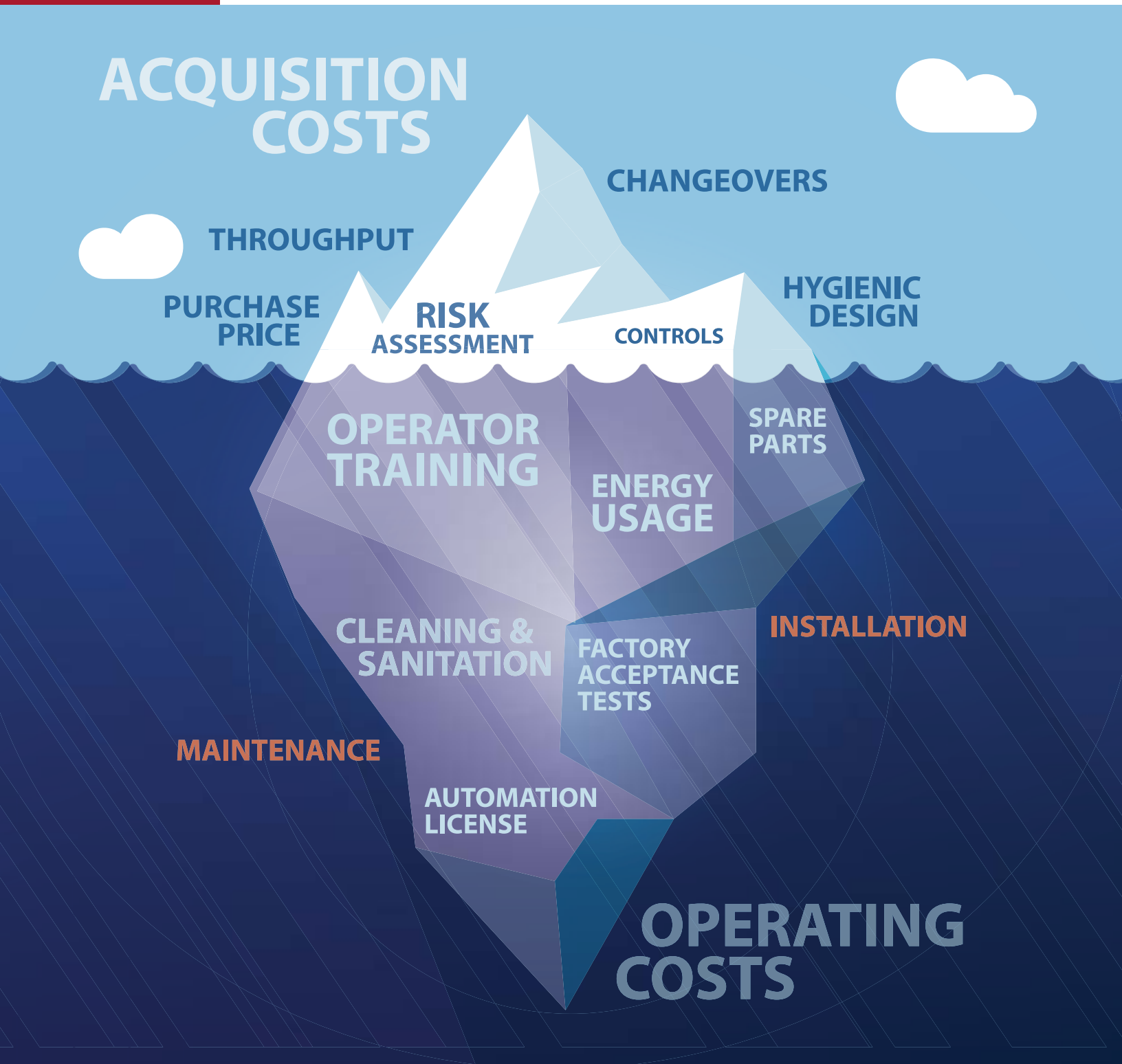
2020 TOTAL COST OF OWNERSHIP
USER GUIDE FOR CPG INDUSTRY



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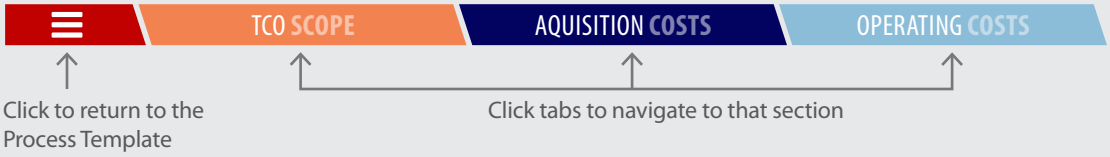
OpX™ Leadership Network
Moving Operational Excellence Forward

FSQ institute™
the manufacturing health people

HOW TO NAVIGATE THIS DOCUMENT



G **Leadership Guidance**

R **Industry Resources** — click the covers to download the document

CONTENTS

SPONSORS

Facilitated by PMMI, the OpX Leadership Network is a dynamic community of manufacturing, engineering and operations professionals dedicated to operational excellence. Through open dialogue between CPG manufacturers and OEMs, the OpX Leadership Network provides an exceptional forum where the best minds come together to identify and solve common operational challenges, and apply best practices and innovative solutions to the real-world context of manufacturing.

PMMI is a trade association of more than 900 member companies that manufacture packaging, processing and related converting machinery in the United States or Canada; machinery components and packaging containers and materials. PMMI's vision is to be the leading global resource for the packaging and processing supply chain, and its mission is to improve and promote members' abilities to meet the needs of their customers. Learn more about PMMI and the PACK EXPO trade shows at **PMMI.org** and **Packexpo.com**.

The purpose of the **FSO Institute (the Manufacturing Health People)** is to accelerate the performance and sustain results along twelve dimensions of manufacturing health for small-to-mid-sized food and beverage manufacturers. The FSO Institute utilizes its resources - networks, data, coaches and process tools - to assess manufacturers' current state of manufacturing health and provide solutions for its ongoing improvement.

INTRODUCTION

One of the most significant challenges facing consumer packaged goods manufacturers (CPGs) and original equipment manufacturers (OEMs) today is determining the initial equipment purchase price versus the long term cost of owning the equipment. The need for an industry norm for Total Cost of Ownership (TCO), specifically written for the CPG industry has become increasingly apparent to these and other stakeholders involved in the purchase/sale of capital equipment.

To address these issues, The Total Cost of Ownership Solutions Group, one of the many teams of subject matter experts which comprise PMMI's OpX Leadership Network, first published the TCO Playbook and checklists in 2013.

THE NEED

The need was clear: there had been a lack of clarity in TCO resulting in unmet expectations for too many stakeholders when engaging in the commercial transactions for capital equipment.

THE SOLUTION

The solution was also clear : to provide guidelines and checklists, developed by industry subject matter experts (see nearby list of contributors), for the broad adoption and use throughout the CPG industry.

The power of this OneVoice for TCO is to encourage the dialogue and collaboration among all stakeholders during commercial transactions so everyone's expectations are met. You will undoubtedly see with much greater clarity not only the "tip of the iceberg" acquisition costs, but the operations costs lurking beneath the as well!

NEW USER GUIDE FEATURES AND NAVIGATION TOOLS

Recently the Total Cost of Ownership Solutions Group was reconvened to revise and update the original TCO Playbook and checklists, especially the addition of significant User Guide features that make it easier to navigate and gain the maximum value of this successful document.

