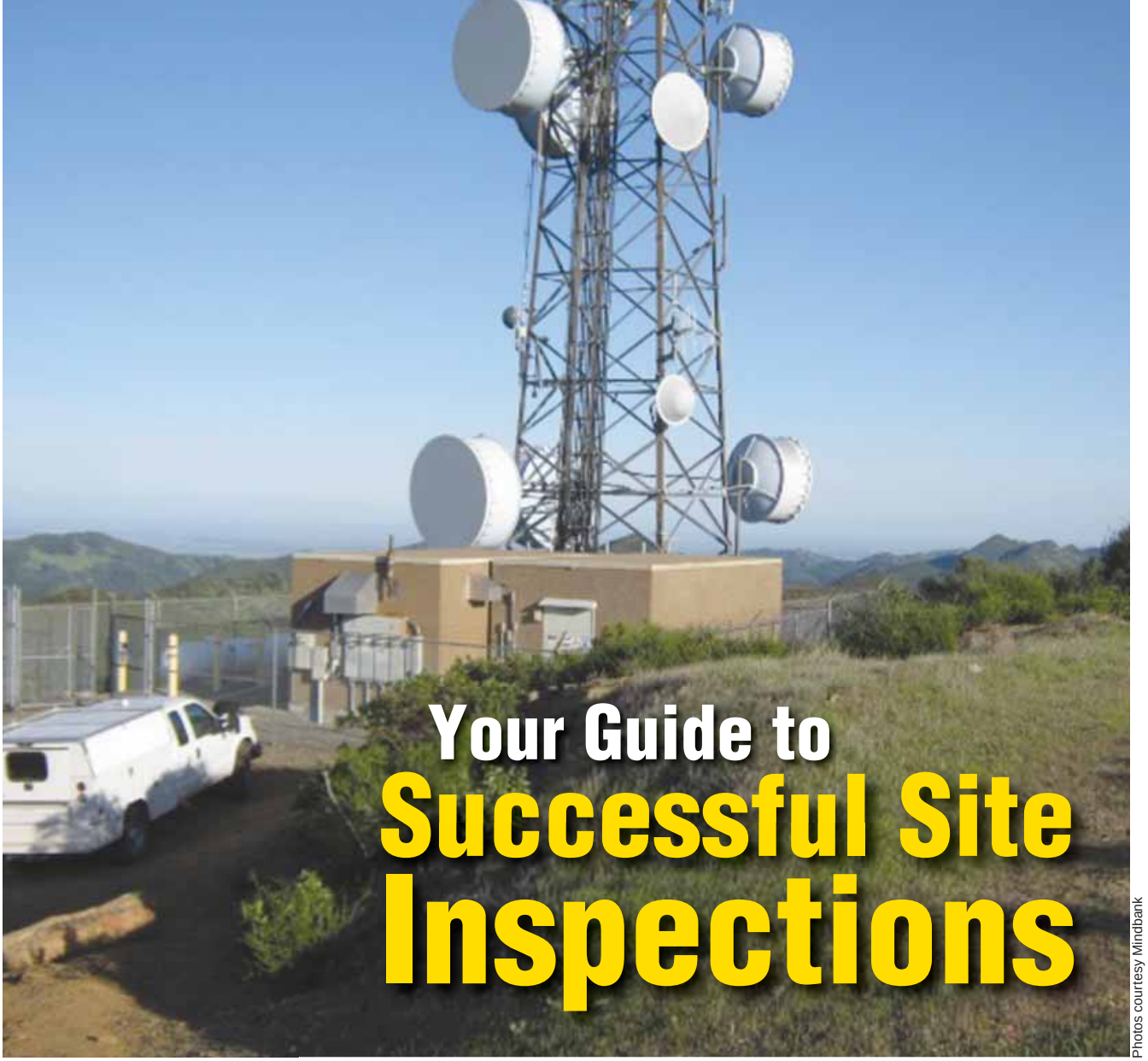


Your Guide to Successful Site Inspections

Photos courtesy Mindbank

A radio tower site inspection checklist helps cost effectively manage your network without cutting corners.

