Setting the Standard for Automation™

SCADA
An Integrative Approach

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Standards

Certification

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Presenter

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  - Pharmaceuticals, Food, Bulk chemical, Laboratories, Educational facilities
  - Data centers, Power distribution and metering , Building control systems
- Employer Portfolio
  - Burgess and Niple, Earth Tech./Tyco, MSD- Louisville

Presentation Goals

- Traditional Versus Integrative Design Approach

- Features of Integrative Approach

- Trends of SCADA toward Integrative Approach

- Delivering a successful SCADA Project-KPIs

  - Project team

  - Project management

  - Communication

  - Measurement and verification

- Standards

Traditional Approach

- Design- Bid- Construction Approach
  - All team members of one firm, but seem to work in silos
  - Lack of open communication among team
  - Unclear/Unspecific project requirements and goals
  - Poor project progress documentation
  - No change control procedure
  - Award construction to the lowest bidder
  - Keep contractor responsible for total project
  - Lack of follow up after construction
    - Required Training
    - System performance
    - Verification of benefits

Integrative Approach

- Integrative Design Approach
  - Open communication and connections among design professionals
  - Synergy among the Team
  - Clear Project Definition and Management of Change
    - Goals (availability, integrity, confidentiality….), cost, benefits,…
  - Performance measurement and verification
    - Process of using measurement to determine savings of a Energy Management Program
  - Reductions in cost of ownership
    - Standards
    - Life cycle assessment
    - Life cycle cost
    - Reduce risk
    - Eliminates inefficiencies through audits
    - Sustainability goals of 21st Century
      - Energy use, environment, public infrastructure

Integrative Approach
SMART Project Management-1

- Project manager
  - Project requirements (Owner project requirements- OPR)
    - Technical
    - Financial
    - Time

- Use SMART plan
  - S for Specific
    - What is to be achieved
    - By whom
    - Where
    - And when it is to be achieved
  - M for Measurable of financial and progress parameters
    - Monitor through out the project meetings
    - Milestones reviews versus the baseline
    - Make sure that the project is on the right track towards the OPR

Integrative Approach
SMART Project Management-2

- Use SMART plan
  - S for Specific
  - M for Measurable
  - A for Attainability
    - Ensure that the requirements are attainable (Technical, Financial, Time)
    - Ensure that the team believes that it is attainable
    - Look at the man in the mirror (strength and weakness)
  - R for Relevant
    - Make sure that the team efforts are relevant to the OPR
    - Keep the focus on short term OPR requirements and then
    - The long term requirements

