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Measuring the Value of EMIS

Midwest Environmental Compliance Conference
April 11, 2018

Joshua Gardner, Trinity Consultants

Agenda

- What is EMIS?
- Identify worthiness of EMIS
- Measuring the value of EMIS
  - The EMIS implementation process
  - Building a business case
  - Estimating ROI and cost savings

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What is EMIS?

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What is EMIS?

- Environmental Management Information System
  - A partially automated information technology (IT) system that simplifies the process of data collection, recordkeeping, auditing, and reporting of EHS data at one or more facilities.
- Technology choices are abundant:
  - Commercial Enterprise EHS Software
  - Microsoft Solutions
  - Custom or In-House Solutions
- Goals for EMIS consumers: reduce costs, improve EHS information and personnel efficiency, risk reduction and mitigation

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Examples of EMIS Capabilities

Water Management

Regulatory Compliance Management

Air Quality Management

Audits and Inspections

Waste Management

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EMIS "Action Words"

- **Comply** – Track regulatory deadlines and compliance tasks through compliance calendars
- **Remind** – Auto-generate emails that remind task owners of a compliance obligation; supervisor escalation should reminder go unresolved
- **Simplify** – Streamline collection of recordkeeping data by integrating facility legacy systems, which reduces or could eliminate double data entry

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EMIS "Action Words"

- **Report** – Auto-generating environmental reports (e.g., annual emissions inventory) that match manually generated results, with less user intervention/input
- **Predict** – Create alarms that warn users when at risk of an exceedance or excursion of regulatory limits
- **Think** – Performing "what-if" scenarios and assessments

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Identify Worthiness of EMIS

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Signs of the Need for EMIS

- New requirements or regulations have increased monitoring, recordkeeping, and reporting burden
- Overlapping regulations have led to confusion
- Reduced environmental staff with the same or increased regulatory burden
- Little standardization in EHS work processes
  - Facility-to-Facility
  - Person-to-Person

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Signs of the Need for EMIS

- Overly dependent on spreadsheets that are understood by few staff members
- Loss of staff member has created a knowledge gap with respect to EHS data or processes
- Generation of regulatory reports involves the manual transcription of data from various sources

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EMIS vs Spreadsheets

EMIS		Spreadsheets
One current system of record	***Data Centralization***	Scattered and outdated
Real-time dashboards	***Reporting***	Static, cut and paste
Immediate and broad	***Visibility***	Manual and isolated analysis
Dynamic workflow	***Process***	Slow email routing
One-time entry/data feeds	***Data Accuracy***	Error-prone/re-keying
Evergreen regulatory updates	***Timely***	Out-of-date, static data
Fast and intuitive	***Ease of Use***	Complex and time-consuming

A Guide to EMIS Functions, Benefits & Trends,
The Bureau of National Affairs, Inc., 2016.

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Measuring the Value of EMIS

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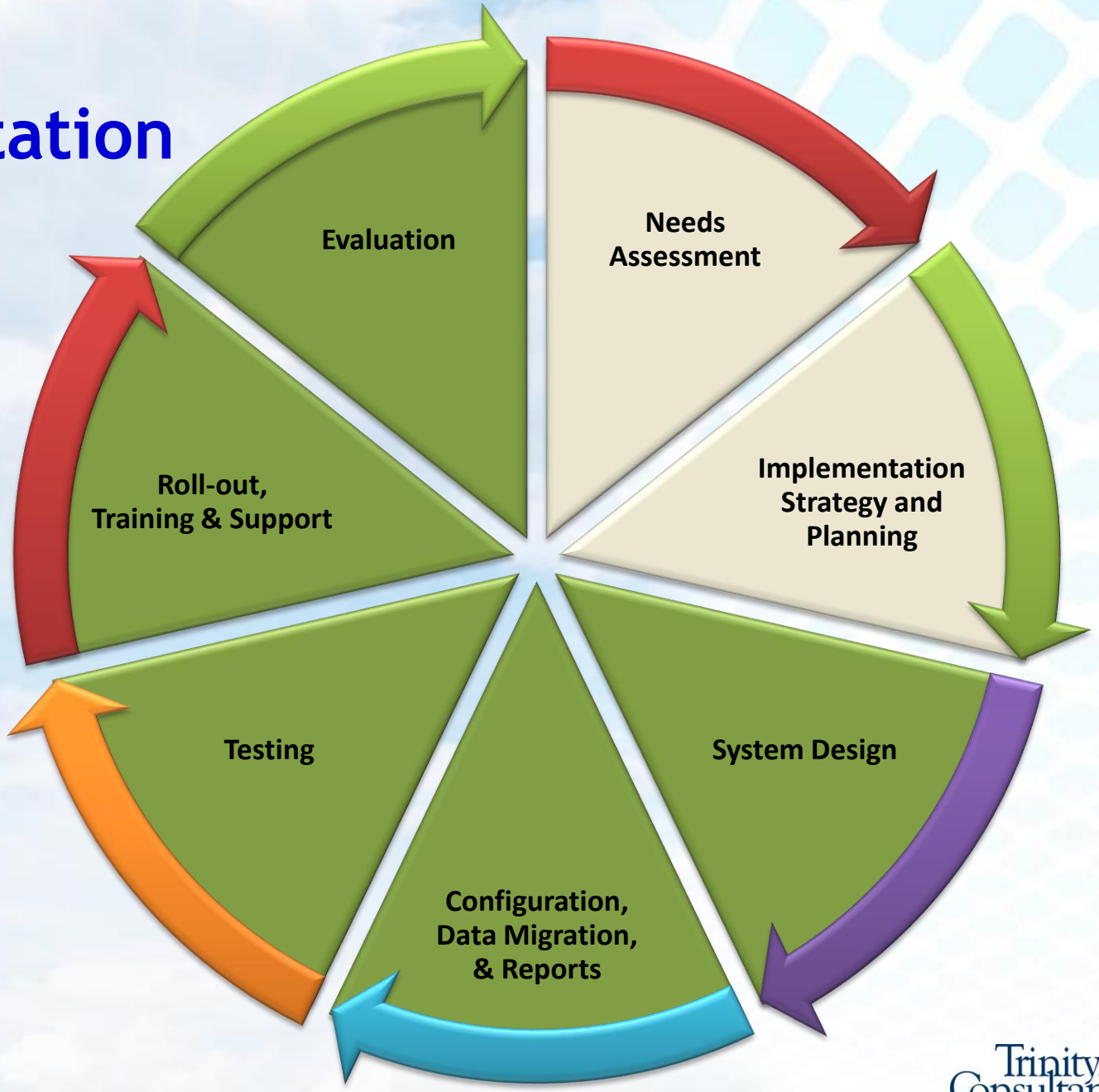
The EMIS Implementation Process



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Building a Business Case

- EMIS needs assessment
  - Identify and prioritize functional requirements “wishlist”
  - Map current and “to be” workflows
- Identify current system costs
- Scope potential EMIS solutions
  - Product costs
  - Labor costs (initial and operating)
- Identify non-economic benefits of EMIS