By Mike Stanley, David Ethridge and Ted Sumner

A successful radio system must embody three essential, inter-related characteristics. First, it must provide for the safety of personnel who use the radio system and technicians who service the radio equipment and infrastructure. Second, the radio system must provide the performance, coverage and reliability the users require. The system also must be adaptable enough to incorporate new technologies for delivery of new applications without disruption of safety or performance.

In today's economy, radio managers are searching for creative ideas to produce the optimal combination of site compliance, performance and upgradability possible within current operation and maintenance (O&M) budgets. In a perfect world, every organization would perform regular radio site inspections — once in the spring and once in the fall — to tackle preventative maintenance and compile actionable intelligence on site equipment and operating conditions for making infrastructure management decisions.

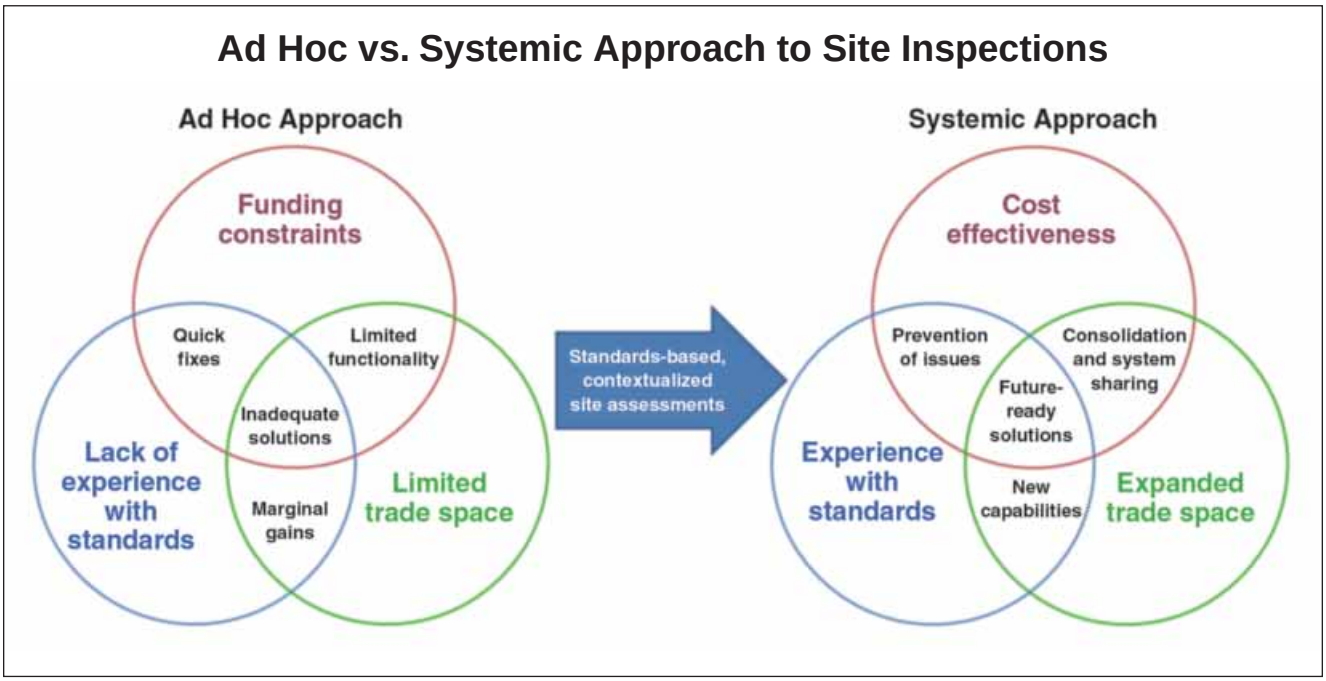
Unfortunately, site inspections often fall victim to one of three problems:

1. Funding constraints and other priorities squeeze the O&M budget to the point that site inspections are suspended; or

2. Site inspections are conducted, but they are not performed consistently or commensurate with national standards; or

3. The urgency to address immediate operational issues compromises due concern for future growth.

All of these factors impact a radio communications network's safety, performance and future readiness. Regardless if only a single site is



providing system support or if there are numerous sites, there is a common factor among all site locations — the cost of operating and maintaining the infrastructure — that has always been a challenge to meet. Many system problems derive from the conditions at the radio site itself.

