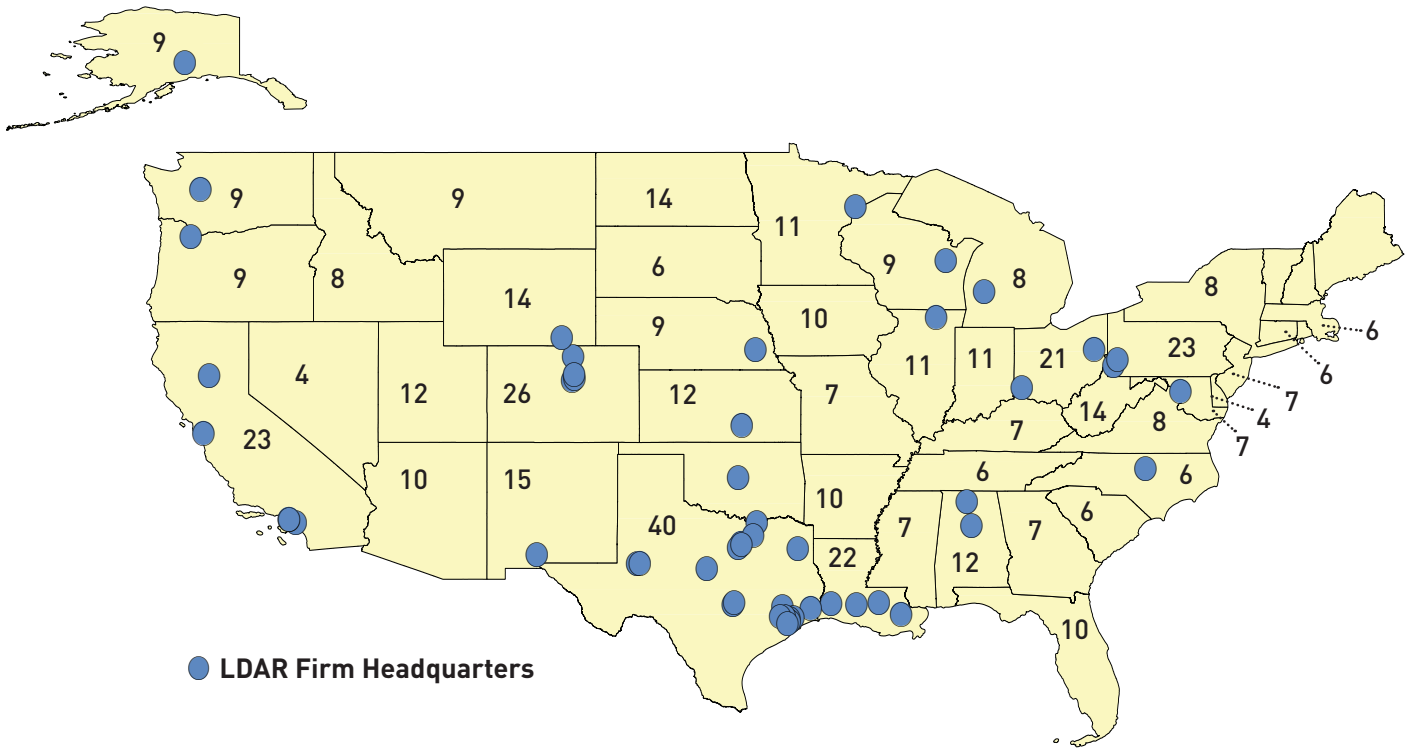
Red Hen, founded in 1997, had previously conducted other helicopter-based surveys, turning to leak detection services when a new technology became available. Insight Environmental, founded in 2004, had well-established LDAR portfolios and increased its competitive advantage by offering aerial technology services.

GEOGRAPHIC REACH

LDAR service company headquarters, and the client sites they serve, encompass a broad geographic reach (see Figure 6). Though companies are headquartered in 20 states, most of the firms (60%) have their headquarters in major energy-producing states such as Texas, California, Colorado, and Louisiana. Texas, with the largest number of gas wells in the United States (EIA, 2016), is home to 38% of firm headquarters.

Client sites served by LDAR firms in our sample stretch across 45 states (exceptions are Hawaii, Maine, New Hampshire, Rhode Island and Vermont). Unsurprisingly, the highest concentrations of client sites served are found near major shale formations: Marcellus (Pennsylvania, West Virginia, Ohio and New York), Eagle Ford (Texas), Barnett (Texas), Utica (Ohio, Pennsylvania and West Virginia), and Haynesville (Louisiana and Texas). Nearly 60% of the firms serve clients outside their home state and neighboring states.