Integrative Approach
SMART Project Management-3

- Use SMART plan
  - S for Specific
  - M for Measurable
  - A for Attainability
  - R for Relevant
  - T for Time Based
    - Time frame the requirements
    - Time frame critical technical milestones
    - Time framing project achievements is a good motivator
    - Time framing prevents procrastination by the team
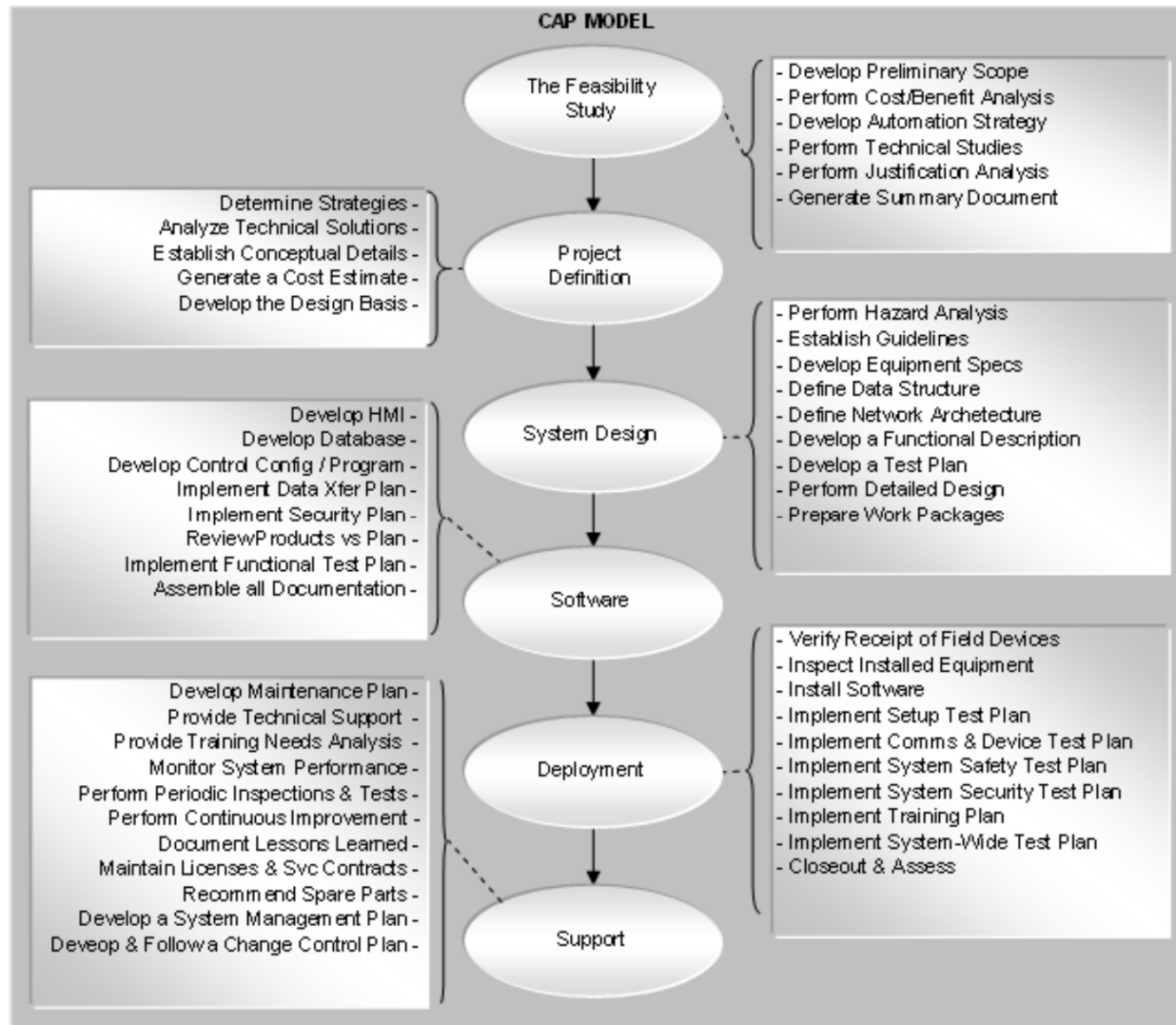
Integrative Approach
SMART Project Management-4

- Use SMART plan
  - S for Specific
  - M for Measurable
  - A for Attainability
  - R for Relevant
  - T for Time Based

- SMART plan
  - Creates awareness for the Team
  - Allows for timely execution
  - Focuses on order
  - Motivates the Team
  - Prevents costly mistakes , rework and disappointments

Integrative Approach
Project Management- Critical

- Selection of the Project Manager and the Team
- Preparation of OPR with stakeholders
- Preparation a SMART plan
- Refining of the Team
  - Roles and responsibilities
- Follow the SMART plan
- Start Project Life Cycle
  - What needs to be done
  - Assign to the best qualified entity
    - One firm
    - Multiple firms
- Measurement and verification plan

CAP MODEL

The Feasibility Study
- Develop Preliminary Scope
- Perform Cost/Benefit Analysis
- Develop Automation Strategy
- Perform Technical Studies
- Perform Justification Analysis
- Generate Summary Document

Determine Strategies -
Analyze Technical Solutions -
Establish Conceptual Details -
Generate a Cost Estimate -
Develop the Design Basis -

Project Definition

- Perform Hazard Analysis
- Establish Guidelines
- Develop Equipment Specs
- Define Data Structure
- Define Network Archetecture
- Develop a Functional Description
- Develop a Test Plan
- Perform Detailed Design
- Prepare Work Packages

Develop HMI -
Develop Database -
Develop Control Config / Program -
Implement Data Xfer Plan -
Implement Security Plan -
ReviewProducts vs Plan -
Implement Functional Test Plan -
Assemble all Documentation -