Accordingly, the new TCO User Guide leads the user through this comprehensive, disciplined document with some new TCO Navigation Tools including leadership guidance, industry examples and links to other relevant OpX Leadership Network work products. The TCO User Guide also links to relevant areas of a companion document, the TCO Workbook.

Now users can navigate through both documents with greater ease without sacrificing the discipline required to truly understand the purchase and sale of capital equipment!

TCO SOLUTIONS GROUP

Dedicated to the memory of John Kowal
(May 28, 1958 – July 8, 2020) whose passion, commitment and contribution to our industry has inspired us all.

Abbott Laboratories ..... Matthew Grashel

Abbott Nutrition ..... Richard Coker

Amway ..... John Giles
Boyd Pearce

Barry-Wehmiller ..... Bruce Larson
Scott Yurjevich

Bosch ..... Michael Swanson

Bush Brothers ..... Chris Payne

Campbell Soup ..... Dave Watson
Matt Swanson

C F Sauer ..... Mike Draper
Mark Holmesley

Chobani ..... Hugh Roddy

Clemens Food Group ..... Brian Fox

FSO Institute ..... Stephen Perry
Steve Schlegel

Hormel Foods ..... Steve Sampson

Impossible Foods ..... Roy Greengrass

Kellogg's ..... Brianna Franks
Aniket Gur

Land O'Frost ..... Dave Krolman

Maple Leaf Foods ..... Robert Kaminski

Mettler Toledo Product Inspection ..... John Uber

Nature's Bounty ..... Jose Rios
Scott Spencer

Nestlé ..... Tom Doney

PepsiCo ..... Tony Vandenoever

PMMI ..... Tom Egan
Bryan Griffen

Post Holdings ..... Ron Denig

Pretzels, Inc. ..... Paul Schaum

Smithfield Foods ..... James Couch
Bruce Owens

Snyder's Lance ..... Toby Strickland

Schneider Equipment ..... Linda Palladino

TCO Process Template

The four components below – TCO Scope, Acquisition Costs, Operating Costs and TCO Workbook - comprise the most fundamental assessment tools required for a successful TCO analysis

TCO SCOPE

Development of Internal & External Requirements

Alignment with internal and external stakeholders
Capital Appropriation Requests
Request for Proposal Documents (see OpX RFP guidelines)
Define Performance metrics

LEARN MORE

ACQUISITION COSTS

Determine critical success factors for project

Alignment with internal and external stakeholders
Prioritize the most significant items for analysis
Document findings for comparisons

LEARN MORE

OPERATING COSTS

Determine critical success factors for performance

Alignment with internal and external stakeholders
Prioritize the most significant items for analysis
Document findings for comparisions

LEARN MORE

TCO WORKBOOK

Document project information

DOWNLOAD NOW

TCO SCOPE

Why TCO on this project?

TCO is all about the cost and value, not about the price. It is far better to understand cost to acquire, operate & maintain over a specified time. Determine what was not clearly conveyed or understood in RFP process. These items could include performance requirements, consumables, wear parts, spare parts, service costs, proprietary or licensing software, obsolescence of software etc. Now, with that information, you can do a deeper dive to compare the TCO of the equipment offerings.

LEARN MORE

What are our Objectives?

It is expected that to reach the TCO stage in your supplier evaluation process, the candidates have met your basic criteria. Now, it is important to have greater clarity and transparency on critical areas. The CPG therefore should identify those objectives/expectations that you will be living with for the expected life of the equipment such as operating performance, training, maintenance, parts, etc. Consider providing your key metrics for each critical area.

LEARN MORE

What are the concerns on this TCO?

It's not about the initial "Price we Pay" for equipment but the "Cost to Operate" the equipment. The price is only one small component of the operating cost. So, the concerns should be articulated and communicated to the suppliers. In this manner, you will be better informed through transparency and uncovering hidden costs. TCO analysis is a critical tool in the equipment purchase decision-making toolbox, for any business, it requires a complete understanding of the investment.

LEARN MORE

TCO SCOPE

Why TCO on this project?

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Determine what was not clearly conveyed or understood in RFP process. These items could include performance requirements, consumables, wear parts, spare parts, service costs, proprietary or licensing software, obsolescence of software etc. Now, with that information, you can do a deeper dive to compare the TCO of the equipment offerings.

G

- What life of equipment is expected (3,5, 10 or more years)?
- What are the expected recurring costs such as MRO?
- What are the recommended consumables, their operating and cost impact?
- What are the startup objectives for this equipment?
- How rapidly can we go from commissioning to full capacity production?
- Is this equipment technically complex and needs additional training?
- What is the operating environment in which the equipment will be placed and will there be unique hygienic or safety requirements (e.g. "ready to eat")

R

RFP Guidelines for CPG Industry

1. INVITATION TO PARTICIPATE
2. COMPANY INFORMATION
3. INSTRUCTIONS AND SCHEDULE TO COMPLETE RFP
4. DOCUMENTS SUMMARY
5. PROJECT INTRODUCTION
6. PRODUCT AND PACKAGE DESCRIPTION
7. PERFORMANCE SUCCESS CRITERIA

TCO SCOPE

What are our Objectives?

It is expected that to reach the TCO stage in your supplier evaluation process, the candidates have met your basic criteria. Now, it is important to have greater clarity and transparency on critical areas. The CPG therefore should identify those objectives/expectations that you will be living with for the expected life of the equipment such as operating performance, training, maintenance, parts, etc. Consider providing your key metrics for each critical area.

G

- What is OEM willing to guarantee for Runtime Efficiency?
- Beyond the base performance requirements, what level of additional support after the sale should be expected and at what cost?
- What does vertical startup look like with your equipment?
- What issues on material access to the equipment?
- How many micro-stops should be expected?
- For maintenance, what are the recommendations for Mean Time Between Failure (MTBF) etc.
- What is the tolerance of materials to run effectively and the impact on waste?
- What are the expectations of utilities usage and costs?
- What is the typical frequency and costs associated with wear parts (guides, cylinders, chains, sprockets, electronics, etc.)
- What is recommended Preventative Maintenance Program and the parts required for inventory?
- What parts are the critical, long-lead parts that require additional inventory?
- What parts require assistance with troubleshooting or additional field service support?
- What are the intellectual property (IP) restrictions?
- What costs are associated with service calls?
- Is there service or maintenance agreements?
- How will the equipment design support features like modularity to facilitate line changes?
- When would you expect for a major overhaul/upgrade to the equipment?
- What is the learning curve needed for operators, technical staff, maintenance, etc.?
- What on-going training programs are offered- frequency and costs?
- What is the recommended general maintenance budget and man-hours?

TCO SCOPE

What are the concerns on this TCO?

It's not about the initial "Price we Pay" for equipment but the "Cost to Operate" the equipment. The price is only one small component of the operating cost. So, the concerns should be articulated and communicated to the suppliers. In this manner, you will be better informed through transparency and uncovering hidden costs. TCO analysis is a critical tool in the equipment purchase decision-making toolbox, for any business, it requires a complete understanding of the investment.