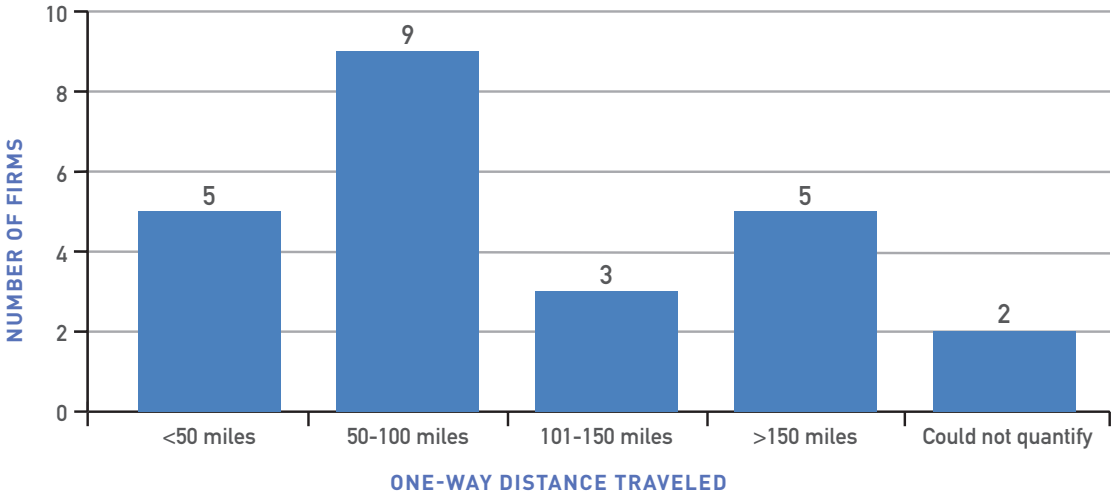
FIGURE 6. Number of LDAR Firms Serving Oil & Gas Clients, By State



SOURCE: Industry Interviews and U.S. Energy Information Administration
NOTE: Based on a sample of 60 LDAR firms

A sub-sample of the firms elected to provide detailed travel information. Of these 24, 17 firms (71%) reported that their crews typically travel less than 150 miles each way (See Figure 7). This "regional" model enables firms to limit travel costs by serving clients in close geographic proximity. In contrast, 21% of the sub-sample follows a "national" model, which relies on broader travel. These firms report typical travel distances from 300 to 1,000 miles each way. To the extent possible, these firms strategically schedule surveys, bundling clients and sites over several days.

FIGURE 7. Typical One-Way Travel Distance Reported



SOURCE: Industry Interviews
NOTE: Based on a sub-sample of 24 LDAR firms

All firms, regardless of travel model, stated they would not hesitate to serve well sites located farther than the ones they currently serve. For example, one sample firm indicated that while most of its crews typically spend less than one hour travelling, it has a dedicated special crew to inspect well sites located father away.

WORKFORCE

The LDAR service workforce comprises two primary roles: technicians and project managers. Firms employ all educational backgrounds—from high school graduates to PhDs—and facilitate role-based training that provides employees with a diverse set of transferable skills. Not only are the jobs diverse, the people are as well. A third of respondents reported an employee base that is at least 40% Non-White.

ROLES AND WAGES

Within LDAR companies, the two most common positions are technicians and project managers. Whereas technicians perform the day-to-day leak detection activities on client sites, project managers oversee a portfolio of LDAR projects and manage client relationships.

To fulfill these roles, leak detection companies employ workers with varying education levels (see Table 4).

- Since it is common practice in the industry for employers to invest in necessary skills and training, many companies hire LDAR technicians with a high school diploma.
- Technicians often acquire job-specific certifications, which focus either on safety or specific technologies, such as TVA-1000B Analyzer for portable analyzers or Level 1 Thermographer for OGI cameras.
- Project managers have obtained either a Bachelor's degree or are former technicians who have been promoted.
- Environmental engineers and environmental scientists require a Bachelor's degree.
- Drone operators and helicopter pilots, employed by companies using airborne leak detection technology, require a high school diploma, along with flight-specific training. Like LDAR technicians, their skillset does not require a traditional higher education degree, but rather job-specific certifications and experience.
- Companies offering more comprehensive or specialized LDAR services, such as a proprietary technology or compliance consulting, usually have additional positions on staff. These jobs have more specialized education requirements, such as a bachelor degree in environmental health and safety, or a higher degree in aeronautical or mechanical engineering.

TABLE 4. Characteristics of Jobs in Leak Detection and Repair Services

TITLE	MOST COMMON EDUCATIONAL REQUIREMENT	HOURLY WAGE	SALARY
LDAR Technician	High School Diploma	$13-19	$27,040-39,520
Project Manager	Bachelor Degree; High School Diploma with Experience	$20-29	$41,600-60,000
Environmental Engineer	Bachelor Degree in Engineering; Master in Engineering	$41	$84,560
Environmental Scientist	Bachelor Degree	$32	$67,460
Drone operator	High School Diploma; Unmanned Aerial Vehicle (UAV) training	$22-24	$62,000-69,000
Helicopter pilot	High School Diploma; FAA training and Certification	N/A	$84,510-113,110

SOURCE: Industry Interviews, Company Websites, U.S. Bureau of Labor Statistics and job-search websites