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Functional Requirements "Wishlist"

- Areas to consider
  - Permit compliance tracking
  - Audit findings/follow-up
  - Air emissions
  - Waste manifests/reporting
  - Corporate metrics/stewardship reporting
  - Others…
- For each area:
  - Identify detailed requirements
  - List both what is needed and what is not wanted
  - Apply prioritization ranking

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Functional Requirements "Wishlist"

Detailed View

	A	B	C	D	E	F	
1				Health & Safety Functional Business Requirements			
2		Category Name	Category Area	Functional Requirement	Application Priority	Category	Support
3		Health and Safety					
44			Ergonomic Assessment		8		
45				Follow-up Notification System	10	F	
46				Employee details and date of last assessment	10	F	
47				Interface with HR system to identify new employees and employee moves	9	I	PeopleS
48				Trigger notification to responsible groups when changes identified, document follow-up and closeout	7	F	
49				Assign case numbers which could be used in incident tracking	10	F	Ability to
50				Reports for Facility, Department, Incident Priority, Incident Evaluation	8	F	
51				Security to limit data entry and access	10	S	
52				Track History of Assessment and Actions	8	S	
53			Risk and Hazard Assessment		10		
54				Perform hazard assessment on facility or area basis of operator tasks	10	F	
55				Standardized Risk Matrix and Identify Possible Actions	10	F	
56				Document results and Flag critical risks	10	F	
57				Trigger action item for critical tasks and required documentation or training	10	F	Ability to
58				Follow-up and closeout documentation	10	F	
59				Guide risk assessment team through checklist of identifying risks for projects, capital expenditures	10	F	
60				Generates a Contingency Plan	1		
61				Generates a Risk Management Plan	1		
62			RMP/PSM		2		configur Lost Ca
63				Incident tracking status (PSM or non-PSM)	5	F	
64				Action item followups	5	F	
65				Document Management	10	F	
66				Tie in with other modules (action tracking, incident model)	10	I	

Summary View

	A	B	C	D	E	F	G
1	Environmental						
2		Compliance Tracking					10
3		Permit Tracking					7
4		Emission Inventory					10
5		GHG Emissions					10
6		Chemical Inventory					5
7		Spill and Release Reporting					10
8		Waste Reporting					2
9		Wastewater Reporting					3
10		Remediation Tracking System					7
11		Equipment Inventory					1
12							
13	Health and Safety						
14		Incident Tracking					10
15		Concern Tracking					10
16		Training Tracking					10
17		Action Tracking					10
18		Inspections and Audits					9
19		Ergonomic Assessment					8
20		Risk and Hazard Assessment					10
21		RMP/PSM					2
22		MOC					10
23		IH/Medical Surveillance					6
24		MSDS					1
25		Contractor Management					1
26							

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Mapping Workflows

- "As Is" Workflow
  - Define the current practice for accomplishing "output" (reports, compliance demonstrations, calculations, etc.)
  - Identify where data comes from, who collects, how is it processed, what is the output
- "To Be" Workflow
  - Where are opportunities for a system to streamline/improve/simplify the process?
  - Notate improvements to timing, compliance assurance, etc.
- Remember to brainstorm workflow improvements, don't limit yourself to pre-conceived software functionality!

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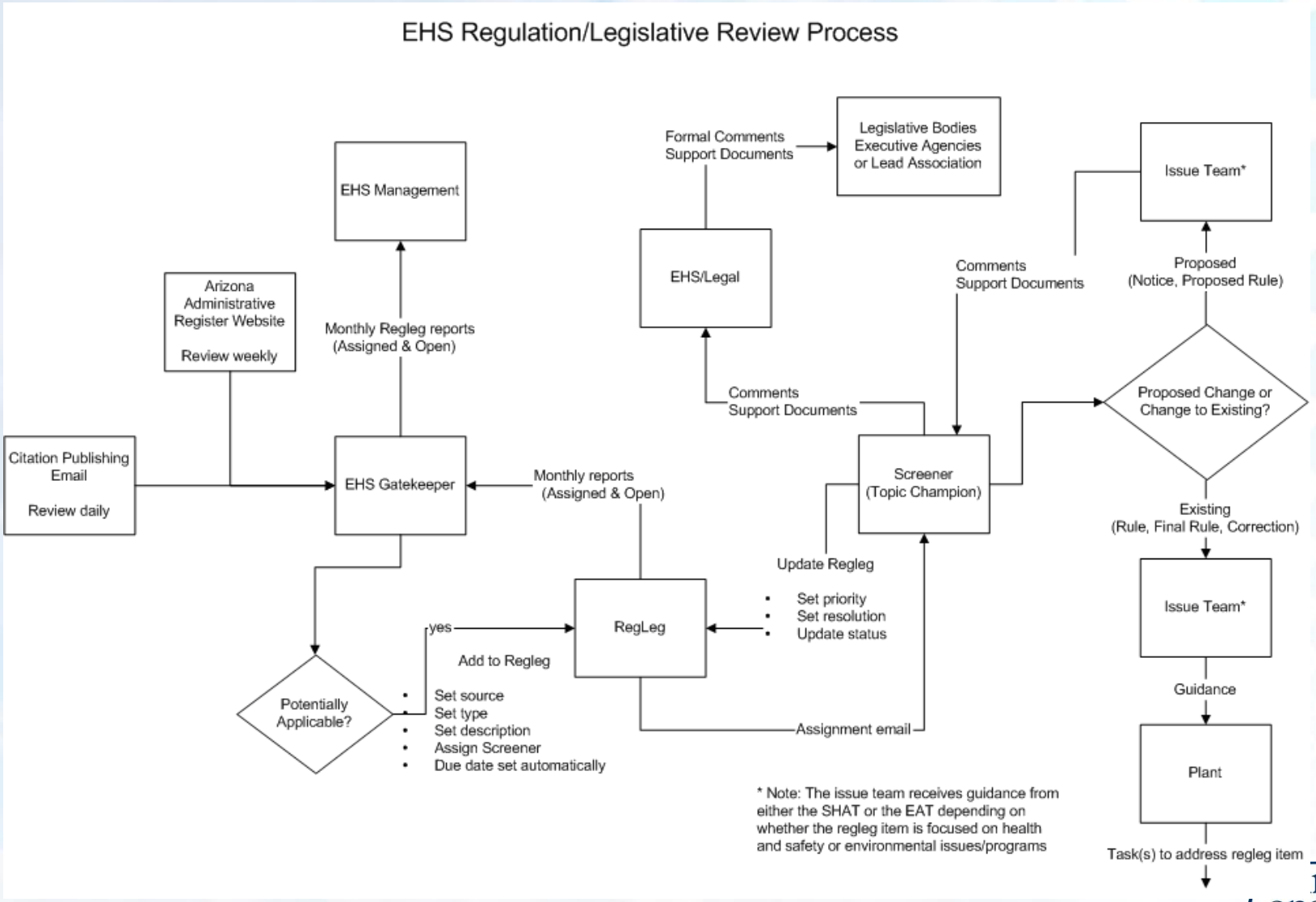
Mapping Workflows ("As Is")