G

- What are the warranties and performance guarantees?
- What is the expected obsolescence on critical technologies used in the equipment?
- What are the operating best practices for this equipment?
- What are the remote service support options?
- How will my Cost of Goods Sold (COGS) be affected?
- What are your typical equipment changeover times?
- What are your equipment lead (delivery) times?
- Equipment footprints (layout)?
- Does the HMI have accessible training embedded?

ACQUISITION COSTS

Acquisition costs equate to the "price we pay" in making a capital equipment purchase. It is an important, albeit only partial, consideration in calculating the "total cost" of equipment. What follows below in this section of the OpX Total Cost of Ownership User Guide are the most significant factors to consider when assessing the price you pay for equipment. To facilitate your calculation of these acquisition costs, each item is also addressed in the OpX Total Cost of Ownership Workbook.

Equipment Design & Application

Project Requirements

Installation

Initial Training

Validation

Utility/Energy Costs

ACQUISITION COSTS

Equipment Design & Application

Consider all equipment design and application costs. Manufacturing environments, functionality and flexibility of equipment require that the material and design of equipment needs to be fit for purpose. Additional labor for sanitation purposes may be required.

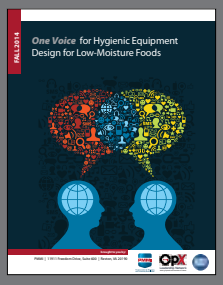
ENGINEERING COSTS

Consider all external (to the CPG) engineering costs when it comes to equipment design. Additional costs for engineering provided to support the project may include:

- **Pre-engineering**
- **Facility Factors**
- **Support**
- **All Engineering Not Included in the OEM Package**

R

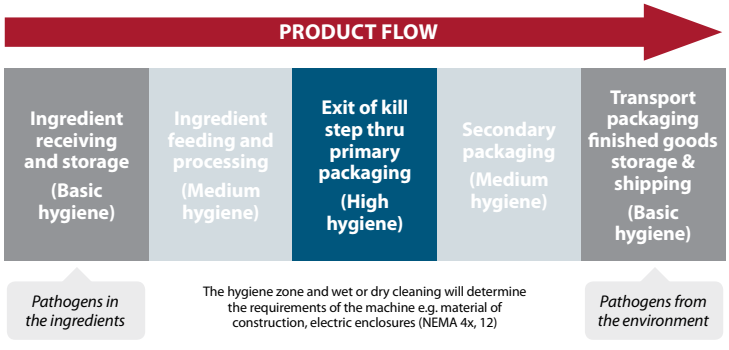
One Voice for Hygenic Equipment Design for Low-Moisture Foods



FACILITY HYGIENIC ZONING

Each food manufacturing operation requires an appropriate environmental cleanliness level in order to minimize risks of contamination. The degree of the hygienic design of the equipment in the facility depends on the product and a thorough analysis of its potential hazards. It is important to locate where (what zone) in the facility the equipment will be operationg and what level of hygiene is appropriate based on the resluts of a risk assessment.

FIGURE 4: FACILITY HYGIENIC ZONE MAP



ACQUISITION COSTS

Equipment Design & Application

HEALTH, SAFETY & ENVIRONMENTAL REQUIREMENTS

Make sure to keep health, safety and environmental considerations at top of mind when assessing equipment design and application acqusition costs. The CPG will provide the specific health, safety & environmental requirements.

Safety Risk Assessment

G

There is a worker safety acceptance testing process when new equipment comes onto the floor and when equipment is modified.

There is a definitive commitment made that action will be taken to improve worker safety and reduce risk on existing equipment identified.

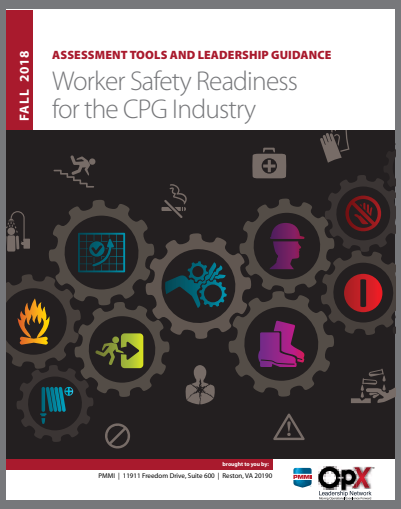
The PMMI risk assessment for equipment and the end user is available. It will assist in fostering Safe design, safeguarding and safe use of equipment as viewed as a lifetime risk assessment.

R

PackSafe® Software

designsafe®
risk assessment software
Packsafe
Robot Risk Assessment

Worker Safety Readiness for the CPG Industry



ACQUISITION COSTS

Equipment Design & Application

Regulatory Requirements

G An ergonomic worker safety perspective should consider the current standards and best practices. Knowing what solutions are available will enable taking corrective action.

As production management experiences and learns what works and what is problematic to the operators; it is important to document that information. Monitoring and tracking of implemented improvements should be part of an awareness program within your training activities.

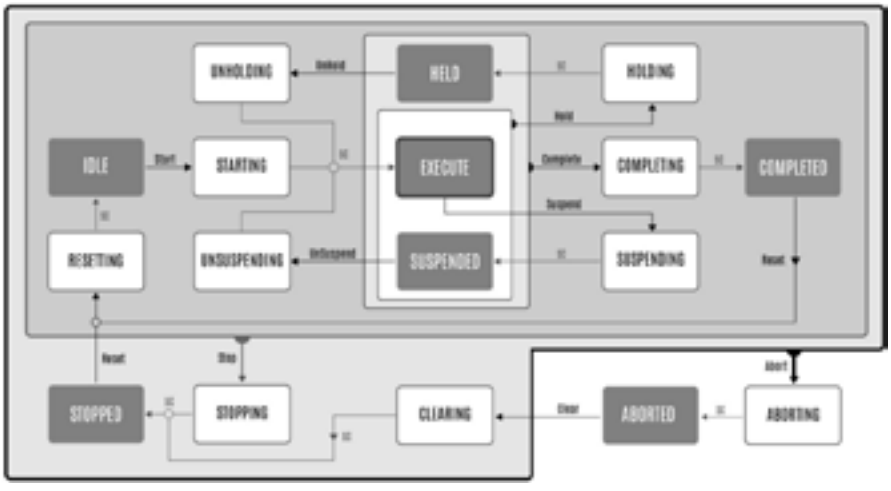
SPECIFIC CONTROLS

Look to the OMAC (Organization for Machine Automation and Control) to account for specific control requirements with equipment design and application. The OEM will provide the standard, while the CPG will provide requirements for specific controls.

Control Logic and Programming Platform

R

PackML an OMAC standard



ACQUISITION COSTS

Equipment Design & Application

Interoperability with Multiple Products

G

CPG provides its sanitization regimen, and the Bidder is expected to provide its limitations of its equipment related to the CPGs hygienic procedures.

CPG provides any limitations it has (e.g., zero water for cleaning).

CPG identifies its expectations on risk assessment documentation for the equipment being considered.

CPG identifies how they see the power will be supplied and require the Bidder to describe how it will interface to the power supply.

CPG should consider getting stakeholders' perspective on safety.

CPG provides any preferred technology providers normally used;
CPG provides preferred integration protocol (e.g. PackML).

Mechanical and Electrical safety protocols via automation CPG needs on bi-directional communications

CPG provides its level of line automation.(Type 1, 2, 3 and, 4 via OMAC example or ANSI standard B 155-2016)

CPG should provide its intention on Remote Access. (see OpX Secured Vendor Access document)

CPG should designate which industry standards it requires. It is then the responsibility of the Bidder to meet those standards (or identifyexceptions).