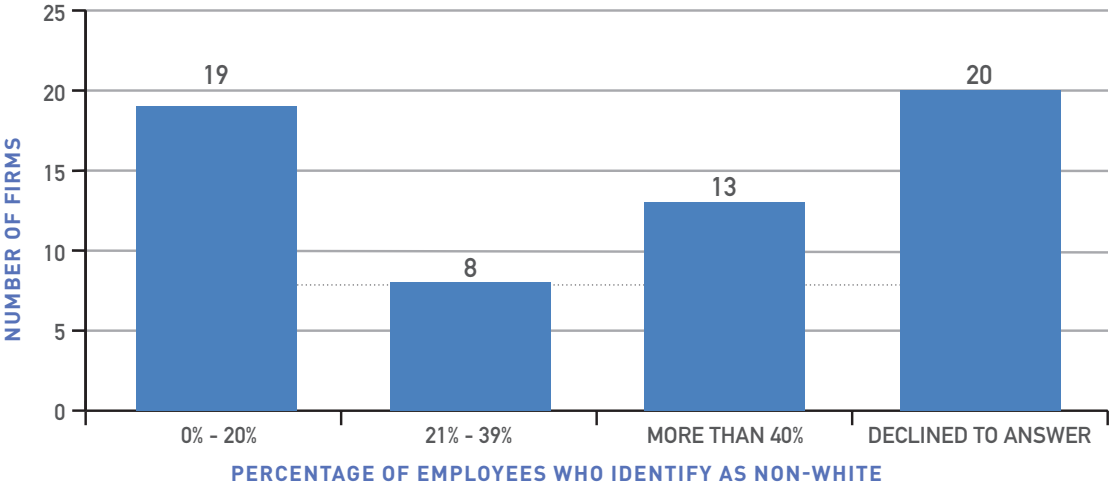
EMPLOYEE DIVERSITY

The leak detection companies in our sample show varying degrees of racial diversity (see Figure 8). When companies were asked about the racial make-up of their staffs, 13 companies (of 40 that responded) reported that at least 40% of their employees identified as Non-White. The highest racial diversity figures were reported by firms headquartered in Texas, with eight Texas firms estimating their share of Non-White employees as 40% or more.

UPWARD MOBILITY

A variety of professional growth trajectories are available to LDAR technicians. Of the 40 respondents that offer technician positions, 17 (43%) offer two to three levels of technicians, each level associated with specific on-site responsibilities. It is common practice to differentiate between an entry-level technician, a specialized technician in charge of safety or component tagging, and a lead technician responsible for the entire crew. Consequently, with sufficient training and tenure, technicians can advance both within and beyond the role. In addition to intra-role growth, lead technicians have the opportunity to advance to project manager.

FIGURE 8. Racial Diversity Within Leak Detection and Repair Firms



SOURCE: Industry Interviews
NOTE: Based on a sample of 60 LDAR firms

Many of the skills developed by LDAR technicians are transferrable to other jobs in the oil and gas industry. Industry recruiters cite three specific skillsets as desirable: field experience, demonstrated commitment to safety procedures, and an understanding of applicable regulations (ShaleNet, 2013). Since technicians are thoroughly trained on existing regulatory compliance metrics, they are also well positioned to understand the application of new regulations in the oil and gas operating environment.

Compensation benchmarking for workers of similar age, education and vocation indicates that average LDAR industry wages for technicians is highly competitive. The salary for an LDAR technician varies from $27,040 at an entry level to $39,520 at a more senior level, while the U.S. median annual earnings of full time workers who have completed high school is $30,000 (NCES, 2016, p. 3 Figure 3).

REVIEW OF KEY FINDINGS

This report has documented a growing industry of 60 U.S. LDAR firms working in 45 states to help oil and gas operators reduce emissions of methane, the primary component of natural gas. These service firms are increasingly available to help oil and gas operators of all sizes accomplish the leak inspection process. They offer the technical staffing required for regular inspections, thus saving operators the cost of hiring full-time staff and owning and maintaining the high-accuracy equipment needed to conduct inspections.

More than half (55%) of the LDAR firms identified in this report are small businesses. Over one third (36%) were established within the past 6 years, reflecting a growing industry that provides U.S. jobs and upward mobility. Employee education levels range from high school diplomas to PhDs, with annual salaries ranging from $27,040 to $113,110. LDAR service firms are structured to encourage job growth for technicians and higher wages when moving into a project manager role.

The emerging LDAR service industry is poised to help the oil and natural gas sector reduce waste by finding and fixing potentially expensive methane leaks. These firms provide services that clients may find difficult to sustain financially in-house. By identifying methane leaks, LDAR service firms are helping the oil and gas industry improve its operational efficiency and mitigate its contribution to climate change.

Company Profile: CB&I

CB&I has more than 25 years of experience developing and managing leak detection and repair (LDAR) programs that comply with state and federal regulatory requirements, as well as various individual consent decrees. LDAR programs are set up for oil and gas production facilities, chemical and pharmaceutical plants, petroleum refineries, and other industries. The company performs a wide variety of services, such as the development of turnkey LDAR programs, emissions calculations and reporting, full LDAR compliance and efficiency evaluations.

