



# APCO 1.117.1-2019

## Public Safety Communications Center Key Performance Indicators

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# FOREWORD

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# EXECUTIVE SUMMARY

Organizations employ many mechanisms to improve the quality of products or performance. Total Quality Management (TQM) focuses on improving an organization's output through continual improvement of internal practices. This structured approach to management rose in popularity in the decades following World War II, led by noted American engineer and statistician William Edwards Deming. TQM depends on measurable components, such as the Key Performance Indicator (KPI), to drive improvement. As quoted by renowned business expert Peter Drucker, "What gets measured gets managed."

Quality improvement and quality assurance intersect with TQM and have become standard components of most business models. Public agencies, including emergency communications centers (ECCs), are deploying processes and mechanisms to quantify and improve quality, integrating this business model into the public service environment. Indeed, ECC products *are services*, experienced rather than tangible; as such public perception and experience define the quality of ECC products. TQM and quality improvement are vital to public trust and outstanding service provision. APCO/NENA ANS 1.107.1.2015 *Standard for the Establishment of a Quality Assurance and Quality Improvement Program for Public Safety Answering Points*, published in 2015, provides a foundational tool for our industry.

This standard, *Public Safety Communications Center Key Performance Indicators*, provides another quality improvement and monitoring tool for ECC managers and directors. The goal of this standard is to provide fundamental key performance indicators (KPIs) inherent in all ECC work, regardless of size, services, or location. It also provides a list of conditions that allow agencies to further refine performance analysis and management, if applicable to its needs. The standard approaches this topic by:

- Designating mandatory KPIs applicable to all ECC environments;
- Documenting conditional measures that allow for more detailed root-cause analysis; *and*
- Identifying data elements necessary to complete the KPI.

Appendices to this standard provide additional resources for those new to KPI development and tracking, or for experienced users seeking to review KPI and statistical processes. Resources include:

- A reference document for national performance standards related to the ECC;
- A development model for KPI creation and agency responsibility therein;
- Data collection concepts and operational definitions of useful statistical terms;
- A “use case” showing the process of KPI development on a completed template;
- A blank template to develop a KPI;
- Glossary terms, acronyms, and abbreviations.

This standard does not specify performance measurement thresholds with which the agency must comply; ECCs will identify KPI content and thresholds specific to their needs and goals. Many nationally- and internationally- published standards exist for agency adoption (APPENDIX A); state, local, and regional best practices provide additional guidance. These resources offer detailed numeric guidelines and thresholds, depending on association or accrediting body. Individual agencies, managers, or organizations should apply the KPI processes recommended herein; to ensure success in meeting their self-identified standards.

## Chapter One

# INTRODUCTION

## SCOPE

This chapter defines the Key Performance Indicator, its use, purpose and audience.

### 1.1 What is a Key Performance Indicator?

Key Performance Indicators (KPIs) are a set of quantifiable performance measures used by a company or industry to gauge progress toward meeting their strategic and operational goals. KPI development includes **benchmarking** (identifying baseline performance or industry best-practices), setting **targets** (the desired level of performance), and **tracking progress** against that target.

This KPI Standard focuses on evaluation at the organizational level, it is not intended to evaluate individual staff performance. There are many configurations of emergency communications centers (ECC), such as call taking only, call taking and dispatch of single or multiple disciplines, primary answering point, and secondary answering point, to name a few. KPI development differs depending upon both ECC configuration and individual agency needs.

### 1.2 How are KPIs utilized?

KPIs measure various characteristics of an organization with the intent of improving operational performance. Driving forces that may require, or benefit from, a KPI include staffing analyses, training program effectiveness, and technical efficiency. For example, to justify the need for more staff, measuring a performance metric dependent on staffing levels helps determine the adequacy of current staffing levels. Call answer time is one metric used to measure appropriate staffing levels.

This standard considers both general and conditional KPIs. A general KPI measures overall performance. For example, a general KPI might examine average call answering time. A conditional KPI adds detail, or conditions, to this measure. For example, an ECC might be interested in looking at the average call answering time at different hours of the day, times of year, staffing levels, or call sources. Each condition provides additional information about performance. Conditional KPIs enable ECC management to improve operations under specific circumstances, or identify particular conditions that impact performance levels. Applying SMART principals to KPI development directs how and what to measure, and the frequency and duration of measurement. SMART goals are: Specific, Measurable, Attainable, Realistic, and Time sensitive.

### **1.3 Audience for KPIs**

Generally, KPIs are a management tool used to track and influence quality of performance. However, the outcomes of KPI tracking are used by policy and decision makers such as a Board of Directors, Municipal Council, or Government Agency/Department Executive.

### **1.4 Importance of KPIs in the ECC environment**

Public agencies must be efficient with public funds, aware of public perception, and vigilant in protecting public trust. Demonstrating the value or efficiency of investment is difficult, if not impossible, without metrics to quantify organizational effectiveness. Every public organization should strive to improve the quality of its product or service. Due to the intangible nature of ECC deliverables, applying tangible measurements provides concrete evidence of performance. These measurements possess greater validity when associated with industry standards and best practices.

### **1.5 Frequency of KPI reporting**

Typically, ECC performance metrics are measured daily, weekly, monthly, and/or annually. The weekly measures better identify seasonal trends year over year, while monthly reports provide informational data for policy and decision-making bodies. Yearly statistics may be included in annual reports or planning documents available to the public and agency stakeholders.