Local or state requirements should be identified by CPG (e.g. seismic)

Determine whether or not equipment can be upgraded.

CHANGEOVERS

Cost of procurement of materials, OEM and CPG discuss tolerance of materials needed. Customization to CPG requirements when it comes to changeovers is an essential factor in determining equipment design and applications costs as part of machine acquisition. The CPG provides expected rates and needs, while the OEM provides design capabilities.

Requirements

Describe in detail what the CPG expects in performance requirements (KPI's) of the machine (e.g. on changeovers, CPG defines it expects to use two (2) technicians to do the changeover within 45 minutes with tools available).

Define conditions for machine acceptance, including rate, quality and OEE operational expectations.

CPG should ask specifically how the Bidder will meet each of the KPI requirements. The FAT could provide the opportunity to validate the equipment meeting those expectations.

ACQUISITION COSTS

Project Requirements

Consider the full scope of project requirements. Be sure to agree upon the project-related considerations enumerated below, and account for the cost implications.

GENERAL REQUIREMENTS & PERMIT/CERTIFICATION COSTS

Factor in site-specific information. What sets your facility apart? If there's anything remotely unique about the site that may not be factored elsewhere, be sure to factor it here. Don't forget the permits. Depending upon the municipality, building permits, environmental permits, and other certifications might be required.

■ **Facility Design** (hygienic & cleaning)

G

CPG to ask bidders for any exceptions to technical specifications, e.g. power supply variations.

CPGs should advise Bidders to provide explanation of how they meet specific requirements.

CPGs should provide details on site access (machines, job trailers, staging, transport access for machinery (crate dimensions).

Reference or describe the document that will define conditions for machine acceptance, including rate, quality and OEE operational expectations.

CPG provides its sanitization regimen, and the Bidder is expected to provide its limitations of its equipment related to the CPGs hygienic procedures.

CPG provides any limitations it has (e.g., zero water for cleaning).

CPG identifies its expectations on risk assessment documentation for the equipment being considered.

■ **Integration With Other Contractors requirements**

G

Planning this work upfront will help ensure a smooth project.

Consider the frequency of meetings and other communications during course of project (depends upon complexity of project).

CPG provides its expectations of project management reports, timelines, etc (again, depends on complexity).

CPG should expect the Supplier to work with them to develop a Project Execution plan to include Design Reviews, the validation and commissioning protocols (FATs, SATs) and project close out procedures including final documentation.

ACQUISITION COSTS

Project Requirements

- **Site Safety Considerations**
- **Building Permits**
- **Municipality Permits**
- **Environmental Considerations**

G

If hazardous environment, CPG should articulate the characteristics that make it hazardous (e.g., class and division of dust explosion).

Identify the temperature requirements that could impact worker safety (e.g., installation of equipment in a freezer).

CPG states their environmental requirements and asks Bidder to identify emissions from their equipment that could impact policies or jurisdictional requirements (e.g., air, water, radiation, etc.).

Identify the Personal Protective Equipment (PPE) as this could be a cost impact to Bidder and installation crew.

Clarify the needs for temporary structures, clean up, dunnage/dumpster, etc.

During training of contractors, be sure to review GMP requirements.

Identify on floor limitations of placements of contractor tools and supplies, including hygiene and sanitation requirements.

Have clarity on access doors and entire pathway of new equipment into the facility (e.g., machine being delivered in pieces and then assembled) and include weight limits or other material limitations from floors and roofs.

Identify special circumstances for cranes and other unique equipment to place units on roof or within building.

CPG and Supplier will design a training plan to accommodate the various shift personnel.

CPG needs to understand the numbers and level of skills required to operate machines.

Commissioning and startup also needs to consider the different shifts.

ACQUISITION COSTS

< Project Requirements

OPERATIONS & MAINTENANCE DOCUMENTATION

Factor in site-specific information. What sets your facility apart? If there's anything remotely unique about the site that may not be factored elsewhere, be sure to factor it here. Don't forget the permits.

- **Preventative Maintenance**
- **Lube Schedule**
- **Bill of Materials**
- **Theory of Operation**
- **Trouble Shooting Guide**

G Provide the Bidders with the production conditions upstream and downstream of the equipment in consideration.

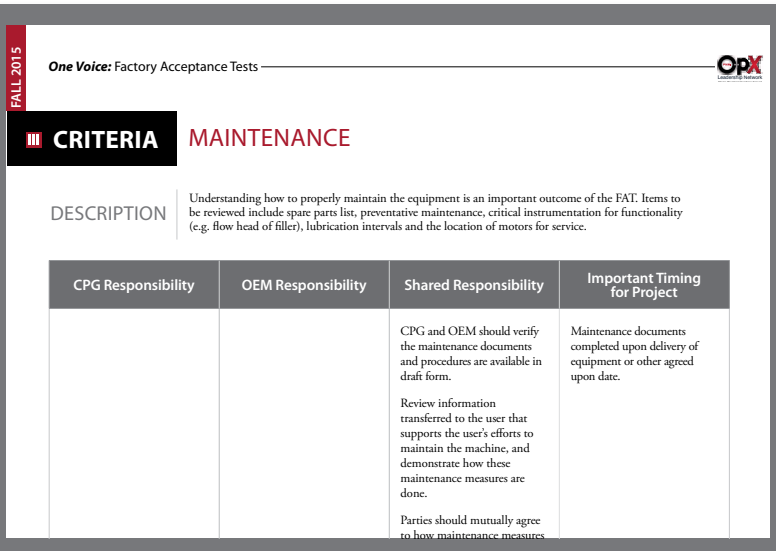
Provide an overview of the production expectations of rates, weights, sizes, etc.

Describe in detail what the CPG expects in performance requirements (KPI's) of the machine (e.g. on changeovers, CPG defines it expects to use two (2) technicians to do the changeover within 45 minutes with tools available).

Define conditions for machine acceptance, including rate, quality and OEE operational expectations.

CPG should ask specifically how the Bidder will meet each of the KPI requirements. The FAT could provide the opportunity to validate the equipment meeting those expectations.

R ***One Voice*** Factory Acceptance Tests


FALL 2015

One Voice: Factory Acceptance Tests

CRITERIA MAINTENANCE

DESCRIPTION Understanding how to properly maintain the equipment is an important outcome of the FAT. Items to be reviewed include spare parts list, preventative maintenance, critical instrumentation for functionality (e.g. flow head of filler), lubrication intervals and the location of motors for service.

CPG Responsibility	OEM Responsibility	Shared Responsibility	Important Timing for Project
		CPG and OEM should verify the maintenance documents and procedures are available in draft form. Review information transferred to the user that supports the user's efforts to maintain the machine, and demonstrate how these maintenance measures are done. Parties should mutually agree to how maintenance measures	Maintenance documents completed upon delivery of equipment or other agreed upon date.

ACQUISITION COSTS

Project Requirements

SPARES/COMPONENT LIFT/REGULAR WEAR PART/LUBRICANTS

Be ready for basic upkeep with spares, lubricants, etc. Be sure to discuss and procure a detailed list of equipment parts (including lubricants), plus their life expectancies and any special tools required.