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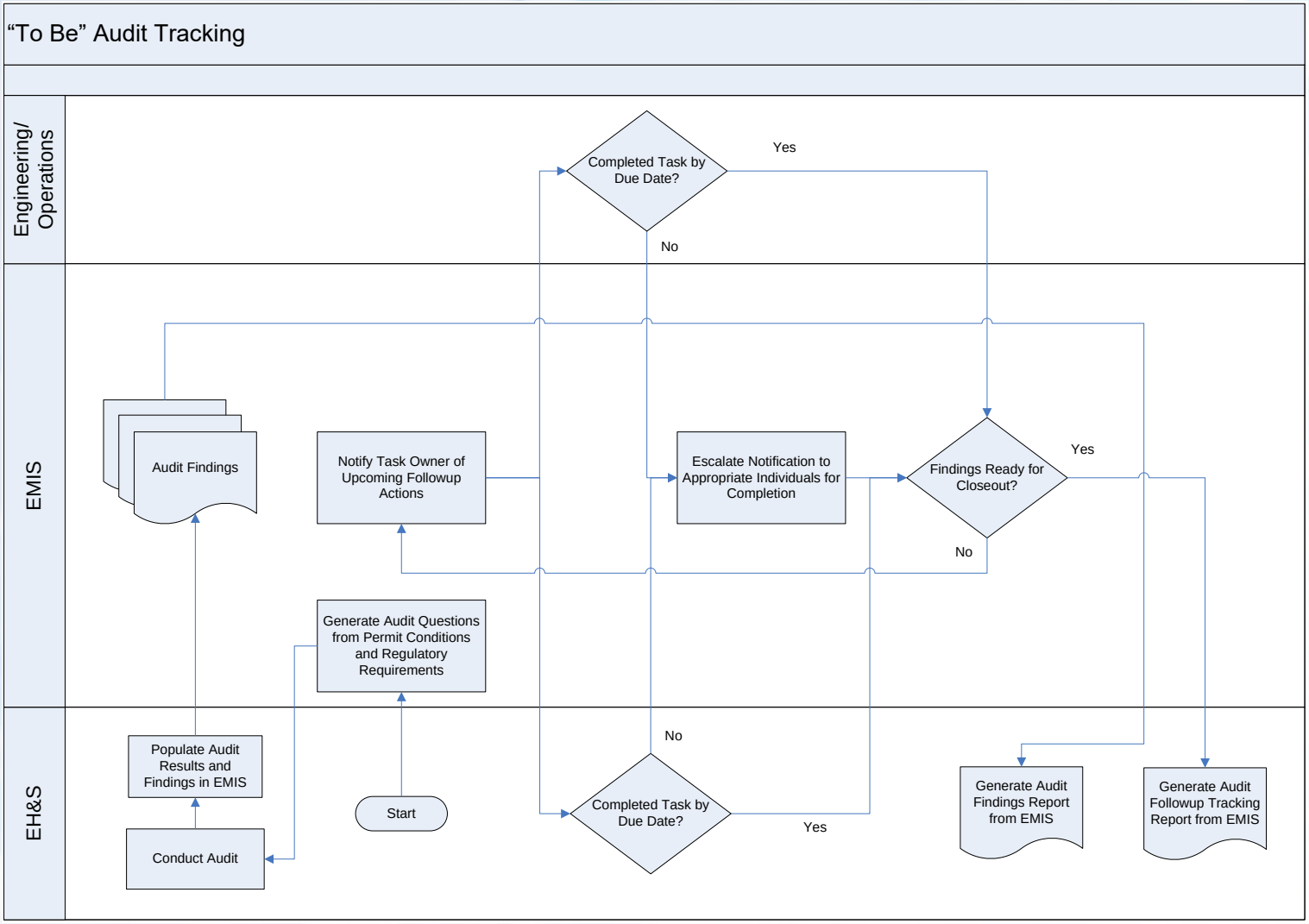
Mapping Workflows ("To Be")



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Quantify Current System Costs

- Number of personnel who handle the same data for different purposes
- Time spent gathering data from production for calculation and reporting
- Time spent auditing and reviewing data gathered and calculation methods
- Time spent updating and supporting disparate in-house legacy systems
- Time spent entering data into spreadsheets
- Time required to manually generate EH&S reports – emissions inventories, manifests, discharge monitoring reports (DMRs), toxic release inventories (TRI), etc.

Quantify Current System Costs

- Time spent tracking waste containers and storage inventory
- Time spent tracking permit changes and effective dates
- Time spent monitoring data and activities to ensure compliance with permits
- Time spent in manually tracking global GHG projects and allowances, and administrative activities such as deal origination, contracting, and invoicing for GHG credits trading activities throughout the world
- Third party auditing costs for certifying a GHG inventory

Identify EMIS Solution
Commercial Enterprise Software

- Applicable to a wide variety of customer needs
  - Environmental Compliance and Data Management
  - GHG & Carbon Management
  - Environmental Business Intelligence
  - Energy Management
  - Quality
- Typical implementation costs range from $100K - $1,000K+

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Compliance Drill Down
Help
User Prefs
Phone Log
Sustainability Dashboard
Data Compliance Dashboard
Favorites
Undo
Reset
Lock
Unlock
Zoom In
Zoom Out
Tasks & Actions Filter
Status
Due/On-Time
Task Driver
Task Subtype
Task Owner
Action
Task Calendar Filter
Due Year
Due Month
Due Day
Task On-Time Status, by Loc...
Task On-Time Status, by Month
Task On-Time Status
Task On-Time Status, by Owner
Corrective Actions
Tasks, by Task Driver
Optional Data Views
Tasks, by Subtype & Ta...
Total Tasks by Owner
Totals and Statistics
Tasks on Time
Detailed View
Task List Details
By Site
By Date
By Employee
View Resulting Details
Task List Details
ID
Task
Location
Status
Due/On-time
Driver
Subtype
Owner
Due
Done
Action
Description
13289 Wizard Facility OZ GLOBAL Closed Closed On Time - - Pam Bobbitt 11/16/07 11/16/07 - -
13290 check valve OZ GLOBAL Closed Closed On Time Incident Spill/Release Pam Bobbitt 11/08/07 11/08/07 - ensure all valves are tight
13299 JHA Review OZ GLOBAL Closed Closed On Time Corporate Pro... JHA Pam Bobbitt 12/31/07 12/31/07 - yearly review of JHA to evaluate for improvemen
13300 JHA Review OZ GLOBAL Pam Bobbitt 12/31/08 - yearly review of JHA to evaluate for improvemen
13318 Monthly Waste water sample OZ GLOBAL Pam Bobbitt 01/04/08 04/12/10 - take monthly waste water sample in accordance
13319 Monthly Waste water sample OZ GLOBAL Pam Bobbitt 01/04/08 - take monthly waste water sample in accordance
13321 ERT Box Check OZ GLOBAL Open Overdue Emergency ... ERT Boxes Pam Bobbitt 04/02/11 - bi-annual check of contents in ERT Box
13322 MSDS Review OZ GLOBAL Open Overdue Corporate Pro... MSDS Pam Bobbitt 02/06/08 - monthly review of MSDS metrics
13323 MSDS Review OZ GLOBAL Open Overdue Corporate Pro... MSDS Pam Bobbitt 03/05/08 - monthly review of MSDS metrics
13325 Monthly Waste water sample OZ GLOBAL Cancelled Cancelled Permit Water Pam Bobbitt 02/01/08 - take monthly waste water sample in accordance