System Design

Software

- Verify Receipt of Field Devices
- Inspect Installed Equipment
- Install Software
- Implement Setup Test Plan
- Implement Comms & Device Test Plan
- Implement System Safety Test Plan
- Implement System Security Test Plan
- Implement Training Plan
- Implement System-Wide Test Plan
- Closeout & Assess

Develop Maintenance Plan -
Provide Technical Support -
Provide Training Needs Analysis -
Monitor System Performance -
Perform Periodic Inspections & Tests -
Perform Continuous Improvement -
Document Lessons Learned -
Maintain Licenses & Svc Contracts -
Recommend Spare Parts -
Develop a System Management Plan -
Deveop & Followa Change Control Plan -

Deployment

Support

Integrative Approach
# Life Cycle Assessment-1

- Life Cycle Assessment of SCADA
  - Features
    - SCADA functions and application
    - Metering for energy conservation
    - Powerful 3rd party analytical database
  - Components
    - Multiple RTUs, MTUs, Workstations
    - High Volume Storage
    - Hardened IT system
    - Meters and sensors
  - Networks
    - Islands of SCADA
    - Wired/Wireless
    - Mobile device connectivity
  - Educate the owner and stakeholders

Integrative Approach
Life Cycle Assessment-2

- Educate the owner and stakeholders
  - Involved
    - Security measures
      - Physical servers
      - Outlets
      - Cyber security
      - Sustainability of Compliance
  - Understand
    - Architecture (Basic…..Advanced)
    - Operational features and forecasted benefits
    - Analysis to improve efficiencies
      - Energy Conservation Measures
      - Reduce MTTR, Increase MTBF
  - Support
    - Continuous training
    - Continuous improvement

Integrative Approach
Life Cycle Cost

Economic Profile = Lifecycle Benefits - Lifecycle Costs
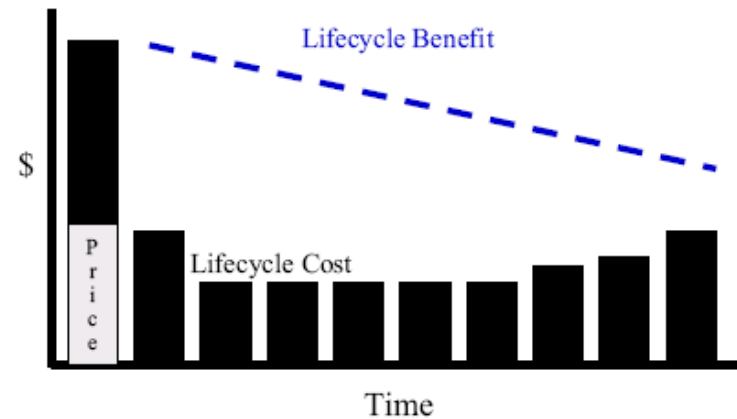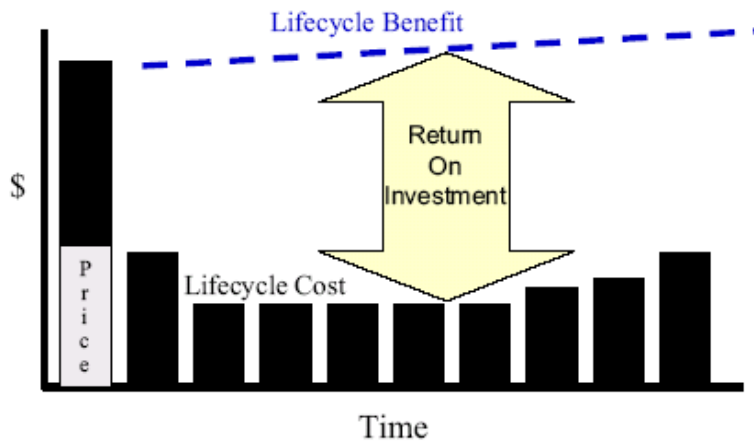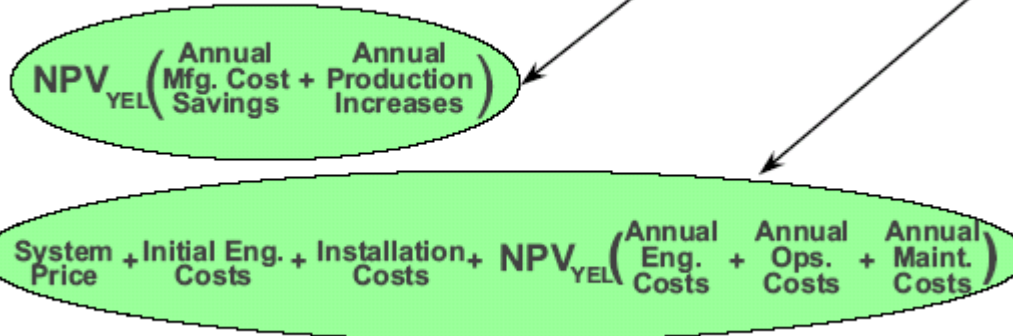
Integrative Approach
Reduce cost of ownership