G

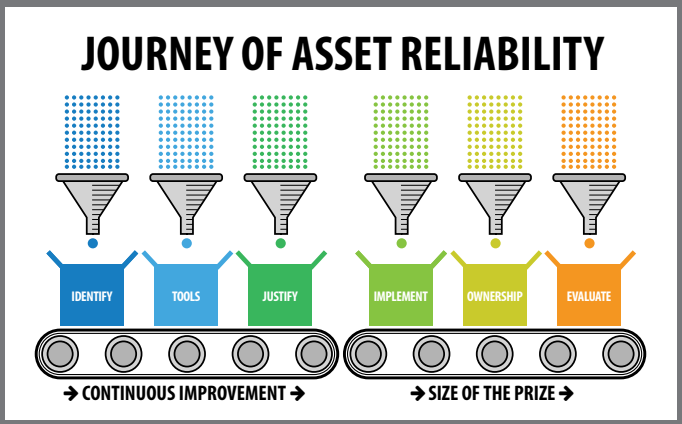
Asset Reliability is focused on the Planned and Unplanned downtime reduction which inhibits the Machine from performing its intended function in the schedule it is expected…or is the machine doing what it is supposed to do, when it is supposed to do it.

Consider MRO – Maintenance, Repairs and Operating Costs:

The total value of maintenance, repair, and operating supplies (MRO) stocked on site to support maintenance. Optimization and rationalization for all inventory items is needed to ensure critical parts are stocked.

R

Asset Reliability



ACQUISITION COSTS

Project Requirements

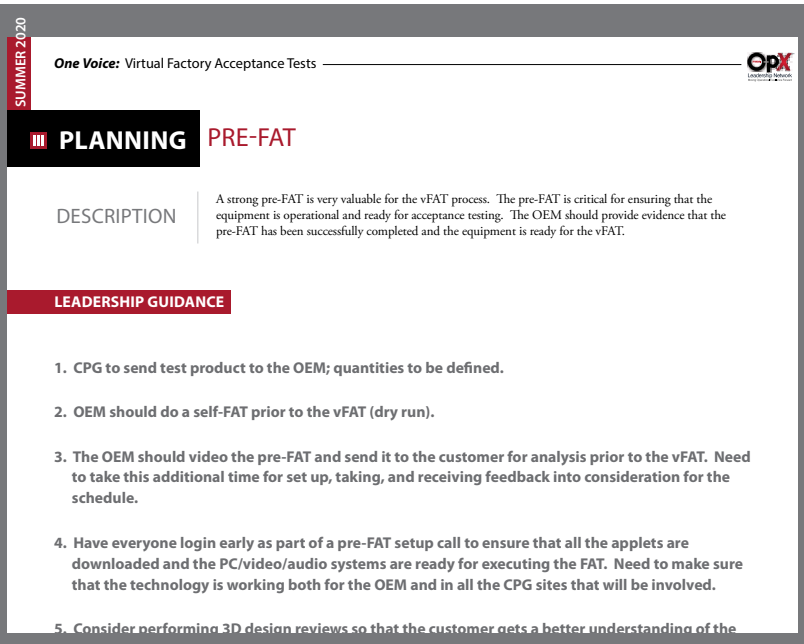
FACTORY ACCEPTANCE TESTS (FATs) & SITE ACCEPTANCE TESTS (SATs)

G Define the specific FAT protocol for the project and establish clear expectations from all parties.

Characteristics include equipment performs as designed and planned, clear identification of the items to be corrected, expectations are clearly defined and timing to be met, vmutual understanding of the requirements. These need to be coordinated with the specified user requirements.

R

One Voice Factory Acceptance Tests



SUMMER 2020

One Voice: Virtual Factory Acceptance Tests

PLANNING PRE-FAT

DESCRIPTION

A strong pre-FAT is very valuable for the vFAT process. The pre-FAT is critical for ensuring that the equipment is operational and ready for acceptance testing. The OEM should provide evidence that the pre-FAT has been successfully completed and the equipment is ready for the vFAT.

LEADERSHIP GUIDANCE

1. CPG to send test product to the OEM; quantities to be defined.
2. OEM should do a self-FAT prior to the vFAT (dry run).
3. The OEM should video the pre-FAT and send it to the customer for analysis prior to the vFAT. Need to take this additional time for set up, taking, and receiving feedback into consideration for the schedule.
4. Have everyone login early as part of a pre-FAT setup call to ensure that all the applets are downloaded and the PC/video/audio systems are ready for executing the FAT. Need to make sure that the technology is working both for the OEM and in all the CPG sites that will be involved.
5. Consider performing 3D design reviews so that the customer gets a better understanding of the

ACQUISITION COSTS

Project Requirements

SHIPPING & RESPONSIBILITY

G

Provide Corporate Social Responsibility (CSR) documents if your company has them, including overview and expectations of corporate policies.

Provide list of key contacts, including identification of those authorized to approve changes to the Supplier (company which was awarded contract).

Reference the name and location of legal documents.

For shipping, provide the Incoterm (International Commercial Terms).

Examples of documents that could be required from the Bidding Company:

- Company overview (credentials).
- Relevant experience.
- Specific project relevant information.
- Warranty information.
- Points of contact to answer questions during the proposal process.
- Organizational plan for this type of project that you will be observing.
- Provide ship to and final destination locations.

ACQUISITION COSTS

Installation

Consider the full scope of intallation costs when calculating the total cost of ownership from an acquisition perspective. It's key to define the requirements and responsibilities in preparing for and executing the installation.

UNLOADING, UNCRATING & DISPOSAL

Unloading, uncrating and disposal is another factor that must be brought to bear against total acquisition costs, and is often forgetten when calculating TCO.

Be sure to consider: **Weights | Special requirements | Necessary equipment**

The CPG begins with expectations for unloading, uncrating and waste disposal, while the OEM counters with any exceptions to those expectations.

G Ask OEM what material they use for crating, check with recycler for plant if they would accept and support removing large amount of material.

Some OEMs may require special crating they want returned at CPG expense (special rigging typically European OEMs).

ASSEMBLY

Once new equipment is delivered, uncrated, and shipping materials are discarded, then assembly, including labor involved and any special requirements, must be factored into the balance of the TCO.

Be sure to consider: **Rigging | Electrical | Plumming/Piping**

Once again, the CPG provides the expectations, while the OEM provides necessary supervision and/or labor, as requested or needed. Need to coordinate the installation with all of the trades to ensure there aren't any conflicts in timing, install locations, etc

G If hazardous environment, CPG should articulate the characteristics that make it hazardous (e.g., class and division of dust explosion).

Identify the temperature requirements that could impact worker safety (e.g., installation of equipment in a freezer).

CPG states their environmental requirements and asks Bidder to identify emissions from their equipment that could impact policies or jurisdictional requirements (e.g., air, water, radiation, etc.).

ACQUISITION COSTS

Installation

INITIAL SET UP

Consider post-assembly factors involved with initial set-up when determining the TCO with regards to machine acquisition.

Factors to identify and quantify include:
Assembled as defined | Prepared with software, changeover parts | Adjustments noted

The CPG will first verify that the installation is in good working order, then the OEM will provide necessary assurance that he equipment is prepared for the validation.

G

Identify the Personal Protective Equipment (PPE) as this could be a cost impact to Bidder and installation crew.