CB&I has a large footprint in LDAR, providing services at 118 sites across 23 states (see Figure 9). Main states served are Texas (27 sites), West Virginia (15) and Louisiana (15). According to Don Kinder, CB&I Operations Manager, about 50% of the company's client accounts involve service at multiple sites, while 50% are for a single site. Because the natural gas industry is regionally based, a large natural gas operator typically will work with different providers in different regions rather than a single LDAR provider nationwide.

CB&I QUICK FACTS

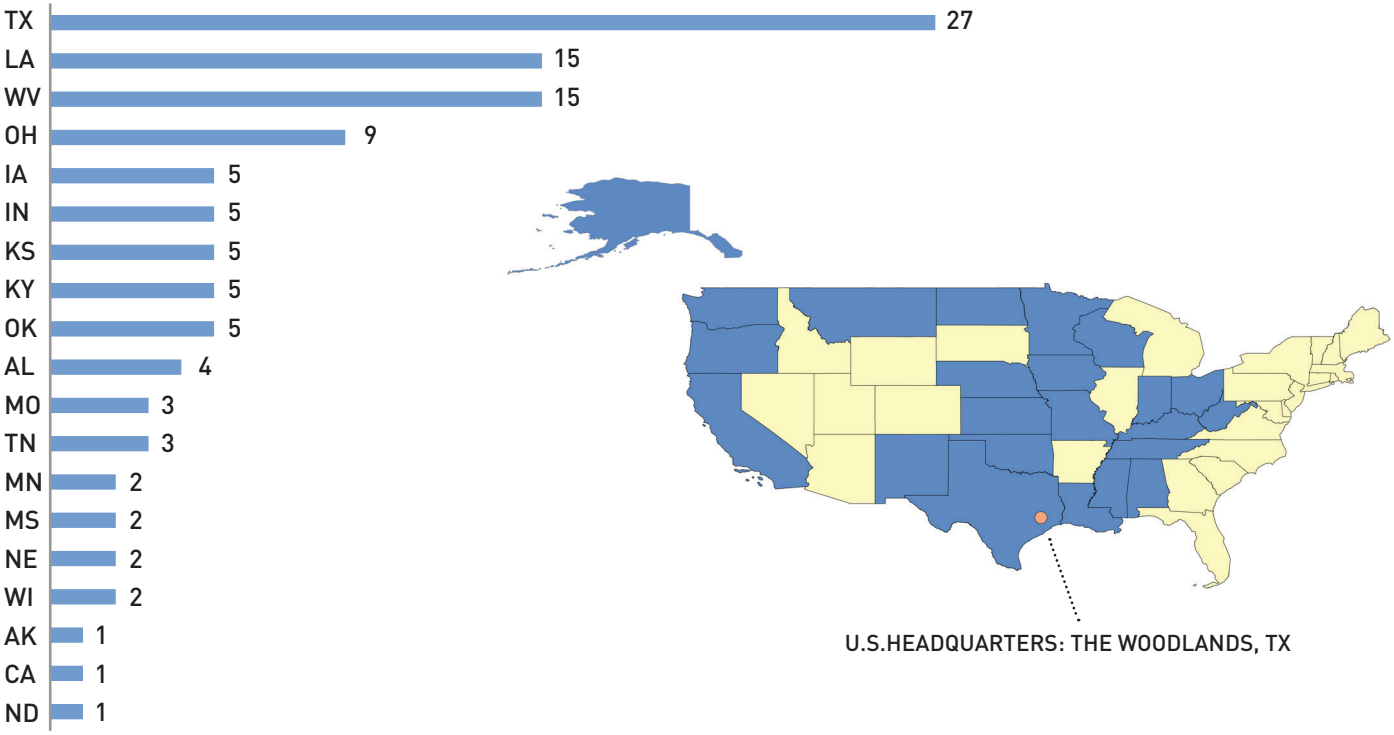
U.S. HEADQUARTERS:
The Woodlands, TX

LDAR EMPLOYEES:
190

TARGET ANNUAL GROWTH FOR LDAR:
10% - 15%

KEY STATES:
TX, WV, LA, OH, IA, KS

FIGURE 9. CB&I LDAR Client Sites, 2015-2016



SOURCE: CB&I and U.S. Energy Information Administration

CB&I's extensive geographic reach enables the company to provide clients with cost-effective LDAR services and individualized attention. Because CB&I manages multiple client sites within a large region, customers benefit from the lower travel costs assumed by the managers and technicians. An additional geographic advantage noted by Kinder is the ability to make more frequent site visits based on proximity. "It's easier to give a client outstanding service when you have other sites in his backyard."

BENEFITS FOR NATURAL GAS OPERATORS

LDAR surveys are increasingly performed by a growing service industry, providing clients benefits they may find difficult to match in-house. Kinder explains that in the natural gas industry, most leaks are about 10,000 parts per million (ppm)—which reflects a leak that could easily go undetected.

"To put this in perspective, even an everyday item such as a felt-tip marker has vapors, so if you took the cap off the marker for just three or four seconds and placed the flame ionization detector (FID) inside the cap, you'd get a reading of 1,200 to 2,000 ppm," Kinder says, referring to the instrument's sensitivity in detecting emissions of any chemical. "Finding a small leak allows you to fix it before it becomes a big, expensive one."