Identify EMIS Solution
Microsoft Solutions

- Excel
  - Extensively used within industry
  - Features that can be exploited for automation
- SharePoint
  - Compliance tracking and notifications
  - Integration with Outlook
  - EHS Work Flow Management
  - Simple Dashboards
- Access
  - Desktop database
  - Previously popular in developing custom solutions
- MS SQL Server / Oracle
  - Microsoft's standard database

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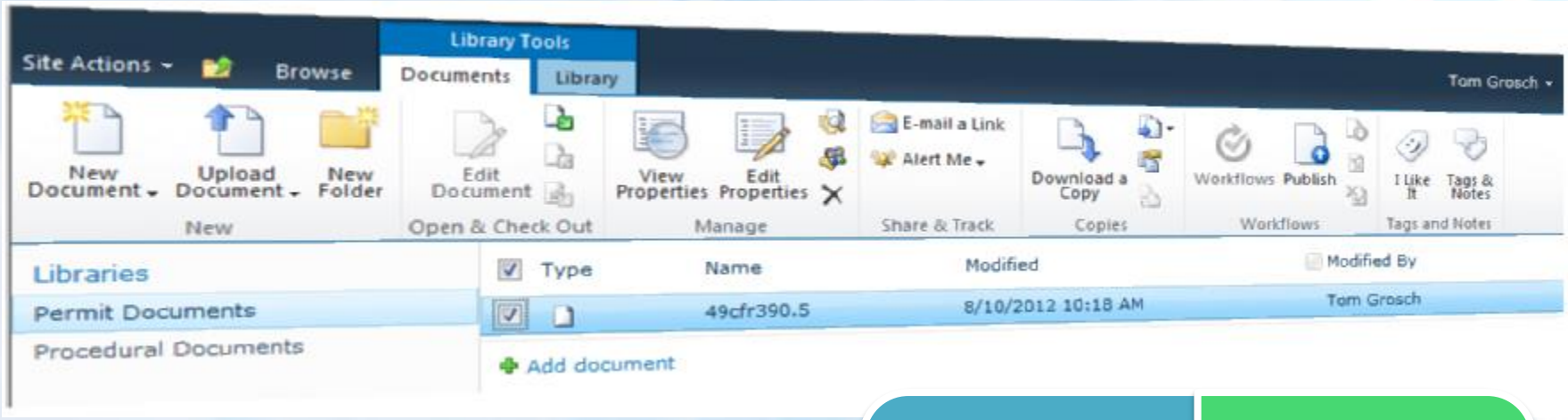
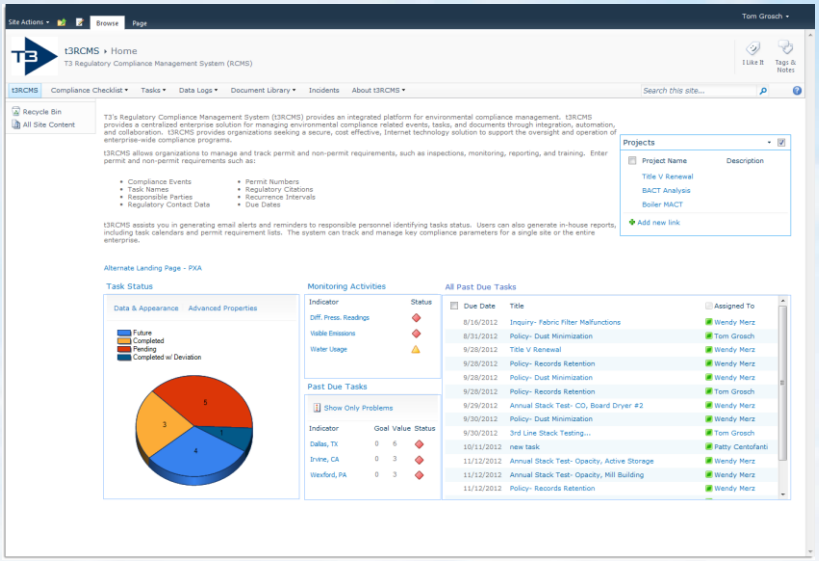
Identify EMIS Solution

Microsoft Solutions





Compliance Tasks, Corrective Actions, Audit Program Management

Documents, Procedures, Records Control System

Communication Collaboration, Workflow, Email Notifications

Data Collection, Dashboard, Legal Reporting

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Identify EMIS Solution
Custom Solutions

- Mobile technology
  - Visible Emissions Management (VEMS)
- Custom or specialized databases
  - TankESP, SANGEA
- Enhanced spreadsheets
  - Trinity Tanks Tool, LARK-TRIPP

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ROI and Cost Savings (1 of 4)

- Return on Investment (ROI) = ([Gain on Investment] – [Cost of Investment]) / [Cost of Investment]
- Internal Rate of Return (r)
  - Set NPV = 0 and solve for r

$$NPV = \sum_{t=1}^{n} \frac{C_t}{(1+r)^t} - C_0$$

Where:

C_t = net cash inflow during the period t
C_o= total initial investment costs
r = discount rate, and
t = number of time periods