Clarify the needs for temporary structures, clean up, dunnage/dumpster, etc.

During training of contractors, be sure to review GMP requirements.

Identify on floor limitations of placements of contractor tools and supplies, including hygiene and sanitation requirements.

Have clarity on access doors and entire pathway of new equipment into the facility (e.g., machine being delivered in pieces and then assembled) and include weight limits or other material limitations from floors and roofs.

Identify special circumstances for cranes and other unique equipment to place units on roof or within building.

CPG and Supplier will design a training plan to accommodate the various shift personnel.

CPG needs to understand the numbers and level of skills required to operate machines.

Commissioning and startup also needs to consider the different shifts.

ACQUISITION COSTS

Installation

INSTALLATION SERVICE TECHS

Installation involves human labor in the form of service techs. Be sure to consider the following, which affect the TCO:

OEM startup costs | Timeline for startup | Proposed plan | Related costs | Special conditions

The CPG provides expectations for installation service tech requirements, and the OEM will provide a response.

G The continuous improvement process should include worker safety as a necessary consideration of impact.

A risk assessment should be done on the assembly of machinery on the line.

To do this effectively, understand the JSAs for each task in the room (machine operator and fork truck driver) and the interface with the risk assessment for machinery.

ACQUISITION COSTS

Initial Training

To properly account for TCO, the CPG and OEM must agree upon the training requirements related to a machine installation, and cost implications that they carry. The OEM provides needs assessment, theory of operation, classroom vs. hands-on, CPG and OEM develop plan, identify needs & resources, time required.

TECHNICAL TRAINING

Comprehensive technical training can be costly both in expense and time, so it needs to be considered in TCO. Training should improve an employee's ability to do the following with any physical assets:

Set-up | Operate | Changeover | Teardown | Maintain | Repair | Troubleshoot

G Both the CPG and OEM need to develop their recommended participants in the FAT. This includes the labor needed to run the equipment during test, technical staff to observe and evaluate, as well as others for training purposes. The complexity of the equipment will be a key component in the decision.

R

Mechatronics Certification Program

PMMI MECHATRONICS™

Developed for industry by industry, PMMI Mechatronics Certifications helps ensure that employees have a solid base of technical knowledge. Additionally, the PMMI Mechatronics Certifications can be used by employers to help with local community colleges customize their training programs to meet industry needs and help keep a full pipeline of qualified technicians.

The modular certifications can be utilized in a number of ways:

- Requirement of specific certifications for new hires
- To assess the capabilities of existing workers in order to identify knowledge gaps to be addressed with additional training
- Provide a career pathway for employees looking to advance within your organization.

ACQUISITION COSTS

Initial Training

DOCUMENTATION

The OEM needs to provide a theory of operation, which is a description of how a device or system should work. It is often included in documentation, especially maintenance/service documentation, or a user manual. It aids troubleshooting, who ideally would have been trained by a PMMI Certified Trainer, by providing the troubleshooter with a mental model of how the system is supposed to work. The troubleshooter can then more easily identify discrepancies, to aid diagnosis of problem.

G

CPG articulates what is expected to effectively complete the project before it is officially closed out.

User should require a description of the documentation for the machine, including, manuals, drawings, safety documents, maintenance, cleaning, sanitization, and spare parts. Bidder should include a description of the standard documents supplied with the equipment.

Declare requirements for hard-copy or electronic documents.

If the user has requirements for extraordinary documentation that is not normally transferred, these requirements should be made known as part of the RFP, e.g., a requirement for spare parts identifications, using the user's internal part numbers on the exploded view drawing of the manual.

SCOPE OF TRAINING

The CPG and OEM must work together to estimate the cost to provide the training, and the time required to deliver the training. Classroom and hands-on operator and technicians training shall be provided and completed prior to start-up of equipment as needed to instruct employees on the proper operation, maintenance, and troubleshooting procedures as described in the provided manuals.

R

PMMI Certified Trainer

This workshop provides technical trainers with the strategies and tactics to train well across all employee skill levels including service technicians, service and training managers, maintenance technicians, internal trainers, line supervisors, and any employee tasked with training fellow employees or customers.

This program helps trainers to:

- Provide better machinery training
- Maximize productivity while enhancing safety
- Increase machinery efficiency
- Lower operating costs
- Increase satisfaction

ACQUISITION COSTS

Initial Training

TRAINING LEVELS REQUIRED

The level of training needed is to be determined by the receiving plant and its familiarization with the equipment.

Basic: Less than one day, and requires minimal operational or maintenance training to successfully operate and care for this equipment – i.e. – a tank or a small conveyor

PMs and BOMs (with critical spares identified) required

G **Performance Success Criteria**

CPG provides the Quality, Rate, Validation and Performance Requirements as measured and acknowledged by the plant or facility operations team. Approval and sign-off of these criteria will trigger final payment and indicate contract fulfillment is met by equipment supplier.

As a CPG, you should be aware of the industry standard of performance of this type of equipment so that your expectations are realistic (e.g., expected throughput or number of operators). CPGs should encourage the Bidders to look for solutions to exceed the current industry norm.

CPG should consider encouraging the Bidders to exceed most impactful KPIs for this project.

ACQUISITION COSTS

Validation

The OEM provides needs assessment, while the GPG and OEM develop plan.

COMMISSIONING

The process of the orderly transfer or handover of ownership of the capital equipment from the OEM to the CPG. This assures the compliance to the requirements.

Demonstrates the equipment can produce the products at the quality and speed required

- Meets all SKUs
- Improve quality criteria
- Meets or exceeds QA testing criteria
- Sterility tests
- Induced Failure tests

Endpoint: Completion of Commercial Sterility (test to verify acceptance for saleable product) and FU (follow up) to IFTs (induced failure tests).

QUALIFICATION

Demonstrates the capability of the total system (equipment, material and people); to operate safely at specified MTBF (mean time between failure) levels necessary to achieve going performance criteria.

- Operating techs are qualified and team capability is at the desired level.
- Supporting systems & procedures are operational and delivering desired results.
- Accurate LEDS (line event data system) data is being collected and evaluated to identify growth.
- Onsite OEM support still required.

Endpoint: MTBF performance is validated while sustaining target quality.

ACQUISITION COSTS

Validation

VERIFICATION

Demonstrates that people, material, supporting systems, and equipment have the capability to operate at going performance criteria on a continuous, daily basis, over normal manufacturing system conditions.

- System now produces quality product at specified rate without outside support.
- Continually improve operating team and equipment capability, material compatibility with the production system, supporting systems & procedures.
- Track results, identify issues and improvement items, forwarding to the appropriate groups.
- Onsite OEM is not required, but may be on-call to correct any deficiencies or issues plant operations are having to perform at desired rates.

Endpoint: Project Close out

ACQUISITION COSTS

Utility/Energy Costs

The OEM provides usage requirements at maximum and continuous consumption rates, while the CPG calculates costs base on local site conditions.

COMPRESSED AIR | ELECTRICAL | GAS | WATER USAGE | WATER TREATMENT

G

Baseline: A usually initial set of critical observations or data generated over a specified timeframe and used for comparison or a control with observations and data over other time periods.