Operational equipment and maintenance is a crucial issue for the vast majority of CB&I's LDAR customers. In the case of the infrared camera, clients prefer not to purchase a $125,000 device as they may not have the in-house expertise to operate properly, maintain, repair, or calibrate the instrument. CB&I currently owns two infrared cameras, one for their Midwest operations, and one for their East Coast operations. "We spread the cost of our infrared cameras over a large number of oil and gas clients," says Kinder. "This drives down service costs, and spares operators from having to buy expensive equipment."

Perhaps most important, LDAR service providers help operators avoid unnecessary exposure to liability and compliance issues. CB&I's LDAR clients must comply with rules set by various entities, including the EPA, state governments, and operators themselves.

The CB&I LDAR team has enabled a perfect track record of zero "Notice of Violation" issuances from the EPA for the natural gas, chemical and refining sites managed by CB&I. To date, EPA rules focus primarily on volatile organic compounds (40 CFR Part 60, subpart KKK), but Kinder notes that with successful implementation of the New Source Performance Standard requirements for methane emissions, LDAR service providers will similarly be able to help natural gas operators maintain compliance for methane.

FUTURE GROWTH

Anticipating the natural gas industry's increasing focus on reducing methane emissions, CB&I hopes to grow its LDAR services in the coming years at a rate of 10-15% annually. The company's national presence will enable it to leverage existing locations to seize new opportunities. The aim for new employees is to achieve a mix of 70% technicians and 30% managers. Newly hired technicians will require a high school diploma. Experience in industrial plants is preferred, but it is not required, as all newly hired technicians receive LDAR-specific training.

CB&I is prepared for the possibility that small natural gas operators will increasingly join their larger counterparts in enlisting the services of LDAR service providers. Kinder points out that from a monitoring standpoint, small operators will reap the same benefits as current, larger ones, if their geography lends itself to saving travel costs. Regardless of location, "we welcome the chance to expand our services for oil and gas operators of all sizes."

DEXTER QUICK FACTS

U.S. HEADQUARTERS:
Beaumont, TX

NON-WHITE EMPLOYEES:
40%

KEY STATES:
OK, TX and NM

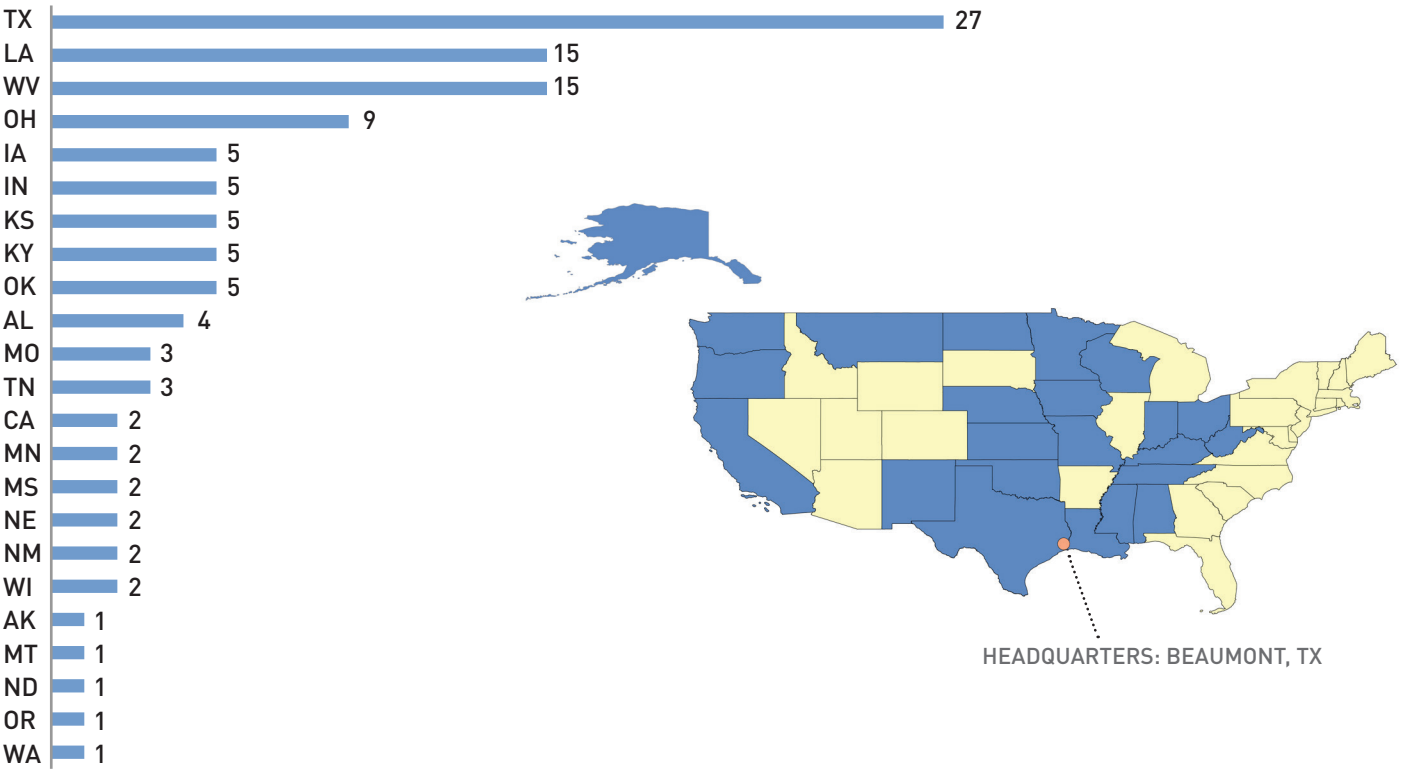
TARGET GROWTH IN LDAR STAFF OVER NEXT FIVE YEARS:
75 jobs