## Chapter Two

# EMERGENCY COMMUNICATION CENTER BEST PRACTICE KPIS

## SCOPE

This chapter provides KPIs for mission-critical functions, conditional KPI examples used to refine performance analysis, and data requirements needed for KPI measurement. KPIs are presented by core competency area of the ECC, including call taking, dispatch, technical systems, QA/QI, and administration.

### 2.1 Mission Critical KPIs

Mission Critical KPIs are general KPIs related to core functions of an ECC. Agencies should set goals based on existing industry standards, and local, regional, or state requirements. Unless specified otherwise, KPIs shall be measured monthly and annually. Monthly measurement allows ECC's to identify trends as they arise; this data may be aggregated into annual reports for organizational planning, such as budgetary planning, strategic planning, or comprehensive planning. Agencies shall formally adopt and track mission-critical KPIs as applicable to their functional responsibility.

### 2.2 Conditional KPIs

Conditional KPIs provide a more detailed view of ECC performance by including various conditions to mission critical KPIs. ECCs must identify conditions relevant to its operations. Examples of conditions include, but are not limited to: hours of day, day of week, busy hour, busy season, discipline, call source, class of service, shift, staff, priority level, protocol, and event type.

### 2.3 Call taking KPIs

#### 2.3.1 Mission critical call taking KPIs

The following mission-critical KPIs relate to call answering and call processing of voice- and non-voice calls, to and from the ECC. ECCs shall measure the following:

- 2.3.1.1 Percentage of 911 calls answered within x number of seconds;
- 2.3.1.2 Percentage of non-911 or non-emergency calls answered within x number of seconds;

- 2.3.1.3 Percentage of CAD entries, or calls for service (CFS), entered within x number of seconds from call-answer-time to available-for-dispatch time.

### **2.3.2 Conditional call taking KPIs**

Each agency should identify and measure conditions relevant to its operations. The following is a non-exhaustive list of possible conditional KPIs; some use variables identified in section 2.2, others are driven by functionality.

- 2.3.2.1 Percentage of 911 calls answered within x number of seconds by call source (such as voice or text);
- 2.3.2.2 Percentage of 911 calls answered within x number of seconds during the busiest hour of the day;
- 2.3.2.3 Percentage of alarm calls answered within x number of seconds;
- 2.3.2.4 Average talk time duration;
- 2.3.2.5 Ring time durations by call source;
- 2.3.2.6 Percentage of high-priority CFS (CAD entries) entered within x number of seconds from call-answer-time to available-for-dispatch time;
- 2.3.2.7 Percentage of total calls by event type;
- 2.3.2.8 Percentage of total calls by call source;
- 2.3.2.9 Percentage of 911 calls transferred to an outside agency (may require outgoing call data);
- 2.3.2.10 Percentage of abandoned 911 calls;
- 2.3.2.11 Percentage of abandoned calls with follow-up contact (requires outgoing call data);
- 2.3.2.12 Percentage of calls resulting in a CAD CFS;
- 2.3.2.13 Percentage of time public safety telecommunicators (PSTs) were performing call-related activities (call processing, after-call work, hold, etc.) out of the total time they were available.

### **2.3.3 Data requirements**

Useful information for measuring call taking KPIs include the follow phone system and CAD data:

- 2.3.3.1 All incoming calls, voice and non-voice;
- 2.3.3.2 Call taker ID;

- 2.3.3.3 Call source;
- 2.3.3.4 Event priority;
- 2.3.3.5 Event type;
- 2.3.3.6 Timestamps demarcating: Ring-time, answer time, hang up time, CFS creation time, call transfer time;
- 2.3.3.7 All other conditional data required for ECC KPIs.

## 2.4 Dispatching

### 2.4.1 Mission critical dispatch KPIs

The following mission-critical KPIs focus on radio-related performance, from the point a call is available for dispatch, through close of the call; including field-initiated events. ECCs shall measure the following:

- 2.4.1.1 Percentage of calls dispatched within x number of seconds;
- 2.4.1.2 Percentage of calls in which dispatcher responded to emergency (emergency alerts, mayday) activation within x seconds.

### 2.4.2 Conditional dispatching KPIs

Each agency should identify and measure conditions relevant to its operations. The following is a non-exhaustive list of possible conditional KPIs; some use variables identified in section 2.2, others are driven by functionality.

- 2.4.2.1 Percentage of high-priority calls dispatched within x number of seconds;
- 2.4.2.2 Dispatch times by call type during busy seasons;
- 2.4.2.3 Percentage of calls in which response plan was over-ridden;
- 2.4.2.4 Percentage of accurate status changes;
- 2.4.2.5 Percentage of time dispatcher airs life- or scene safety information (such as weapons, CPR in progress, hazmat on scene) when it is available;
- 2.4.2.6 Average time between entry of life- or scene safety information to transmission to field;
- 2.4.2.7 Percentage of transmissions answered within x number of seconds;
- 2.4.2.8 Percentage of status checks completed within x seconds of designated time;

- 2.4.2.9 Percentage of calls with stop traffic request completed within x seconds;
- 2.4.2.10 Percentage of calls closed with correct disposition coding or case number;
- 2.4.2.11 Incidents generated by field units versus other sources;
- 2.4.2.12 Number of on-air units per dispatch position sorted by discipline;
- 2.4.2.13 Call pending time by priority.

### **2.4.3 Data Requirements**

Useful information for measuring dispatch KPIs include the following CAD and logging recorder data:

- 2.4.3.1 Number of status checks recommended by CAD timers;
- 2.4.3.2 Number of officer emergency alerts, mayday activations;
- 2.4.3.3 Number of CAD calls with all statuses included;
- 2.4.3.4 Number of traffic stop calls;
- 2.4.3.5 CAD Information for service for the period;
- 2.4.3.6 Number of Unit ID logs;
- 2.4.3.7 Recordings pertinent to the KPI metrics;
- 2.4.3.8 Radio System Activity Logs.