Audits can be conducted by members internal to the organization or by third parties. Audits can also be conducted of the organization or any part thereof, as well as of suppliers. Certain third parties may also be able to provide attest or certification functions against publicly available or other recognized criteria. Finally, before a full audit program is implemented, certain preaudit functions can be the first steps in developing an audit program, e.g., gap assessment, self-assessment.

Product Development (PD): The overall process of strategy, organization, concept generation, product and marketing plan creation and evaluation, and commercialization of a new product.

Life Cycle Analysis (LCA): Also known as Life Cycle Assessment, LCA is a technique for assessing the potential environmental aspects and potential aspects associated with a product (or service) through production, usage, and disposal, by:

- compiling an inventory of relevant inputs and outputs,
- evaluating the potential environmental impacts associated with those inputs and outputs,
- interpreting the results of the inventory and impact phases in relation to the objectives of the study.

R

Journey to Sustainability Excellence

ATTRIBUTES (click on category header below, e.g., "Governance", to view a summary of key takeaways)	Beginner			Intermediate			Advanced		
	People	Planet	Profit	People	Planet	Profit	People	Planet	Profit
FOUNDATION									
Triple Bottom Line	x	x	x	x	x	x	x	x	x
Social Responsibility	x			x	x	x	x	x	x
Environmental Indicators		x	x		x	x	x	x	x
GOVERNANCE									
Management Support			x	x		x	x	x	x
Business Case			x		x	x	x	x	x
Team	x	x	x	x	x	x	x	x	x
Governing Structure		x	x		x	x	x	x	x
Ethics			x	x	x	x	x	x	x
MEASUREMENT									
Baseline			x			x	x	x	x
Audit			x			x	x	x	x
Product Development		x			x	x	x	x	x
Life Cycle Analysis (LCA)		x	x	x	x	x	x	x	x
COMMUNICATION									
Reporting		x	x		x	x	x	x	x
Training and Education	x	x	x	x	x	x	x	x	x
Stakeholder Communication	x	x	x	x	x	x	x	x	x
COORDINATION									
Customers			x	x	x	x	x	x	x
Suppliers					x	x	x	x	x
Recognition & Reward	x			x			x	x	x

OPERATING COSTS

While acquisition costs equate to the "price we pay" in making a capital equipment purchase, operating costs are the "cost to operate" once the capital equipment purchase has been made. Operating costs complement the acquisition costs and complete the analysis when calculating the "total cost" of equipment. What follows below in this section of the OpX Total Cost of Ownership User Guide are the most significant factors to consider when assessing the ongoing costs to operate equipment. To facilitate your calculation of these operating costs, each item is also addressed in the OpX Total Cost of Ownership Workbook.

- **Quality**
- **Labor**
- **Maintenance**
- **Cleaning & Sanitation**
- **Training**
- **Utilities & Environment**

OPERATING COSTS

Quality

Quality can mean any number of aspects including defective scraps, those eyeing design values of loss upfront or rework being unforeseen or unknown loss during production. Materials can also be a significant cost. Different equipment can have varying sensitivities to materials, tolerances, thicknesses, finishes, and what have you.

DEFECT

(designed loss) OEM provides machine efficiency, defects per "x" rate, CPG provides minimum requirements

G A defect could constitute anything the customer determines is wrong. With well defined parameters established early on in the acquisition process, definitions for what is a defect and what is within the spec will be agreed upon by both parties. These parameters should be detailed in the OEM's equipment to perform within an "acceptable" range of quality variation and loss due to defect.

SCRAP

(designed waste) OEM provides machine efficiency, scrap per "x" rate, CPG provides minimum requirements

G Designed scrap or waste is different from waste generated due to equipment, people or packaging errors. This scrap is considered a normal part of operations and is programmed into the operating budget. However, all material that is not considered saleable product, including cost of disposal, is waste and should be eliminated. Use the Overall Equipment Effectiveness (OEE) Benefits Calculator to determine how to avoid waste in operations.

GENERAL START UP

General Start up expenses, OEM and CPG discuss requirements

G This addresses the time and cost required to do a cold start of the equipment. For example, this could be following a weekend downtime.

- Routine start up in plant
- Material & associated labor

COST OF MATERIALS

Cost of procurement of materials, OEM and CPG discuss tolerance of materials needed

G Costs associated with the procurementof materials, including the adaptability and flexibility of the equipment to handle materials, affects TCO.

OPERATING COSTS

Quality

THROUGHPUT

Throughput-machine performance reliability OEM provides machine efficiency (OEE, design and planned), CPG provide their minimum requirements.

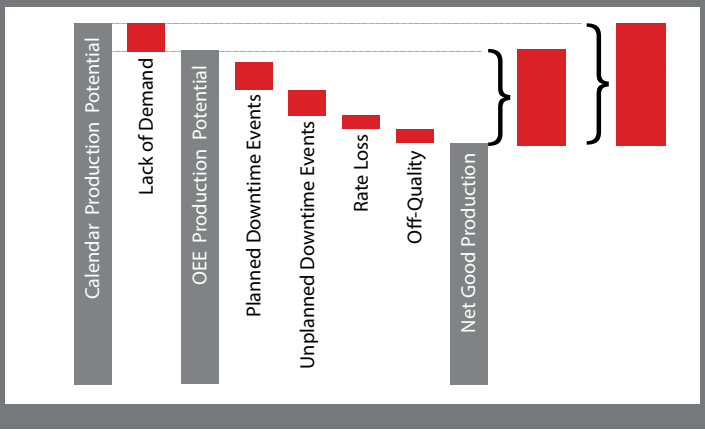
G Machine performance reliability can be defined as the ability of the equipment to meet the agreed upon expectations within the agreed upon time frame. Having these reliability standards and time frames in writing ahead of time will clear up any gray areas between expectation and reality. Utilize the OEE Starter Tool and the OEE Benefit Calculator to assist in defining how the OEE performance has a pervasive impact on shareholder value:

- Access OEE calculators
- Customer service & delivery
- Quality variation and defect loss
- Raw material scrap & waste
- Labor efficiency
- Equipment repair & maintenance expense

R

OEE Benefit Calculator

OEE Starter Tool



REWORK

Unintentional loss, needs to be extrapolated by CPG based upon its experience

G Any costs that must be added to the machine to make it acceptable to the customer is considered Rework, and is yet another drag on TCO.

OPERATING COSTS

Quality

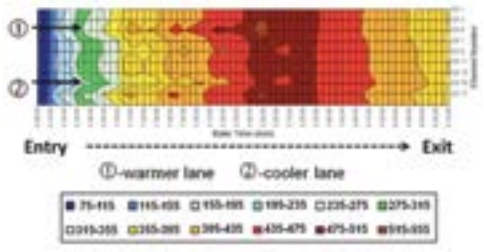
R

Pathogen Reduction Validation

Illustration 1. **Temperature map of a continuous belt oven with multiple zones**

Example. Below is an illustration of a temperature map of a continuous belt oven with multiple zones. Note that at product in lane ① experiences temperatures that are higher than average; lane ② product experiences temperatures lower than average. Arrows show the direction of product flow

Map of an oven, looking down from the top:



From this mapping study, we may surmise:

- The baffles in the zones may be able to be adjusted, to eliminate the temperature difference.
- If laboratory microbiological testing is conducted, then a conservative (low-temperature) profile may be modeled based upon lane ②.
- If in-oven microbiological count-reduction testing is conducted with a surrogate, then lane ② may provide a conservative path to test.
- If a model of pathogen destruction is used, then the map can be examined to determine if the temperature differences have a significant effect on microorganism reduction.