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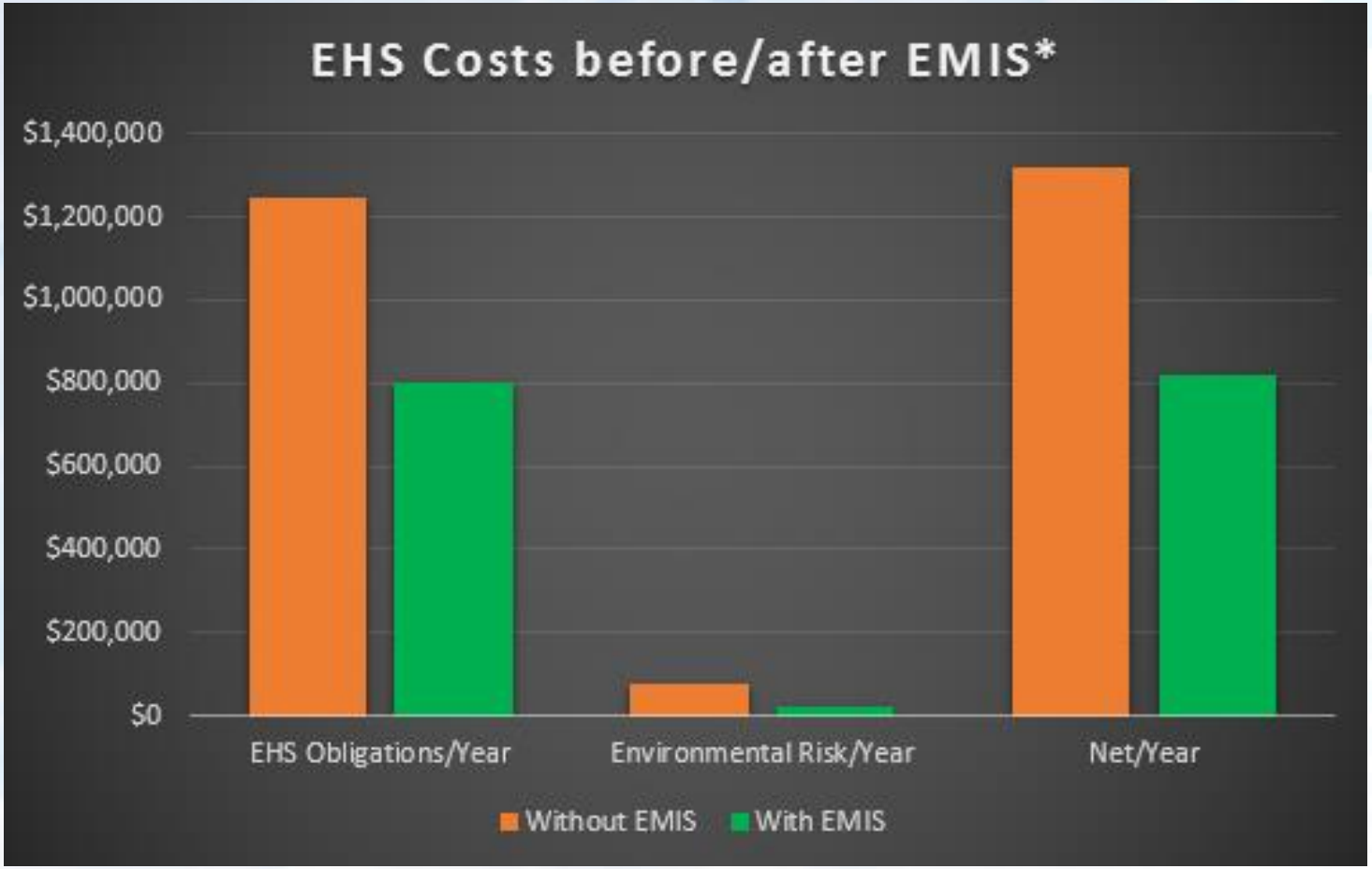
ROI and Cost Savings (2 of 4)

Example Chemical Facility – ROI = 38%



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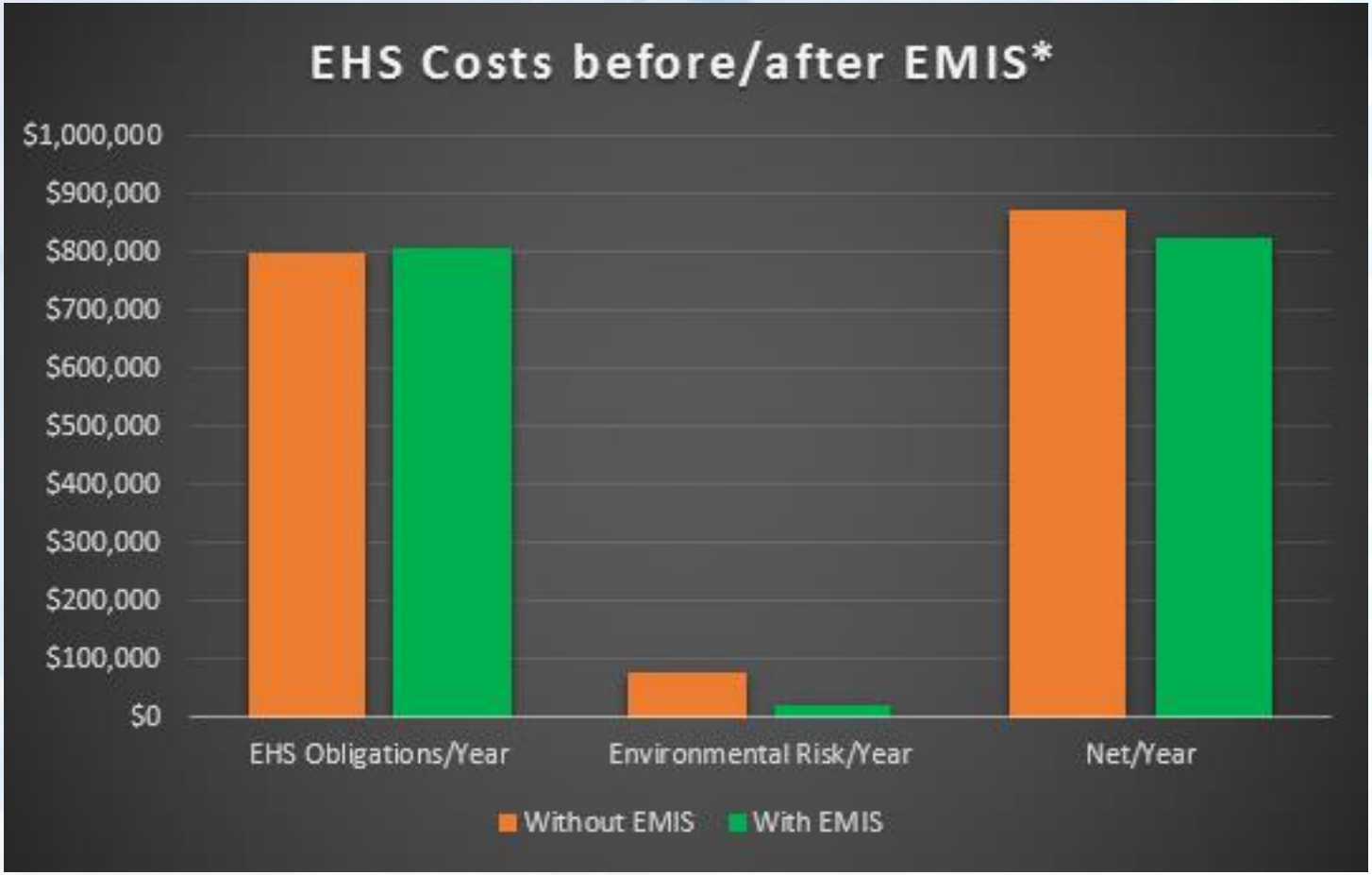
ROI and Cost Savings (3 of 4)