## **2.5 Technical Systems Functionality**

This section focuses on the operation of technical systems, measuring reliability of information systems, equipment, software, back-up systems, and continuity of operations processes.

### **2.5.1 Mission Critical Technical Systems KPIs**

The following mission-critical KPIs focus on technical systems health, including location information accuracy, system availability, reliability, redundancy, call delivery, and continuity of operations. The ECC shall measure the following:

- 2.5.1.1 Accurate location information received for x% of all calls for service;
- 2.5.1.2 Phase II information is available within x seconds for all wireless calls;
- 2.5.1.3 Map (MSAG/GIS) updated x times per year;

2.5.1.4 The following communications systems are available x% of time:

- Phones,
- CAD,
- Radio,
- Alerting;

2.5.1.5 x% of calls are successfully delivered from CPE to console;

2.5.1.6 x% of calls transferred to ECC are successfully received;

2.5.1.7 Back-up procedures completed within x minutes;

2.5.1.8 Mission critical services restored within x minutes;

2.5.1.9 Time from outage to readiness of back-up systems is x minutes;

2.5.1.10 Back-up systems are tested x times per month, to include:

- Generator,
- UPS,
- Back up phone systems,
- Back up radio systems,
- Back up alerting systems;

2.5.1.11 Load testing completed x times per month;

2.5.1.12 Phone trunks are busy less than x% of time;

2.5.1.13 CAD system unavailable x% of time overall;

2.5.1.14 Radio system is available x% of time overall.

## 2.5.2 Conditional technical systems KPIs

Each agency should identify and measure conditions relevant to its operations. The following is a non-exhaustive list of possible conditional KPIs; some use variables identified in section 2.2, others are driven by functionality.

2.5.2.1 Accurate location data received for x% of calls by wireless provider;

2.5.2.2 Accurate location data received for x% of all calls by class of service

2.5.2.3 Mission critical systems are down x% of time due to planned outages;

2.5.2.4 Mission critical systems are down x% of time due to unplanned outages;

- 2.5.2.5 Mission critical systems fail due to elevated stress on system x times;
- 2.5.2.6 Mission critical systems remain operational during system stress of x (agency must identify threshold);
- 2.5.2.7 Phone trunks are unavailable x% of time due to outages;
- 2.5.2.8 Phone trunks are unavailable x% of time due to network and or hardware maintenance;
- 2.5.2.9 Phone trunks are unavailable x% of time due to unplanned outages such as network cable cut;
- 2.5.2.10 CAD system unavailable x% of time due to system maintenance;
- 2.5.2.11 CAD system unavailable x% of time due to unplanned failures;
- 2.5.2.12 CAD system operating below optimal level x% of time overall;
- 2.5.2.13 CAD system operating below optimal level x% of time due to network or software issues;
- 2.5.2.14 Radio system unavailable x% of time due to system busies;
- 2.5.2.15 Radio system, or portion of the radio system, unavailable x% of time due to system maintenance;
- 2.5.2.16 Radio system, or portion of the radio system, unavailable x% of time due to unplanned outages;
- 2.5.2.17 Alerting system unavailable due to system busies x times during reporting period;
- 2.5.2.18 Alerting system unavailable x% of time due to system maintenance;
- 2.5.2.19 Alerting system unavailable x% of time due to unplanned outages;
- 2.5.2.20 Load testing completed under varying conditions and stress levels x times within reporting period.

### **2.5.3 DATA REQUIREMENTS**

Data requirements for technical systems KPI measurement include:

- 2.5.3.1 ALL information for all calls, including conditions specific to ECC KPI needs;
- 2.5.3.2 Number of map updates;
- 2.5.3.3 Number of changes affecting map, GIS data, or MSAG;
- 2.5.3.4 Timestamps for all technical systems, identifying the following demarcation times:

- Testing begins/ends,
- Trouble begins/ends,
- System out of service,
- System restored to service,
- Back-up system engaged/disengaged;

2.5.3.5 Measures of demand put on system during load testing;

2.5.3.6 Total number of calls received by CPE;

2.5.3.7 Total number of transfers.

## 2.6 Quality Assurance/Quality Improvement Program (QA/QI)

This section focuses on core competencies of a QA/QI program.

### 2.6.1 Mission critical QA/QI KPIs

The following mission critical KPIs focus on QA/QI system administration, these KPIs do not apply to individual QA performance goals. The ECC shall measure the following:

2.6.1.1 X% of calls for service shall be reviewed for call taking, radio, and CAD performance;

2.6.1.2 Agency shall provide QA feedback within x number of days of call handling;

2.6.1.3 Agency shall sample x% or x number of calls per week;

2.6.1.4 Agency shall maintain x% of calls within each compliance level;

2.6.1.5 Calls falling below x% compliance level trigger remediation.

### 2.6.2 Conditional KPIs

Each agency should identify and measure conditions relevant to its operations. The following is a non-exhaustive list of possible conditional KPIs; some use variables identified in section 2.2, others are driven by functionality:

2.6.2.1 Agency reviews x number of calls within each discipline;

2.6.2.2 Agency reviews x% of high-priority or high-acuity calls;

2.6.2.3 Agency maintains x% of calls within compliance level, categorized by shift;

2.6.2.4 Agency maintains x% of calls within each compliance level, categorized by busy hour;

- 2.6.2.5 Agency maintains x% of calls within each compliance level, categorized by trainer or trainee role;
- 2.6.2.6 Agency maintains x% of calls within each compliance level, categorized by Emergency Rule activation;
- 2.6.2.7 Agency maintains x% of calls within each compliance level, categorized by discipline;
- 2.6.2.8 Agency maintains acceptable compliance levels for each competency reviewed.