Company Profile: Dexter ATC Field Services

Since 2005, Dexter has performed LDAR and other air quality services for clients, devoting 40-45% of staff to the oil and gas industry. In March 2016, Dexter was acquired by ATC Group Services, a 1,350-employee firm that aims to establish a footprint in the leak detection and repair space. As Dexter ATC Field Services, the company plans to expand its LDAR staff by roughly 75 jobs in the coming five years.

Of Dexter's total 150 employees, 13% work out of the Beaumont, Texas headquarters; the remaining 87% service client sites all over the United States (see Figure 10).

FIGURE 10. Dexter LDAR Client Sites, 2015-2016



SOURCE: Dexter ATC Field Services and U.S. Energy Information Administration

STAFF DIVERSITY

Dexter's staff is characterized by diversity in race, age and education. An estimated 40% of employees have a minority racial or ethnic background, including Hispanic, African American, and Native American. Most hiring is done locally in client locations, so the firm's diversity is explained in part by the fact that employees' education and ethnic background represent the local communities in which they work. For instance, one crew serving clients in New Mexico predominantly has technicians of Native American origin. Another, in El Paso, Texas, has mostly crew members of Hispanic origin.

For Dexter's technicians, the minimum education requirement is a high school diploma. Meanwhile, several project managers and members of the leadership team have at least a bachelor degree. These team members include chemical and process engineers, environmental managers, and highly experienced technical personnel. Staff ages range from technicians as young as 19, to project managers in their early 60s.

GOOD JOBS

Nick James, Dexter's Operations Director, notes that LDAR provides young people who lack a college degree the opportunity to acquire a broad, transferable set of skills and earn good entry-level wages. Hourly wages for LDAR technicians range from $14 to $28 per hour ($560-1,120 weekly.) James' own experience illustrates a climb up the career ladder. Hired in 2007 as a $13-an-hour field technician, he is now Operations Director overseeing Dexter ATC's entire field staff.

Upward mobility at Dexter is supported by extensive internal training focused on safety compliance and skill development. For example, in 2015 Dexter launched an onboarding program for technicians during their first six weeks on the job. Since it began, the induction program has drastically reduced the number of safety incidents and near-misses associated with new technicians. Employees also receive mentoring on best practices—in particular, sharing innovations with other crews. "Once we started this knowledge sharing," says James, "we have seen greater consistency in not only training but also basic work practices amongst our personnel spread out across the country."

LDAR technicians and project managers acquire specific skills that are transferable not just within the oil and gas industry, but beyond. These include valuable maintenance, client management and work safety skills. Also transferable are professional certifications relevant to LDAR, such as the Safety Trained Supervisors (STS) certification of the Board of Certified Safety Professionals.

ANTICIPATED GROWTH

The company anticipates that possible upcoming federal methane regulations, encompassing new and modified as well as existing sources, has potential to generate an estimated $3.5 million in additional work for existing clients alone. Dexter is already keeping its four infrared cameras busy and will likely be purchasing at least two more to accommodate these new business opportunities within the next 18 months.

James notes that across the industry, many compressor stations and well sites have never been subject to such stringent leak detection and repair as required by new regulations, a sure indicator that many more personnel will be needed. James estimates that the company's target to double revenues would require adding at least 70 technicians and 5 project managers over five years. Such staff expansions for new locations are usually made by conducting local hiring campaigns to employ and train a new class of young, ambitious technicians. James looks forward to helping natural gas operators achieve "sustainable compliance with these federal and state regulations, but really everything that goes along with fewer leaks: less waste, safer facilities, cleaner air, and healthy relationships with the communities surrounding these locations."

Appendix: List of Companies Providing Leak Detection and Repair Services in the U.S.