In 2003, the Bureau of Indian Affairs (BIA) commissioned the inspection of 170 radio tower sites. An inspection process was launched that delivered 15,000 pages of documentation. Based on the radio site findings, in 2007, the Department of Interior's (DOI) Office of the Inspector General (OIG) issued a report that identified DOI's radio communications infrastructure as a material weakness. In response, the DOI issued Directive 2009-008, DOI Radio Communications Site Standards, developed by the National Radio Spectrum Program Management Office (NRSPMO) in conjunction with departmental and bureau specialists. These standards provide that radio communications sites are developed, operated, properly maintained and inspected according to common health and safety standards using industry-standard guidelines. The next move was to figure out how to accomplish the goal of inspecting more than 2,000 DOI-owned radio sites in a cost-effective way, and to do it in a manner that provided alternatives to optimize efficiencies.

In response to the OIG's mandate in 2007, the Bureau of Land Management (BLM) launched the Radio Infrastructure Compliance Assessment Safety Health Environment (RI CASHE) audit program. Because traditional site inspections only provided part of the data about site conditions and saving money often meant cutting corners, BLM staff envisioned a holistic approach — one that included a standards-driven inspection with a process for developing alternatives to reduce O&M costs and make sites future ready.

The site checklist is comprised of more than 1,000 data points including 74 questions with 585 findable focus points.

The BLM RI CASHE program audit model was so successful that it was employed again, with only minor modifications, as a key element in evaluating the DOI's more than 100 LMR facilities along the southwest border in California, Arizona, New Mexico and Texas as part of the Southwest Border Radio Regionalization project in 2011 – 2012.

The Process

Using an updated and improved version of the original BIA radio site inspection checklist and process, more than 450 radio tower site inspections have now been performed for the BLM, including 400 sites owned or operated by other agencies. Fieldwork found that funding constraints over the years resulted in quick fixes leading to short-term solutions and marginal improvements. These efforts corrected the immediate problem but neglected to consider the long-term effects. For example, site safety issues endanger technicians working on-site; they can also impact the safety of first responders who depend on system availability 24/7.

Based on understanding systemic issues within radio systems, further improvements to the site inspection checklist were made by working with standards groups and providing feedback and product improvement

The Telegraph Pass site in Arizona has facilities owned by Western Area Power Administration (WAPA) and Arizona Department of Public Safety.

suggestions to OEMs. Using the best field inspection methods, including lessons learned from years of field experience and a number of improvements to the site inspection process, national standards requirements, and the development of cost-saving alternatives, these ideas become the foundation of a Mindbank-defined process and methodology for the BLM RI CASHE program called LMR*site*-Compass.

The focus of constructing this tool and process was to turn the table on the traditional drain of infrastructure assessments, making the inspection process proactive verses reactive. Alternatives such as future upgrades and improvement needs were considered, including how the site performs within the group of sites providing communications at a systems level. The process provides information about available "trade space" such as adjacent towers and shelters on the site that are perhaps owned and operated by other parties, or sites nearby that may provide options for expansion and sharing costs.

Site Inspections

Site inspectors must work within the parameters of budgets and a coordinated effort to meet customer needs and expectations. If a customer has a series of sites in specific geographic areas, a precise plan is developed that includes how sites will be sequenced in the field, the level of effort required for each inspection, the distance between sites, and needs for site access such as 4 x 4 vehicles, all-terrain vehicles and helicopters. This initial planning phase is evaluated and approved by the customer prior to field execution. Mapping activities to requirements and budget is a critical first step.