### **2.6.3 DATA REQUIREMENTS**

Useful information for measuring QA/QI KPIs include the following data:

- 2.6.3.1 All incoming calls for the performance period from which to select the sample to be measured, categorized by:
  - Police Responses,
  - Fire Responses,
  - EMS Responses;
- 2.6.3.2 Phone and radio recordings for sampled calls;
- 2.6.3.3 Associated CAD notes for sampled calls.

## **2.7 Administrative Functions**

This section focuses on overall organizational functions, including organizational characteristics inherent in most business and non-profit environments.

### **2.7.1 Mission Critical Administrative KPIs**

The following mission-critical KPIs focus on organizational administration. Topics include budget performance, strategic planning, staffing, training, customer service, public information and public education. The ECC should measure the following:

- 2.7.1.1 Agency's budget utilization does not exceed x% of annual allocation;
- 2.7.1.2 Agency reviews x% policies and procedures within specified time frame;
- 2.7.1.3 Agency maintains a retention rate of x%;
- 2.7.1.4 Agency conducts exit interviews of x% of non-probationary employees to determine causes for turnover;
- 2.7.1.5 Agency completes APCO RETAINS workload analysis every x number of years;
- 2.7.1.6 Agency meets pre-determined Supervisor-PST span of control x% of time;



- 2.7.1.7 Agency strives to hire and/or promote a diverse workforce, setting a goal for x% diversity across age, gender, ethnicity, and in leadership roles;
- 2.7.1.8 Agency ensures staff completes x hours of training within x timeframe;
- 2.7.1.9 Agency ensures staff complies with certification requirements within the specified timeframe;
- 2.7.1.10 Agency ensures staff complies with continuing education requirements to maintain certification;
- 2.7.1.11 Agency investigates x% of all complaints received;
- 2.7.1.12 Agency does not exceed x number of corroborated complaints per year, or x% of total call volume;
- 2.7.1.13 Agency responds to public information requests within requirement x% of the time;
- 2.7.1.14 Completes public information request within x number of days;
- 2.7.1.15 Completes required documentation x% of the time;
- 2.7.1.16 Agency conducts x number of public education events annually;
- 2.7.1.17 Agency updates social media posts at least x times within a time frame;
- 2.7.1.18 Agency engages in media outreach x number of times per year.

## **2.7.2 Conditional Dispatching KPIs**

Each agency should measure and identify conditions relevant to its organizational needs. The following is a non-exhaustive list of possible conditional KPIs; some use variables identified in section 2.2, others are driven by functionality

- 2.7.2.1 Agency documents mutual aid, notification, or other interagency coordination activities x% of time;
- 2.7.2.2 Agency's budget amendments do not exceed \$x or x% of budget;
- 2.7.2.3 Agency's overtime and staffing budgets do not exceed \$x or x% above allotted amount;
- 2.7.2.4 Agency may review x% vendor contracts for cost and service prior to expiration or renewal dates;
- 2.7.2.5 Agency establishes pre-determined levels of training in multiple disciplines or areas of knowledge;
- 2.7.2.6 Agency requires employees to create x% of department training;

- 2.7.2.7 Agency tracks complaints by outcome—uncorroborated, corroborated, and unable to determine;
- 2.7.2.8 Agency tracks complaints by source—internal, member agency, and general public;
- 2.7.2.9 Agency tracks complaints by discipline;
- 2.7.2.10 Agency compares complaints by shift, supervisor, PST;
- 2.7.2.11 Agency ensures senior employees spend x time mentoring younger employees and sharing professional knowledge;
- 2.7.2.12 Agency examines the amount of mission-critical communication received and reviewed by staff, striving for 100% communication 100% of the time;
- 2.7.2.13 Agency strives to engage x% of employees in professional development, such as career progression tracks/continuing education beyond typical CDE tracks;
- 2.7.2.14 Agency reviews turnover for non-probationary vs. probationary employees;
- 2.7.2.15 Agency reviews turnover by shift, supervisor, amount of time in position;
- 2.7.2.16 Agency reviews span of control by hour, day, shift, and year over year.

### **2.7.3 Data Requirements**

Data required for measuring Administrative KPIs include:

- 2.7.3.1 Data collected from budgetary software;
- 2.7.3.2 Vendor list;
- 2.7.3.3 List of all systems/software/technology used;
- 2.7.3.4 Policy manuals;
- 2.7.3.5 Professional standards list;
- 2.7.3.6 Number of new hires;
- 2.7.3.7 Number of exit interviews;
- 2.7.3.8 Number of total employees;
- 2.7.3.9 Total staff training hours;
- 2.7.3.10 Training programs available;
- 2.7.3.11 Number of employees engaged in professional development;

- 2.7.3.12 Staff-years in position;
- 2.7.3.13 Number of hours spent working with newer staff;
- 2.7.3.14 Number of communiques disseminated;
- 2.7.3.15 Number of communiques acknowledge;
- 2.7.3.16 Number of staff within protected class groups;
- 2.7.3.17 Number of all applicants;
- 2.7.3.18 Number of protected class groups applying for positions;
- 2.7.3.19 Number of protected class groups hired or promoted;
- 2.7.3.20 Number of employees at each employment level;
- 2.7.3.21 Supervisor to subordinate ratio;
- 2.7.3.22 Number of complaints;
- 2.7.3.23 Total call volume;
- 2.7.3.24 Number of customer surveys sent out;
- 2.7.3.25 Number of customer surveys returned;
- 2.7.3.26 Number of public education events;
- 2.7.3.27 Number of social media posts;
- 2.7.3.28 Number of media outreach occurrences.