NUMBER OF EMPLOYEES: <50: ▲ | 50-200: ▲▲ | 201-1,000: ▲▲▲ | >1,000: ▲▲▲▲

ANNUAL REVENUE (USD million): <15: $ | 15-50: $$ | 51-500: $$$ | >500: $$$$

TECHNOLOGY: Portable Analyzer: PA | Optical Gas Imaging: OGI | Laser Absorption Spectroscopy: LAS
Ambient/Mobile Leak Monitoring: AMLM | Acoustic Leak Detector: ALD | Audio-Visual-Olfactory Inspection: AVO

FIRM NAME	NUMBER OF EMPLOYEES	ANNUAL REVENUE	TECHNOLOGY USED	FIRM HEADQUARTERS* AND CLIENT SITES SERVED IN US
A.R.T. Airborne Natural Gas Leak Detection	▲	$	LAS	TX*
Aerial Inspection Resources	▲	$	OGI, LAS	AZ, CA, ID, MT, OR*, WA, WY
Alliance Source Testing	-	-	PA, AVO	AL, AR, PA, TX
Amerigo	▲	$	OGI	CO, TX*
AmeriTek Environmental	▲▲	$	PA, OGI	TX*
Apex Companies	▲▲▲	$$$	PA, OGI, AVO	AR, CA, CO, FL, GA, KS, LA, MD* MO, NC, NE, NM, OH, OK, OR PA, SC, SD, TX, WA, WV, WY
Apogee Scientific	▲	$	AMLM	CO, NY, PA, TX, VA, WV
Atmosfir Optics	▲	-	AMLM	CA, NC*, TX
Beacon Energy Services	▲▲	$	PA, OGI	AK, CA*, NE, OR, TX, WA
BLOC Environmental Solutions	▲	$	PA, OGI	CA, IN, MI, MN, NE, NM, PA, TX*, WA
Bowen Infrared	▲	$	OGI	WI* and most continental U.S. states
Business Technical Services	▲	-	PA	IL, IN, KY, OH*
CB&I	▲▲▲▲	$$$$	PA, OGI, AVO	AK, AL, CA, IA, IN, KS, KY, LA, MN MO, MS, MT, ND, NE, NM, OH, OK, OR, TN, TX*, WA, WI, WV
Clearstone Engineering	▲	$	PA, OGI, AMLM, ALD, AVO	-
Contek Solutions	▲	-	OGI	OK, TX*
Corridor Field Services	▲	$	OGI	AL* and most continental U.S. states
Custom Stack Analysis	▲▲	-	PA	IL, NY, OH*, PR, SC
Dan Fitzgerald & Associates	-	$	PA	CA*
Darbonne Services	▲▲	-	PA, OGI	AR, FL, LA*, OH, PA, WI
Dexter ATC Field Services	▲▲	$	PA, OGI, ALD, AVO	AR, CA, CO, DE, KS, LA, MI, ND, NM, NV, OK, PA, TX*, UT, WA, WY
EcoTest Energy Services	-	-	PA, OGI	CO, KS, NM, OK, PA, TX*, WV
Emission Monitoring Service (EMSI)	▲▲▲	$$	PA, OGI	TX* and most continental U.S. states
ENCOS	▲	$	PA, OGI	AL, LA*, TX, VA
Enviro Clean	▲▲	-	OGI	OK*, TX
Environmental Compliance & Testing Services	▲	$	PA, OGI	OH, PA*, WV
ERM	▲▲▲▲	$$$$	-	AK, AL, AZ, CA, CO, CT, DC, FL, GA, HI, IL, IN, IA, KS, LA, MD, MA, MI, MS, MN, MO, NE, NJ, NM, NY, NC, OR, PA, RI, SC, TN, TX, UT, VA, WA, WV, WI
GeoStat Environmental	▲	$	PA, OGI	IA, KS*, OK

FIRM NAME	NUMBER OF EMPLOYEES	ANNUAL REVENUE	TECHNOLOGY USED	FIRM HEADQUARTERS* AND CLIENT SITES SERVED IN US
GHD	▲▲▲▲	$$$$	PA, OGI, LAS	CO, NY, OH, OK, PA, TX, UT, WV
Guardian Compliance	▲▲▲	$$$	PA, OGI	TX* and most continental U.S. states
Heath Consultants	▲▲▲▲	$$$	PA, OGI, LAS	TX* and most continental U.S. states
Hy-Bon Engineering Company	▲▲	$$$	OGI	CO, IL, KY, LA, ND, NM, OH, OK, PA, TX*, UT, WV, WY
Infrared Services & Thermal Imaging of Texas	▲	$	PA, OGI	AR, KS, LA, OK, TX*
Insight Environmental	▲	$	PA, OGI, AVO	AK, LA, MN, ND, PA, WI*, UT
IPR-EMS	▲▲▲	-	PA, OGI	AL, CO, LA, MT, OH, OK, TX*, VA, WV
Kairos Aerospace	▲	$	OGI	CA*
K&K Services	▲	$	PA	IL*, MI, OH, TX
L&M Environmental Response	▲	$	PA, OGI, AVO	LA*
LaSen	▲	$	LAS	CA, CO, LA, ND, NM*, OH, OK, PA, TX, WY
Leak Imaging	▲	$	OGI	LA, NM, OK, TX*
Leak Surveys	▲	$	OGI	AR, AZ, CA, CO, IN, KS, LA, NM, OH, TX*, WY
Lesair Environmental	▲	-	PA, OGI	CO*, WY
Louisiana Natural Gas Services	▲	$$	PA, OGI	CO, LA*
LT Environmental	▲▲	$$	PA, OGI, LAS, AVO	CO, ID, ND, TX, WY, UT
Montrose Environmental	▲▲▲	$$	PA, OGI, AVO	AZ, CA*, CO, IL, IN, LA, MN, MT, ND, OH, PA, TX, VA, WV, WI
Olsson Associates	▲▲▲	-	PA, OGI, AVO	CO, IA, KS, NE*, TX, WY
Pergam	▲▲	-	LAS	WA*
Rebellion Photonics	▲	$	OGI	AR, CA, CO, ND, NM, OH, PA, SD, TX*
Red Hen Systems	▲	$	OGI, LAS	CO*
RIMA Services	▲	$	OGI	OH, PA*, WV
SCS Engineers	▲▲▲	$$$	PA	AL, AR, AZ, CA*, DE, FL, GA, IN, LA, MA, MO, MS, NJ, OR, PA, SC, TN, TX
Spectral	▲	$	LAS	TX*
Synodon	▲	$	AMLM	CO, OH, OK, TX
Target Emission Services	▲	$$	PA, OGI	TX* and most continental U.S. states
Team Industrial Services	▲▲▲▲	$$$$	PA, OGI	AL, CO, LA, MN, ND, OH, PA, TX*, UT, WV
Tern Technologies	▲	$	OGI	AK* and most continental U.S. states
Tricord Consulting	▲	$	OGI	CA, CO, LA, ND, OK, TX*, WY
Trihydro	▲▲▲	$$	PA, OGI	CO, IA, KS, LA, MN, ND, OH, OK, SD, TX, UT, WY*, WV
UM Inspections	▲	$	LAS	TX*
Untamed Helo Services	▲	-	OGI, LAS	NM, TX*
Westshore Consulting	▲	$	PA, OGI, AVO	MI*