- Economic profile
  - Life cycle benefits (Cost avoidance/cost savings)
    - Efficiency
    - Energy
    - manpower
    - Regulatory
  - Life cycle cost
    - Equipment price
    - Engineering design cost
      - Hardware
      - Software
    - Installation
    - Annual costs
      - Engineering upgrades
      - Operation
      - Maintenance

Integrative Approach
Reduce cost of ownership-Benefits

- Efficiency
  - Select equipment/Take Inventory
  - Establish Eff. baselines
  - 3rd party software-Modeling
  - Specialty program modules- Fine-tune
  - Track/Analysis of control strategy Eff. through Historians and
  - LOOK AT IT

- Energy
  - Select equipment or process
  - 3rd party software- Modeling
  - Specialty program modules- ECM and metering
  - Establish units of measurements
    - KW / GPM, KW/ CFM, KW/ft2, Energy cost effectiveness
  - Track/Analysis/Compare through Historians and
  - LOOK AT IT

Integrative Approach
Reduce cost of ownership-Benefits

- Maintenance
    - Create environment and attitude
    - Needed tools
    - Adequate training
    - Needed infrastructure
        - Connectivity- Wired/wireless
        - Field data (automatic or manual entry)
    - Connectivity to centralized systems
        - Calibration
        - Work order
            - Reduce MTTR
            - Increase MTBF

- Regulatory
    - Reasonable documentations through historians
    - Off-line storage

Integrative Approach
Reduce cost of ownership- Engineering

- Standards
  - Drawings
    - P&IDs, Symbols, Panels. Loops,
  - Communication protocols and media
  - Hardware components
  - IO and wire tagging scheme
  - Programming language
  - Software modules and Strategy Descriptions
  - Alarm management
  - HMI graphics
  - Security
    - Physical
    - Cyber Space
   - Sustainability of Compliance

Integrative Approach
Reduce cost of ownership- Implementation

- Contractors
  - Pre-qualify
  - Site walk through and pre- bid meeting(s)
  - Detail drawing and specification and scope
    - Hardware and installation
    - Installation details
    - Project implementation schedule
  - Construction administration and commissioning
    - Weekly inspection
    - Issues log

- Vendors
  - Pre-qualify
  - Negotiate price and long term support

- Integrators
  - Select the design engineers

Integrative Approach
Project Team

- Owner and Stakeholders
  - Management
  - Operators
  - Technicians- SCADA and IT

- Engineers/ Integrators
  - SCADA hardware and software programmers
    - PLC/RTU
    - HMI
  - Instrument
  - IT programmers for network and security

- Pre-qualified Vendors and Contractors

- General Public- Keep informed

- Government- Monitor regulations and trends

Integrative Approach
Trends in SCADA- Getting complicated?