## Appendix A

Emergency communications centers are typically a collection of various functions and responsibilities that require multiple technical systems, access paths, output paths, applications, policies and procedures. The complexity of the environment has resulted in multiple associations and organizations – local, regional, and national— which establish and publish performance standards related to emergency communications centers. This standard expects agency leadership to establish the KPI goals and objectives. It provides direction on key performance indicators and how to collect the data required to measure them but does not establish numeric thresholds. Due to the absence of numeric goals, this document recommends the following resource. ECC managers are encouraged to research the site for performance standards and thresholds when establishing their agency KPIs.

According to 911.gov, “The National 911 Program's mission is to provide federal leadership and coordination in supporting and promoting optimal 911 services.” Among other projects, the Program continually monitors and compiles a collection of documents, website links, and other tools vetted by industry experts. This resource offers a single point of access to many national standard-setting agencies that define the public safety industry and ECC performance (<https://www.911.gov/national911coordination.html>).

# APPENDIX B

## KPI Development

### SCOPE

This chapter provides a working model of KPI development. It identifies the steps agencies must take to identify, define, track, review, and analyze the KPI; then provides one example. This process does not follow a set formula, nor is it the only way to develop KPIs and gather data.

#### 1. Background

Due to the role that KPIs play in the trajectory of an organization, the ECC must carefully develop and execute the KPI process. The drive to utilize KPI measures in making organizational improvements reflects the ECC's priority to serve internal and external stakeholders, most importantly the public.

Identifying and developing tools, processes, and reports can be a daunting task. It is important to look at the KPI process cyclically, with a focus on planning and review. The KPI process is fluid, intended to meet varying needs and be continually improved. ECCs should engage in creating KPIs that reflect the ECC's own distinct goals and resources. What may be considered successful for a well-staffed and well-funded ECC may be unrealistic for a smaller agency with fewer resources.

#### 2. Examples and Uses

If an ECC has an accreditation goal (i.e. ISO Ratings, CALEA, CAAS), the ability to measure 911 answer times may be important to achieving this requirement or goal. Other uses for answer time metrics include meeting contract standards, governmental oversight, budgeting, or staffing purposes. Downstream impacts to *not* reviewing this measurement may result in a department not achieving accreditation or budgeting too many or too few resources for staffing.

Within ECC operations, 911 answer time metrics allow for a comparison of staffing levels between shifts, days, weeks, or months, and may be used to review public safety telecommunicator (PST) workload or overtime needs. Downstream impacts to *not* reviewing this measurement operationally may be overworked PSTs, poor employee morale, poor customer service, or a negative media story.

### 3. Phases of Development

This standard recommends that ECCs include the following phases and steps in their KPI development process.

#### a. Planning Phase

- i. Establish the objective for analysis,  
*Example: Ensure proper staffing levels, improve customer service, achieve accreditation;*
- ii. Operationalize the objective and create the KPI;
- iii. Select observable, measurable criteria to represent the goal, then create an actionable, measurable statement,  
*Example: Customer service is identified in number of internal and external complaints over x period;*
- iv. Establish a baseline measure of the current status,  
*Example: Current customer satisfaction measures (average complaints per month) identify poor customer service and do not fit the agency's mission;*
- v. Identify the measurement goal(s) of the KPI;
- vi. Identify the measurement that ensures the goal is being met,  
*Example: Improve customer service scores by 10% over the next 12 months; or maintain a customer service satisfaction level of less than four complaints per month;*
- vii. Establish logistics—the who, what and how of gathering, compiling and analyzing KPIs,  
*Example: What data is required? Where do we get the data? Who is responsible for collecting, analyzing, reporting? Duration of measurement? Time interval? What must be removed to ensure a clean dataset?*

#### b. Execution Phase

- i. Measure data to identify the current conditions;
- ii. Continue to collect data at specified time intervals;
- iii. Compare results of periodic data to KPI goals;
- iv. Develop strategies to improve performance.

#### c. Analysis/Reporting Phase

- i. Validate the accuracy of the data;
- ii. Reporting inaccurate data results in negative consequences as well as lack of confidence and trust in the process;
- iii. Prepare data in reports or other useful forms to inform initial objective;
- iv. Use the data for decision making or improvements.

#### d. Review Phase

- i. Review process;
- ii. Identify the need to improve either the KPI or the operational goal and make necessary changes.

#### 4. Use case

The following is a completed template to assist in the creation of a KPI, intended for reference only. A blank copy of this form may be used by Agencies to develop their own KPI (Appendix C).

### Process for Development of a Measure

**Name of Measure:** 911 Answer Time

Form Completed by: NAME

**Objective of Measure:** Accurately measure the time it takes for the Public Safety Telecommunicator to answer all 911 calls that arrive in our center.

**Operational Definition of Measure:** The ECC will utilize the operational definition provided by NENA (National Emergency Numbers Association). As defined by NENA, the call answer standard for 9-1-1 Calls arriving at the ECC reflect that 90% of all 9-1-1 calls shall be answered within ten (10) seconds during the busy hour (the hour each day with the greatest call volume). Ninety-five percent (95%) of all 9-1-1 calls should be answered within twenty (20) seconds.