NOTE: All information self-reported by firms. "-" indicates firm declined to provide information.

References

Alvarez, R., & Paranhos, E. (2012). Air pollution issues associated with natural gas and oil operations. Retrieved February 14, 2017, from http://pubs.awma.org/gsearch/em/2012/6/alvarez.pdf

Bay Area Air Quality Management District. (1990). *Regulation 8. Organic Compounds - Rule 37. Natural Gas and Crude Oil Production Facilities*. Retrieved from http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1173.pdf?sfvrsn=4

Bulan, L., & Yan, Z. (2009). The pecking order theory and the firm's life cycle. *Banking and Finance Letter, 1*(3). Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1347430

Environmental Defense Fund. (2014). *How do the EDF and ARPA-E projects on methane sensing relate to each other? Environmental Defense Fund*. Retrieved from http://blogs.edf.org/energyexchange/files/2014/05/Comparison-Table.pdf

Myhre, G., Shindell, D., Bréon, F.-M., Fuglestvedt, J., Huang, J., Lamarque, J.-F., ... Koch, D. (2013). Anthropogenic and Natural Radiative Forcing. In T. F. Stocker, D. Qin, G.-K. Planttner, M. Tignor, S. K. Allen, J. Boschung, ... P. M. Midgley (Eds.), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Inter-governmental Panel on Climate Change*. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press, Cambridge. Retrieved from https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf

National Center for Education Statistics. (2016). Annual earnings of young adults. Retrieved February 14, 2017, from https://nces.ed.gov/programs/coe/pdf/coe_cba.pdf

Oldham, J. (2014). Colorado: first state to clamp down on fracking methane pollution. Retrieved February 14, 2017, from https://www.bloomberg.com/news/articles/2014-02-24/colorado-first-state-to-clamp-down-on-fracking-methane-pollution

ShaleNET. (2013). *A guide to careers in the oil and natural gas industry.* Retrieved from http://careerguide.shalenet.org/Content/guides/CareerGuide2013.pdf

Stocker, T., Dahe, Q., & Plattner, G.-K. (2013). *Climate change 2013: the physical science basis.* Retrieved from http://www.climatechange2013.org/images/uploads/WGIAR5_WGI-12Doc2b_FinalDraft_All.pdf

U.S. Energy Information Administration. (2016). Number of producing gas wells. Retrieved February 14, 2017, from http://www.eia.gov/dnav/ng/ng_prod_wells_s1_a.htm

U.S. Environmental Protection Agency. (2014). Basic Information | Oil and Natural Gas Air Pollution Standards. Retrieved February 14, 2017, from https://www3.epa.gov/airquality/oilandgas/basic.html

U.S. Environmental Protection Agency. (2016). *Inventory of U.S. greenhouse gas emissions and sinks: 1990-2014*. U.S. Environmental Protection Agency. Retrieved from https://www.epa.gov/sites/production/files/2016-04/documents/us-ghg-inventory-2016-main-text.pdf

U.S. Small Business Administration. (2016). Summary of size standards by industry sector. Retrieved February 14, 2017, from https://www.sba.gov/contracting/getting-started-contractor/make-sure-you-meet-sba-size-standards/summary-size-standards-industry-sector

White House. (2015, January 14). Fact Sheet: Administration takes steps forward on Climate Action Plan by announcing actions to cut methane emissions. Retrieved February 14, 2017, from https://obamawhitehouse.archives.gov/the-press-office/2015/01/14/fact-sheet-administration-takes-steps-forward-climate-action-plan-anno-1

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