| MTU | ⟷ | DCE | ⟷ | RTU | ⟷ | SENSORS |
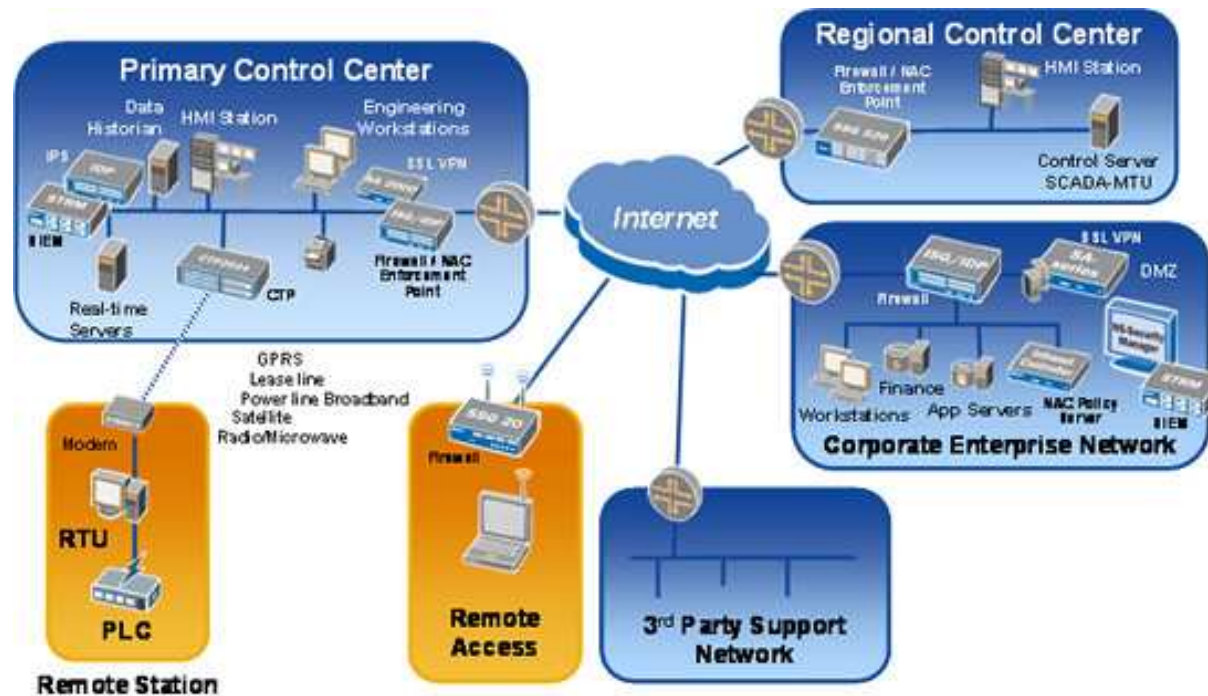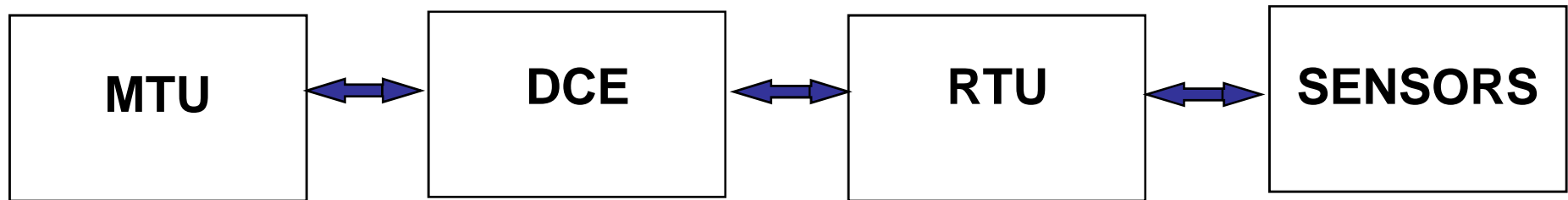
Integrative Approach
Trends in SCADA-1

- Reduce operational cost
- Efficient operation of process
- SCADA system is a specialized IT system
- Secure and hardened infrastructure
  - Physical security of servers and outlets
  - Managed switches
  - Firewalls
  - Sustainability of compliance
    - Monitor/response
    - Antivirus
    - Access control

Integrative Approach
Trends in SCADA-2

- OPC with built-in security

- OPC-UA (Unified Architecture)

- Connectivity to Smart Grid

- Secure wireless networks with encryption

- 3G enabled RTUs with security

- Speed and integrity for data

  – Fiber Optics

  – Fault Tolerance

  – Disaster recovery system

Integrative Approach
Trends in SCADA-3

- Lots of Data
  - Critical Infrastructures CCTV /Video
  - Automatic Meters -AMI
  - On site and remote storage
  - Hot swappable backup
  - Analytical 3rd party software tools
  - Analysis of data
    - Energy, PM, Downtime, Efficiency, Security, Custom reports