**Sampling and Measurement:** Method of Measurement will be utilization of the MIS data to reflect the number of calls answered within 10 seconds divided by the total number of 9-1-1 calls received AND the number of calls answered within 20 seconds divided by the total number of 9-1-1 calls received.

Strategy for Sampling or Grouping Data: MIS Report

Frequency of Measurement: Monthly

**Administration:**

Task

Responsibility/Alternate

Making Measurements:

Name/Alternate

Collecting Data:

Name/Alternate

Developing Charts:

Name/Alternate

Getting Data and Chart in Vector Report: Name/Alternate



# APPENDIX C

## KPI Development Template

1. **Name of Measure:** \_\_\_\_\_

Form Completed by: \_\_\_\_\_

2. **Objective of Measure:**

\_\_\_\_\_  
\_\_\_\_\_

3. **Operational Definition of Measure:**

\_\_\_\_\_  
\_\_\_\_\_

4. **Sampling and Measurement:**

\_\_\_\_\_

Strategy for Sampling or Grouping Data: \_\_\_\_\_

Frequency of Measurement: \_\_\_\_\_

5. **Administration:**

<u>Task</u>	<u>Responsibility/Alternate</u>
Making Measurements:	_____
Collecting Data:	_____
Developing Charts:	_____
Getting Data and Chart in Vector Report:	_____

# Appendix D

## DATA SOURCES, COLLECTION AND PREPARATION

### SCOPE

This chapter provides some key concepts for collecting data and offers operational definitions of statistical measures used in data analysis.

#### 1. Determining a Data Set

Develop business rules for selecting the data set upon which a KPI will be measured -- business rules, in this sense, are the requirements that define the operations, definitions, and constraints applicable to the dataset. They include determination of the system(s) in which data reside, contain detailed specifications to ensure consistency in data collection, and provide clarity in processes for collectors and analyzers.

ECC management should conduct a regular review of business rules, validating them against current operational procedures. When systems are replaced, or new systems added, agencies should revisit business rules and data specifications. Most data sources in the ECC environment are designed around operations, not reporting. The business rules will need to account for extraneous types of information that might exist in the system (i.e. test events). The following information is provided for consideration when working to identify business rules and data sets relevant to KPIs for the agency. It is meant as a starting point and is not all encompassing.

Developing KPIs requires a good data set that contains all the elements necessary to create the measures. Here are some things to think about when developing the data set using call answer time as an example:

- a. Carefully think about how to operationalize the performance measures. How do you measure call answering time? One element of this measure is when a call comes into the call center. What is the indicator of when a call comes into the call center? Is it the first ring on the caller's end or the first ring on the call center's end? What calls should be included? All calls (since emergent calls could come in on the admin line) or just 9-1-1 calls?
- b. Is the data set "clean"? What do you do with calls that have missing or bad data (e.g., due to some system glitch or downtime or whatever can cause bad data)? What do you do with outliers (e.g., long calls in which the PST forgot to close the case, or a lengthy call such as a homicide)?

- c. Make sure the data is in a useful format; translate time stamps into hour of day; determine how to calculate durations and events that crossover midnight for example.
- d. Is there data you need but are not currently collecting? How can you get that data? If you cannot get that data, is there a different way to measure the KPI?

## **2. Answer Time Performance- When gathering data from phone and recording systems, some points to consider include:**

- a. What system information indicates an incoming phone call?
- b. How will abandoned calls be used in metrics?
- c. In what format(s) are call times stored in (i.e. date/time stamps, seconds, milliseconds)?
- d. Do date/time stamps need to be converted based on time zone, crossing midnight or daylight savings time?

## **3. CAD CFS Entry Time Performance – When gathering data from CAD, some points to consider include:**

- a. Are there test events in the live system? If so, how can they be effectively eliminated from the data population?
- b. Are there multiple agencies in CAD? If so, which ones should be part of the data population?
- c. Do CAD user agencies have dispatch groups? Which dispatch groups should be included? Are there special dispatch groups that are not part of the initial dispatch that should be eliminated from the data population?
- d. How are CAD events initiated? (i.e., phone call from public, officer-initiated events, ASAP to PSAP) Which events belong in the data population?
- e. Do all event attributes exist in one table in the CAD database? Do attributes need to be combined from other tables? If the latter, has the data retrieval method been tested and reviewed to verify agreement with the intended data population?
- f. Have events been eliminated that do not meet criteria for the intended data population?

## **4. Useful Summary of Statistical Terms**

This section provides introductory explanations of statistical elements used to craft KPIs.