Example Gen Manufacturing Facility – ROI = 6%



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ROI and Cost Savings (4 of 4)

- Other hard to quantify benefits of an EMIS include:
  - Reduce corporate risk and liabilities
  - Avoid new hires and/or re-deploy human resources
  - Higher production output due to improved environmental data visibility
  - Better customer and supplier relationships
  - Higher brand value

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Key Takeaways

- Understand current processes and their underlying “costs”
- What future state will make changing to EMIS worth the effort?
- Identify the correct EMIS solution
- Quantify “as-is” and “to-be” costs and generate ROI, IRR, or other assessment of investment
- Third-party software may not be the correct decision for all cases
- If you determine EMIS is right for you, find the right partner (vendor, consultant, colleague, etc)

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Comments/Questions

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Bonus Case Study

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EMIS Implementation Case Study

Regulatory Compliance and CEMS Reporting Using an EMIS

Presentation Objectives

- Provide overview of project: drivers, evaluation, requirements, outcomes
- Review of process approach
- Explore critical challenges: technology and other external factors

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Project Background - Business Case

- Refinery operations in the U.S. subject to Refinery MACT, NSPS J requiring rigorous CEMS and excess emissions reporting
- As part of refining consent decree agreement with EPA, facility required to notify “immediately upon detection” when an excess emissions event occurred

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Evaluating Existing Options

- DCS/Process Historian
  - Availability of results to operations critical to managing event avoidance
  - Complexity of emissions would lead to a difficult to maintain solution
  - **Requirements around data validation not supported within existing tools**
- Spreadsheet
  - Data volume requirements exceeded supported Excel versions (Excel 2003)
  - **Supportability and maintenance of change seen as primary deterrent**

Criteria for Environmental Management Information System Approach

- Justification for seeking external solution dependent on ability to deliver the following:
  - "Near real-time" calculation of emission (at least every 15 min)
  - Direct interface to process historian for automated extraction of CEMS concentrations and additional process data
  - Rigorous data validation to determine data status and document malfunctions, calibrations, CMS downtime, unit downtime
  - Aggregation of rolling averages for compliance determination and excess emission events within 24 hr rolling window
  - Feedback to process historian to present results back to operations

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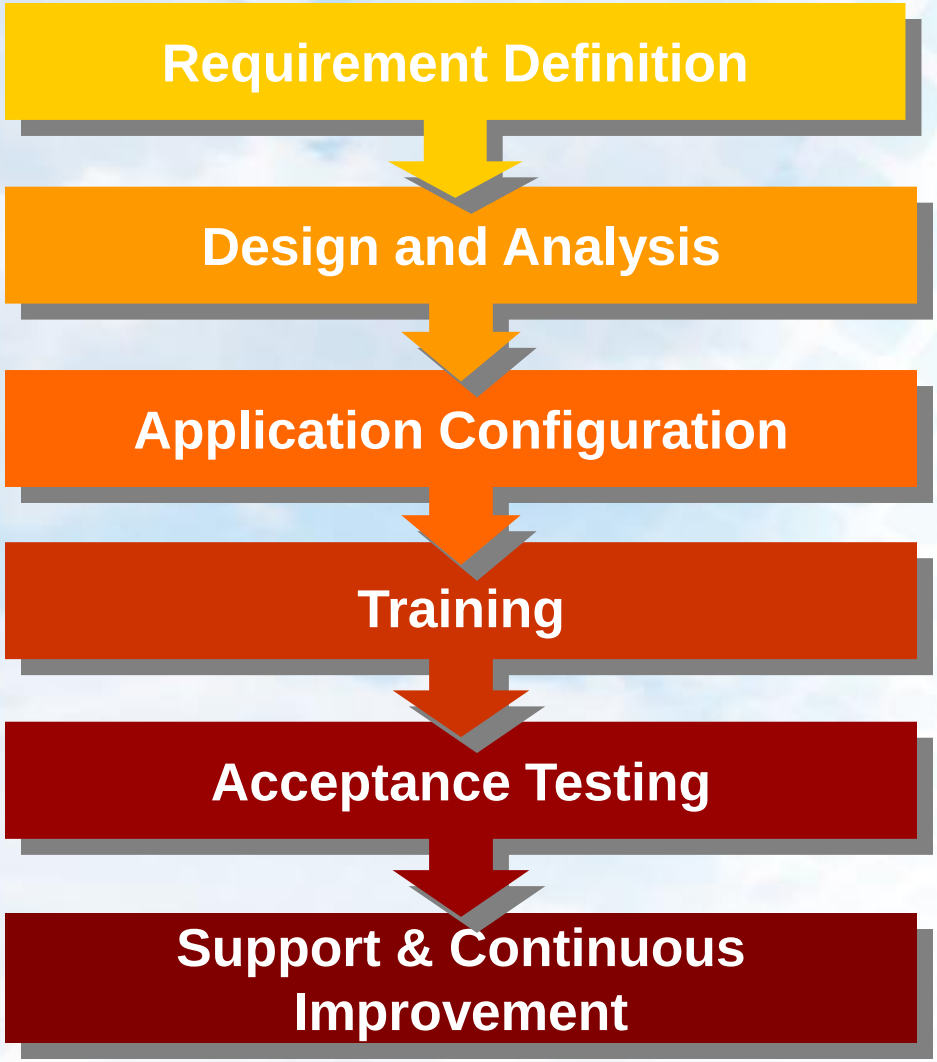
EMIS Life-Cycle Process



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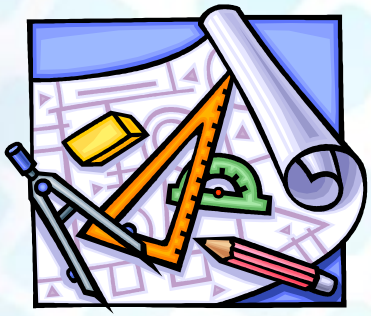
Requirements Definition



- System Selection
  - Conducted workshop to fully define system/business requirements
  - Documented and prioritized outcomes
  - Defined standard demonstration criteria for vendors
  - Evaluation of 7 vendor-provided solutions
  - Selection based on best-fit and tactical considerations
- Design Pre-work
  - Develop measurable “Success Criteria”
  - Establish project team, roles, communication channels

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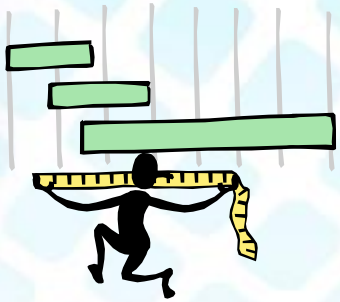
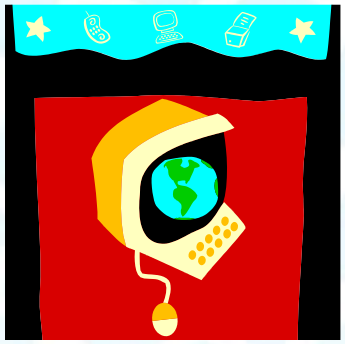
Requirements and Success Criteria