At the site, inspectors use a site inspection worksheet developed in concert with the DOI Radio Electronic Site Survey Instrument. The checklist is comprised of more than 1,000 data points including 74 questions with 585 findable focus points. The checklist is divided into nine sections including the following:

- Site Characteristics: Details about the site that aid in writing descriptive findings
- Site Design and Development: Condition of the tower and compound
- Building Design and Condition: Condition of the shelter
- External Grounding Systems: Condition of external grounding components
- Internal Grounding Systems: Condition of internal grounding components
- Power Systems: Condition of power systems including commercial, solar and backup
- Interference and RF Radiation: Condition of RF systems and actual

Site safety issues can endanger technicians working on-site; they can also impact the safety of first responders who depend on system reliability 24/7.

RF radiation

■ Equipment Installation: Condition of radio and ancillary equipment

■ Equipment Inventory: Inventory of radio assets installed at the site

■ General Site Photos

Inspectors take general site photos that depict all site components and layout conditions. As the inspection develops, detailed photos of each deficiency found are taken to be included in the findings report. Once the inspection is completed and the team returns to the office and completes the electronic version of the checklist, the checklist data is exportable in XML and CSV formats. This data is extracted from the checklist and imported into the LMR*site*Compass tool. The tool is used to concatenate all the data into findings and cost estimates.

The inspection team averages between two and three hours per radio facility. The actual time varies based on the complexity of the site components and the volume of deficiencies. When multiple radio facilities are geographically grouped, an inspection team can complete as many as four inspections in a typical 12-hour day.

Recommendations

The BLM issued a nationwide indefinite delivery indefinite quantity (IDIQ) contract worth $39 million to three vendors to take the findings and begin remediation on all BLM facilities. The "Standard Radio Site Design and Crosswalk" document created by Mindbank Consulting Group in 2012 for the BLM, DOI, U.S. Forest Service and Department of Homeland Security (DHS) is used as the basis for issuing scopes of work for each radio site. This contract is based on having site inspection data that defines exactly what needs to be fixed, what the alternatives and outcomes are, and where the greatest cost savings will come from. Understanding options provides a map to achieve the best long-term value.

For example, at a specific radio site in Arizona, radio equipment from one federal agency is housed in a different agency-owned facility. The facility needs $92,000 in remedial work for compliance with code, and expensive RF equipment is at risk unless improvements are made. Splitting the cost with the facility owner is $46,000. But there is a collocated state public-safety facility with ample rack space for equipment and requires only $8,000 of remedial work to meet code. Splitting the cost with the state agency saves $42,000 and dramatically increases the reliability and survivability of the communications capability at this site.

Radio managers should have a clear set of goals, get outside assistance and develop a process that is tailored to an organization's needs. Look for a partner with experience inspecting a variety of sites over a period of years. Mountaintop sites can be different from sites in urban areas or within buildings, and LMR site technologies, such as grounding and power systems, are always evolving. Make sure the partner is well versed in current industry standards and best practices, including national regulations and local building codes as appropriate. Organizations that are involved with revising these standards and that work closely with tower, shelter and power systems OEMs can also provide valuable input to the process.

If possible choose a partner that is knowledgeable about your particular context. A partner that has performed site inspections for others in your "theater of operations" will understand the technical, physical, logistical, financial and political environment, which will benefit you in two ways. First, their recommendations will be practical and implementable, not "pie in the sky." Second, they will probably have relationships with some of the LMR neighbors and can recommend site consolidation or system sharing strategies that take advantage of the entire LMR community's assets, creating win-win scenarios for all involved. They might even be able to broker an introduction or two.

The result will be a cost-effective program that mitigates funding constraints, infuses the process with standards experience and expands the trade space to increase opportunities for site consolidation and system sharing. This proactive approach will prevent many issues and lead to new capabilities and functionality. ■

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