Control Microsystems 2010
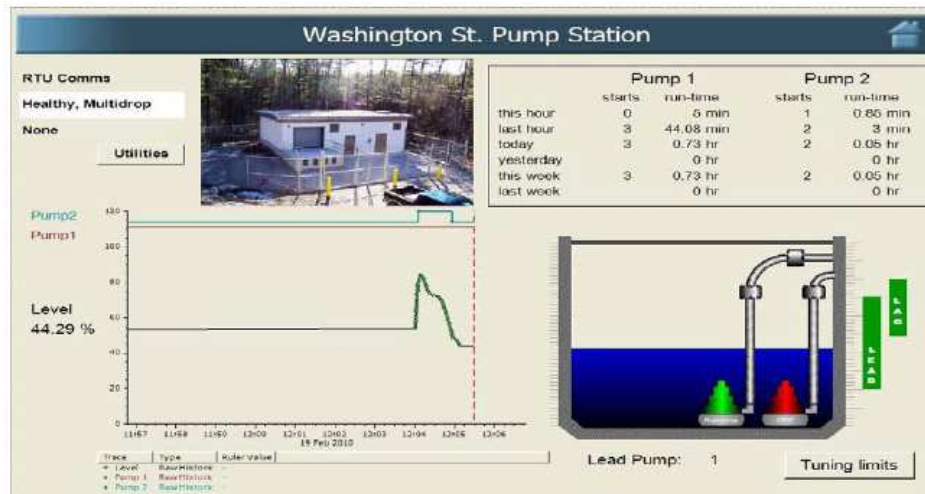
Integrative Approach
SCADA- Energy Conservation

- Recognize Energy as a Business Process
- Train Staff (Operators, Techs. Engineers, Management)
- Identify energy and operational parameters and metering
  - Plant, System, Process
  - Reduce Demand, Reduce Rates, Optimize Load Scheduling
  - Increase Motor Efficiency, Increase Pumping Efficiency, Reduce Losses
- Develop Baseline Energy models
- Plan for Measurement and Verification
- Post installation metering and modeling
- Track parameters
- Portal(s) to display Energy Usage & Savings & KPIs
- Address Deficiencies & Make Continuous Improvements

Integrative Approach
Delivering a successful SCADA Project

- Key Performance Indices
  - Project management
    - Competent project manager
    - SMART plan
    - Project life cycle
  - Communication
    - Team awareness of scope
    - Clarified roles and responsibilities
    - Documentation of meetings minutes and decision milestones
    - Continuous updates to OPR and BOD
  - Project implementation
    - Proof of concept- Reduce risk
    - Detail implementation schedule for contractor- Reduce risk
    - Prevent piecemeal efforts- Improve quality
    - Keep engineers as integrators

Integrative Approach
Delivering a successful SCADA Project

- Key Performance Indices
  - Measurement and Verification (M & V)
    - Keep engineers/integrators on board - cradle to grave
    - Start staff training early
    - M & V Plan- ECM and other measurable benefits
      - OPR and BOD
      - Quantification of benefits (Baselines and new)
        - Efficiency improvements
        - Energy savings
        - Manpower reduction
        - Additional capacity
    - Phased verification plan
      - During program development- Integration
      - During construction- CA and commissioning
      - End of construction- Commissioning
      - Post construction- M & V

Integrative Approach Standards

- ISA Standards
  - ISA 5.1, 5.06, 5.4, 5.5 (Symbols, P&IDs, Loops and functional description)
  - ISA 18 (Management of Alarm Systems for the Process Industries)
  - ISA-20 (Instrument specification forms)
  - ISA-95 (Enterprise-Control System Integration)
  - ISA-99- (Industrial Automation and Control Systems Security)
  - ISA-100- (Wireless Systems for Automation)

- International Performance Measurement and Verification Protocol
  - IPMVP- Options A-D

- ASHRAE Guidelines

"You can not manage what you do not measure."

Jack Welch, GE