- a. Average

- Definition: As used in this document, the average is a central number used to describe the middle number of data set.
  - Calculation: An average is determined by adding all values of the data set and dividing by the number of items in the data set.
  - Example: In a data set of [1, 2, 5, 8, 9, 10, 14], the average value is '7' ( $1 + 2 + 5 + 8 + 9 + 10 + 14 = 49 / 7 = 7$ ).
  - Relevance: Averages are useful for setting and measuring performance in organizations, understanding peak volume times for staffing, and communicating emergency call center performance with the public. For example, computing the average cost per call (Total Call Volume / Budgetary Expenses) allows an ECC to properly budget for changes in staffing levels.
- b. Maximum**
- Definition: As used in this document, maximum refers to the largest number in a set of data.
  - Example: In a data set of [1, 2, 5, 8, 9, 10, 14], the maximum value is '14'.
  - Relevance: Maximums are often used as an ongoing internal metric of performance; and to identify potential staffing, technical, or external issues. For example, monitoring the maximum call answer time at a regular interval can identify time periods where staffing is inadequate, a technical issue is preventing proper call routing, or when a potentially catastrophic event is in progress.
- c. Median**
- Definition: As used in this document, median refers to the middle number in a sorted list of values. It is the exact middle number of a dataset, where half the values are the same or higher than that number, and the remainder are the same or lower than that number.
  - Example: In a data set of [1, 2, 5, 8, 9, 10, 14], the median value is '8' since there are 3 values less than 8 and 3 values greater than 8. When an even number of values are present, take the average of the middle two values as the median. In a data set of [1, 2, 5, 6, 8, 9, 10, 14], the median value is '7' ( $6 + 8 = 14 / 2 = 7$ ).
  - Relevance: Average values can be skewed by outliers (extreme large or small values in a dataset). Employing median values in conjunction with averages leads to a better understanding of the central tendency when data is not symmetric. For example, use both the median and average to best understand call taker performance for a period where 7 calls were answered within x seconds as follows: 1, 3, 3, 4, 5, 5, 48. The average answer time is 9.9 seconds ( $1 + 3 + 3 + 4 + 5 + 5 + 48 = 69 / 7 = 9.857$ ), while the median answer

time is 4 seconds (4 is the midpoint of the data with 3 higher values and 3 lower values). The outlier time of 48 seconds skews the average and may indicate further issues to investigate.

**d. Minimum**

- Definition: As used in this document, minimum refers to the smallest number in a set of data.
- Example: In a data set of [1, 2, 5, 8, 9, 10, 14], the minimum value is '1'.
- Relevance: Evaluation of minimum values provides an ECC with insight to potential performance capabilities. For example, if an ECC has a KPI to dispatch 75% of Priority 1 calls in 60 seconds or less but finds that the minimum dispatch time they are able to achieve is 55 seconds, the ECC should evaluate the achievability of this KPI, and consider if modifications (i.e., staffing, definition of Priority 1 events) need to be made.

**e. Percentage**

- Definition: A subset's proportion of the total set expressed as a fraction of one hundred. Calculation: Calculate the percentage by dividing Value A (the numerator, or subset) by Value B (the denominator, or whole set).
- Example: If an ECC takes 200 calls and 190 of those calls are answered within ten seconds, then 95 percent ( $190/200 = 0.95 * 100 = 95$ ) of the ECC's calls are answered within ten seconds.
- Relevance: Many ECC KPIs require computation of percentages. Examples include percent of calls answered in a set amount of time or percentage of time resources are unavailable. When computing percentages, care should be taken to carefully define the entire population of relevant items (denominator) and the number in that population that meets the criteria for computation (numerator).

**f. Percentile**

- Definition: As used in this document, the percentile describes the percent of values in the data set that fall below a given value.
- Calculation: The percentile is calculated by dividing the amount of values that are equal or less than value by the amount of values in the data set.
- Example: In a data set of [1, 2, 5, 8, 9, 10, 14], the value of '10' falls in the 86th percentile as six of the seven values in the data set fall at or below that value.
- Relevance: ECC's may make staffing decisions based on the expected amount of calls during a given period. Staffing based on the median amount of calls indicates the ECC may be adequately staffed to handle workload fifty percent

of the time. Staffing at the 90th percentile will ensure the ECC can handle the work ninety percent of the time.

**g. Range**

- Definition: As used in this document, the range is the difference between the highest, or maximum, value (Value X) in a set of numbers to the lowest, or minimum, value in that same set of numbers (Value Y).
- Calculation: Calculate the range by subtracting Value Y from Value X.
- Example: If the highest value in a data set is 20 and the lowest value is 2 then the range of the data is 18.
- Relevance: Range gives the analyst a sense of the disparity in the data set.

**h. Ratio**

- Definition: As used in this document, the ratio is an expression of how one set of items (Value C) compares to another set of items (Value D).
- Calculation: A ratio is expressed by dividing Value C by Value D so that it is determined how many of items of Value C there are for every one of Value D, it may be show as C/D, or C:D.
- Example: If an ECC has 15 dispatchers and 3 supervisors, then the ratio of dispatchers to supervisor is 5:1.
- Relevance: Staff to supervisor ratio, or span of control, is a commonly used measure for evaluating effective organizational structure. Optimal span of control varies by organization; it may be determined by supervisor experience, nature of the work being performed, and experience of the employees. Continual evaluation of this metric over time allows an ECC to understand the best way to structure their workforce.

**i. Sample**

- Definition: As used in this document, the sample refers to a subset of the entire population.
- Example: 911 Call Quality Assurance processes often use a sampling of data because reviewing every call would be too onerous to accomplish on a regular basis.
- Relevance: When performing statistical analysis, sampling allows the agency to infer conclusions about the whole, based on a subset. Samples are used when it is impractical to study an entire population. There are many ways to sample data: random, systematic, convenience, cluster, or stratified. A well-designed sample removes bias in the data and drives decision making without the workload associated with reviewing an entire data population.

**j. Sample Size**

- Definition: Sample size refers to number of data points in the data set being studied.
- Example: The dataset sample size recommended by APCO for meaningful 911 Call Quality Assurance is two percent of all 911 calls for the period.
- Relevance: Identifying the appropriate sample size and makeup is important. Size is important as an inappropriately small data set may skew the results of the data analysis. In such cases, expanding the dataset provides a more accurate analysis of overall performance over time. Makeup of the sample set is also important; for example, if you are selecting a sample for QA/QI, you will want to make sure that the sample reflects the overall calls by key characteristics associated with the KPI such 911 calls.