- Refining Process Sources (FCCU/WGS, TGIs, BRU, Acid Gas Flare), Combustion Heaters/Furnaces
  - Emission calculations on hourly and rolling basis
  - Malfunction, startup, and shutdown determinations
  - Limit comparisons and notifications
- Additional sources, limits, and calculations can be added and/or modified per system functionality by EHS users

Web Interface Requirements



- Role-based security
- Manage tags
- View/manage errors
- Data substitution
- Manual scheduled requests
- Edit/update equations
- Manage factors and constants
- Query results/execute standard reports

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Reporting Requirements

- Standard Reports: formatted reports pre-configured to meet specific output needs
  - Exceedance summary reports
  - SSM event reports
  - Analyzer “alarm” tag summary
  - CEMS status summary
  - Audit reports
- Ad-hoc reporting query engine to allow users to output hourly results of any tags or calculations managed in the system
- Users only required to specify date ranges for reports to run
- Results can be saved to PDF output for hard-copy recordkeeping

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Other Key Requirements

- Hourly calculation results written back to historian for long-term record retention and operator control panel display
- Email notifications of limit alerts and changes made within the system
- Role-based security controls and grants access to various features in the system
- Automated “catch-up” capability to accommodate historian outages

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Design and Analysis

- Rigorous review with engineers and environmental staff to define calculations and methodology
- System interface and functionality design
- Detailed workflow of data gathering, validation, averaging, and calculation activities
- Create a living document of accepted methodology for delivering against acceptance criteria
- Test cases developed for each aspect of the system

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Design Outputs for Review

- Detailed calculation definition, review, and signoff process

EQUATIONID	PLANT	AREA	PROCESSPLANT	EQUATIONNAME	DESCRIPTION	EQUATION	UOM	COMMENTS	EFFECTIVEDATE	AUDITNAME	AUDITTIME
17	0	6	22	CE10204	NSR EDMS N Incinerator SO2 at 0% O2	A11456*(20.9/(20.9-A11459))	ppmvdc	Formula EEE - SO2 at 0% O2	9/1/2008 0:00	NA\RJENKS	
18	0	6	22	CE10205	NSR EDMS N Incinerator Total Mass Emissions of SO2	CE10203*CE10204*(ME99202/ME99203)/1000000	LB/HR	Total Mass Emissions of SO2	9/1/2008 0:00	NA\RJENKS	
20	0	6	22	CE10206	N Incinerator TGCU Maximum Next Hour SO2 Concentration Limit	(ME11027*12)-(CE10224*11)	ppmvdc	TGCU Maximum Next Hour SO2 Concentration Limit	9/1/2008 0:00	NA\RJENKS	
23	0	6	22	CE10207	Incinerator TGCU Excess Mass Emissions of SO2	IF CE10225 > ME11027 THEN CE10243 * (CE10225-ME11027) * ME99202 / ME99203 / 1000000 ELSE 0	LB/HR	TGI Excess Mass Emissions of SO2	9/1/2008 0:00	NA\RJENKS	
27	0	6	22	CE10208	Incinerator Tail Gas Incident (TGI) Detection	IF CE10227>ME11028 then 1 else 0 * if CE10228>0 then 1 else 0 * IF CE10229=0 then ME99208 else CE10207	LB/HR	Tail Gas Incident (TGI) Detection	9/1/2008 0:00	NA\RJENKS	
28	0	6	22	CE10209	Incinerator Stack Flowrate MSCFH (from existing South incinerator)	F11315		Incinerator Stack Velocity, feet per second (from existing South incinerator);	9/1/2008 0:00	NA\RJENKS	##########

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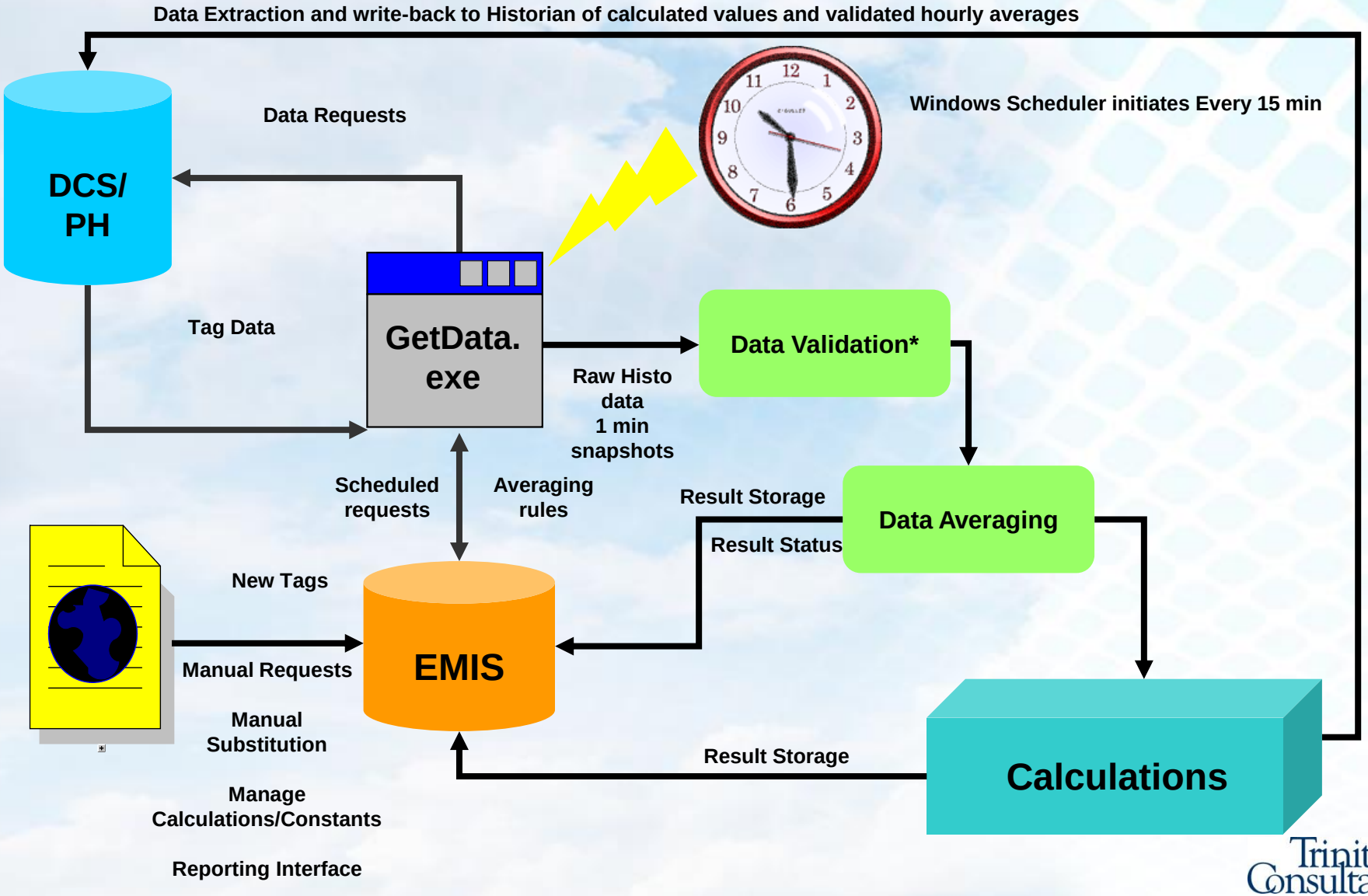
Application Configuration Design