**k. Trending**

- Definition: Trending refers to extracting patterns in data over time.
- Example: An ECC can look at hourly call volume over a series of weeks, months, or years to determine peak call volume hours, regardless of seasonality or other factors.
- Relevance: Reviewing trends over time provides an ongoing characterization of performance. Year-over-year or month-to-month trends help to identify the need for changes to budget, operations, or staffing.

**l. Utilization**

- Definition: Utilized (or utilization) refers to the amount of time a resource is being used out of the amount of time a resource is available.
- Calculation: Utilization is expressed as a percentage of total time.
- Example: If a resource is used 15 minutes out of an hour, then resource utilization is 25% ( $15/60 = .25 * 100 = 25$ ).
- Relevance: Utilization helps the agency determine proper resource allocation and staffing.

# ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
ALI	Automatic Location Information
ANS	American National Standards
APCO	Association of Public Safety Communications Officials
ASAP to PSAP	Automated Secure Alarm Protocol to Public Safety Answering Point (APCO/CSAA ANS 2.101.2-2014)
CAAS	Commission on Accreditation of Ambulance Services
CAD	Computer Aided Dispatch
CALEA	Commission on Accreditation of Law Enforcement Agencies
CDE	Continuing Dispatch Education
CE	Continuing Education
CFS	Call for Service
CPE	Customer premise equipment
ECC	Emergency Communications Center
EMS	Emergency Medical Services
GIS	Geographic Information System
HAZMAT	Hazardous Material
KPI	Key Performance Indicator
MIS	Management Information System
MSAG	Master Street Address Guide
NENA	National Emergency Number Association
NFPA	National Fire Protection Association
PSAP	Public Safety Answering Point
PST	Public Safety Telecommunicator
QA/QI	Quality Assurance/Quality Improvement
SDC	Standards Development Committee
SMART	Specific, Measurable, Attainable/Achievable, Relevant, Timely
UPS	Uninterruptable Power Supply



# GLOSSARY

**Alerting System:** Mechanism used to notify field units of a call for service.

**Availability:** Describes the time an application or system is able to be operational or conversely the time the application or system is not able to be operational.

**Average:** A calculated, central number used to describe the middle number of data set determined by adding all values of the data set and dividing by the number of items in the data set.

**Base Data Requirements:** The most basic set of data (information) needed to begin an investigation – a universal set and can be refined into more specific categories, characteristics or details to complete a given KPI.

**Call Type or Nature Code:** Computer designator given to describe the situation gathered from the calling party and relayed to first responders.

**Categorized Measurements:** Refined data set meant to provide greater insight to performance of a specific identified subset.

**Comparison Metrics:** Another view of measures that compares performance between two or more measures or the same measurement across two or more periods of time.

**Discipline:** Major public safety first-response categories: law enforcement (LE), fire and emergency medical services (EMS).

**Disposition Code:** Computer designator given to describe the outcome of the response.

**Emergency Communications Center (ECC):** Also known as public safety answering points (PSAP), ECC is the term that best describes the Next Generation public safety 911 call and dispatch center.

**Interrogation:** A set of questions designed to determine the appropriate response to a request for service.

**Key Performance Indicator (KPI):** The most elemental measures of performance related to the core competencies of the agency. KPIs are “the critical (key) indicators of progress toward an intended result”. KPIs direct strategic and operational improvement, create an analytical basis for decision making, and help focus attention on what matters most<sup>1</sup>.

**Location Accuracy:** Technical data measuring the reliability and confidence levels of a calling party's exact location.

**Maximum:** The largest number in a set of data.

**Median:** The middle number in a sorted list of values.

---

<sup>1</sup> [kpi.org/KPI-Basics](http://kpi.org/KPI-Basics)

**Minimum:** The smallest number in a set of data.

**Nature Code or Call Type:** Computer designator given to describe the situation gathered from the calling party and relayed to first responders.

**Normal [Frequency] Distribution:** A probability function that describes how values of a variable are distributed. Commonly called the “bell curve”.

**Outliers:** Data in a set of results that is very much bigger or smaller than the next nearest data point.

**Percentage:** Compares one set of items (Value A) to another set (Value B), expressed as a fraction of one hundred.

**Percentile:** Describes the percent of values in the data set that fall below a given value.

**Pre-arrival Instructions:** Life-safety instructions given to a calling party prior to the arrival of first responders.

**Priority:** Designation given to a request for service that indicates the level of urgent or emergent response required.

**Range:** The difference between the highest, or maximum, value (Value X) in a set of numbers to the lowest, or minimum, value in that same set of numbers (Value Y).

**Ratio:** An expression of how one set of items (Value C) compares to another set of items (Value D).

**Redundancy:** Term to describe backup applications or systems to the primary application or system.

**Reliability:** A measure of time an application or system is available or conversely the time the application or system is not available.

**Sample:** Refers to a subset of the entire population.

**Sample Size:** The amount of datum in the dataset being studied.

**Span of Control:** The ratio of supervision to subordinates.

**Standard Deviation:** A measure of the amount of variation, or dispersion, of a data set.

**Standard Operating Procedures (SOP):** A written directive that provides a guideline for carrying out an activity.

**Total Quality Management (TQM):** A management theory focusing on improvement of an organization’s output through continual improvement of all internal practices.

**Transfers:** Describes the action of routing a calling party from one ECC to another for processing of the request for service.

**Trending:** Refers to extracting patterns in data over time.

**Turnover:** Separation of employment.

**Utilization:** The amount of time a resource is being used compared to the amount of time a resource is available.

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