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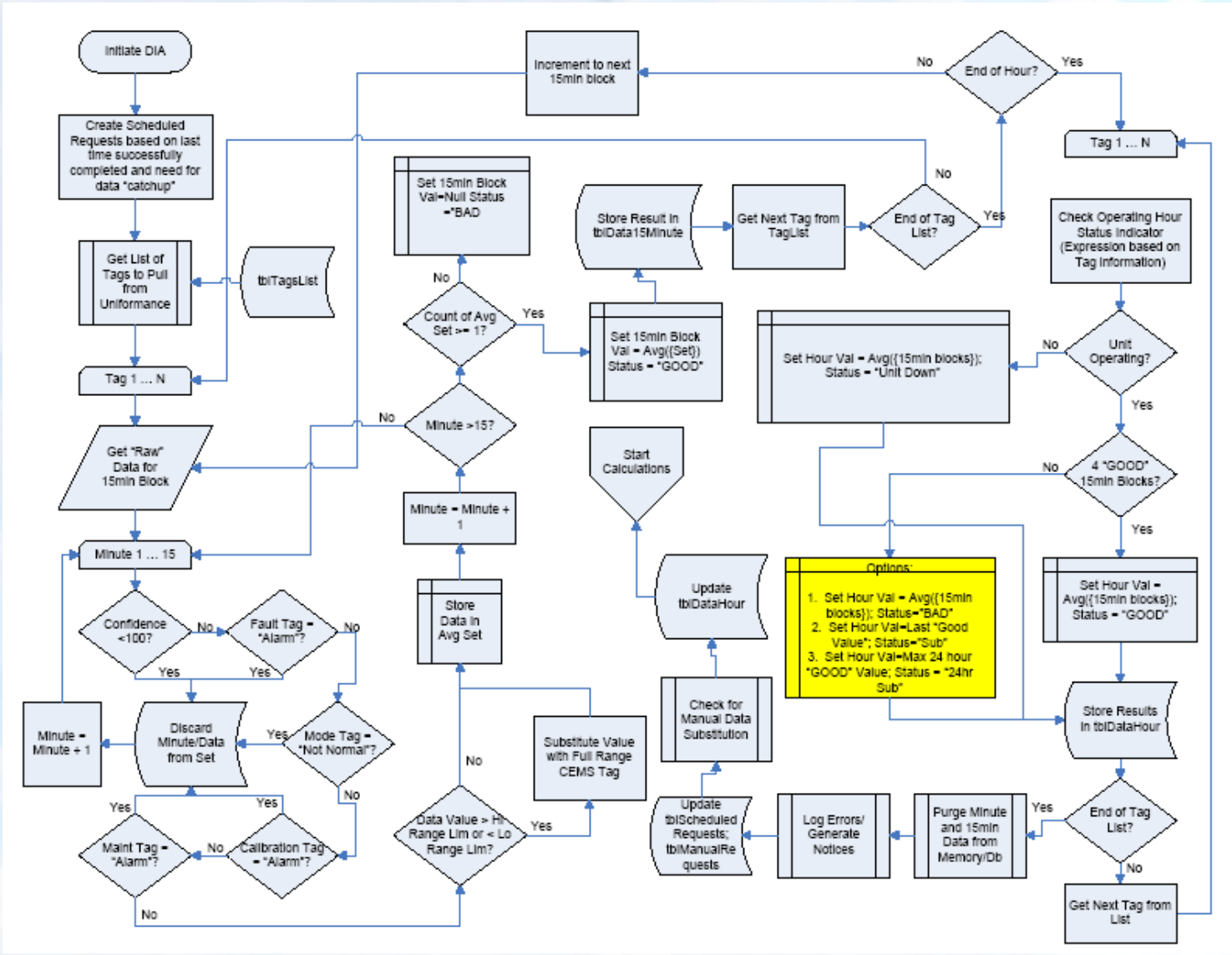
Requirement Outcomes - Workflow



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Application Configuration

- Execution of design documentation developed in prior phase
- Work with site team to flesh out details and make users familiar with system interface
- Weekly status meeting critical to maintain flow of information and showcase application as it develops

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Training

- End User Training and Documentation (~½ day)
  - Focused on “simple” and routine activities common to high-volume of users
    - Basic navigation
    - Responding to notifications
    - Running reports/ad-hoc queries
- Power User Training (~1 ½ days)
  - More detailed training covering work flow process for functionality and report output management
  - More advanced, atypical activities
    - Creating new emissions sources
    - Modifying calculations
    - Creating notifications
    - Interfacing with process historian

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Acceptance Testing

- Site-led verification/execution of test scripts
- Site resource leads will review via hands-on system evaluation
- Document findings and comments for re-configuration
- Sign-off on delivery of requirements

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Support and Continuous Improvement

- Manage transition from project team to support team
- Adopt and use system
- Communication through user role network to build support and identify / manage global issues

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Results

- Successful delivery of application in-time to begin compliance initiation date
- Training and reference materials provided to “core” users – about 20 environmental and engineering resources
- Practical and “real” use of the live system within 10 days of startup – plant upset as new process equipment brought online

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Project Challenges

- Complex calculations
  - New equipment, operations in support of enhanced CEMS reporting requirements led to numerous re-workings of the calculation methodology
- Uncertainty of Information
  - As new systems were going on-line, data availability was literally days before system training and testing
  - Difficult to account for “unusual” data situations (bad data from O2 sensor resulted in calculations of negative emissions!)
- Volume of data (~35,000 records per 15 minutes) made proper QA and analysis

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Project Successes

- Communication plan was rigorous enough to facilitate high volumes of change and ensure project team and end-users were in alignment throughout the project
- Adherence to the project methodology and strong management support was critical to the overall success
  - Fully defined requirements prior to initiation
  - Design detailed enough to flesh out potential issues that would have arisen at compliance date
- The system delivered what was asked and data collection, calculation, and notifications were automated!

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Key Takeaways

- Example of a real-world example of EMIS solving a data, reporting, and compliance issue for a facility
- Key elements (and need of) of the full EMIS project methodology highlighted throughout the engagement

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Questions

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