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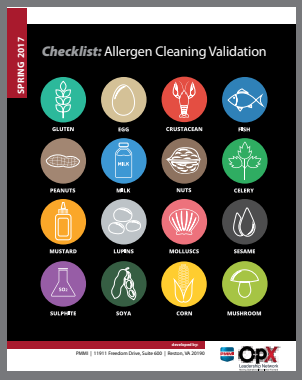


Allergen Cleaning Validation

SPRING 2017

Checklist: Allergen Cleaning Validation Checklist

DATE	REVIEWED BY	PRODUCT/ FACILITY

ITEM OR ACTIVITY – TASKS TO BE ACCOMPLISHED		COMPLETED YES	COMPLETED NO	DATE
1.	**PRELIMINARY STEPS — Discuss and review current operations and applicable regulations**	○	○	
1.1	Assemble the Allergen Validation Team *(may include outside resources)*	○	○	
1.2	Discuss if the product contains allergen properties and the potential risk to the consumer of unlabeled allergen containing product	○	○	
1.3	Review the product flow diagram for that facility including receipt of raw materials, process steps, processing equipment, packaging, labeling, storage and shipping	○	○	
1.4	Review the Food Safety Plan to determine where and how allergen preventive controls are designated	○	○	
1.5	Discuss the status of an Allergen Control Plan (ACP) for that product at that facility or a similar product at another facility	○	○	
1.5.1	Review the procedures described in the ACP's SOPs for allergen cleaning to ensure they are adequate	○	○	
1.5.2	Review the corporate food safety definition of "allergen clean" for each piece of equipment that has direct contact with product	○	○	
1.5.3	Identify if the current ACP contains any documents validating allergen cleaning procedures	○	○	
1.6	Discuss the availability of resources *(internal and external)* for literature review, expertise, testing, data analysis and documentation	○	○	
1.7	Identify existing regulatory requirements being addressed *(cGMPs, Allergen Labeling –FALCPA Act of 2004, FSMA Act of 2011 etc.)*	○	○	

OPERATING COSTS

Labor

Labor is an important consideration as we strive or manufacturing excellence long term. There is an increased focus on the ability to access, hire, and retain technical resources and skilled labor. As organizations continually improve, effective engagement and utilization of resources is key.

STAFF REQUIRED

OEM provides estimate of hours required, CPG needs to insert its fully loaded rate for internal calculations

G Does your current staff have the ability to run the new machine as is? Does the staff require training, or is new staff necessary?

Staff: How many people and who is on this line? Operators, maintenance, supervisors, all staff much be considered.

SKILLS REQUIRED

OEM provides estimate of hours required, CPG needs to insert its fully loaded rate for internal calculations

G Skill Sets: What specific skill sets are required for this equipment?

OPERATOR TIME TO ADD MATERIALS

OEM identify replenishment needs and frequency

G A machine needs to be fed materials to run - have you considered the costs of material handling? new machine also often means new controls, diagnostics, etc. Have you considered optimizing for operability?

Time to add materials – Labor and material costs associated with initial start up.

OPERATING COSTS

Labor

DESIGN FOR OPERABILITY

OEM identifies the equipment characteristics, CPG conveys it operability baseline requirements

G Designed for operability – Consideration for ease of controls, clear diagnostics

RISK ASSESSMENT

(includes lockout-tagout, PPE) OEM provides the risk assessment by piece of equipment CPGs provide their operational/safety requirements

G Safety is king, and safe operations of the equipment is essential for both personal safety and product viability. You also want to understand a true and robust risk assessment which includes any number of aspects whether it be safety, ergonomics, personal protection equipment, blackout type of procedures etc.

R

One Voice **for Hygenic Equipment Design for Low-Moisture Foods**

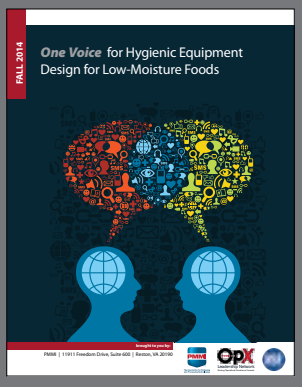
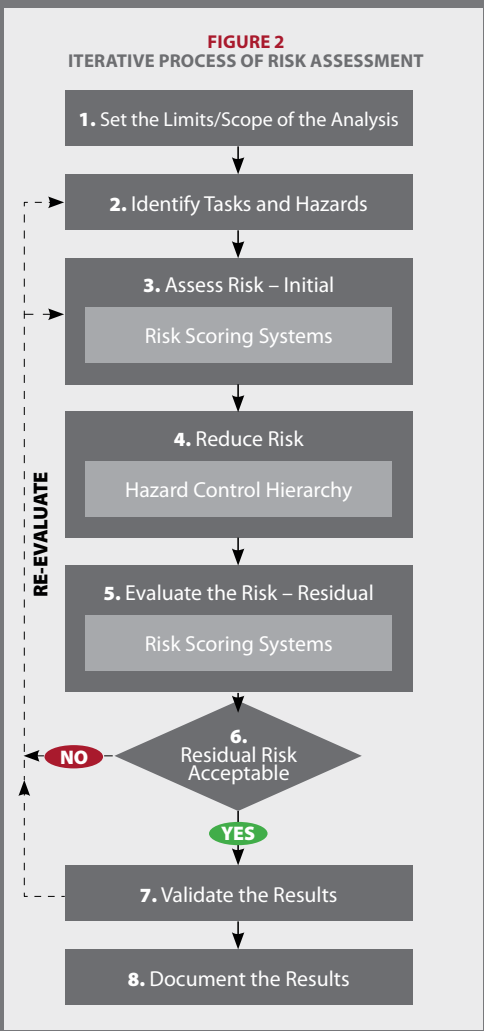


FIGURE 2
ITERATIVE PROCESS OF RISK ASSESSMENT



OPERATING COSTS

Maintenance

Minimizing planned and unplanned downtime is Machine performance reliability. It is defined as the ability of the equipment to meet the agreed upon expectations within the agreed upon time frame. Preventive and Predictive Maintenance programs enables the operations team to have the confidence their equipment will perform to the standards expected.

DAILY SET UP/CHANGEOVER

OEM provides changeover time and cold start time requirements, CPG provides requirements, coordination with upstream and downstream requirements. OEM and CPG need to coordinate on material requirements

G Meeting the consumers' expectations is manifesting itself in a significant growth in SKUs. As a result, flexibility, and the need for changeovers continue to play a key role in unit cost. What level of involvement of operators is required? Can the changeovers be simplified (e.g. tool-less)?

PREVENTATIVE MAINTENANCE

OEMs provide recommended plan and time required

G Preventative maintenance includes the costs to help develop a comprehensive plan, in unison with purchasers, that provides detailed listing of steps, locations, frequency, parts and tools needed to properly maintain equipment. It also includes inventory requirements of spare parts and amount of proprietary parts identified.

OPERATING COSTS

Maintenance

MAINTENANCE COSTS

CPG assigns labor cost based upon OEM requirements

G Annual maintenance activities which can differ from technology to technology. You will also need to consider labor cost, both internally for your maintenance teams and externally for additional complimentary OEM service cost that will exist over the cost of this asset's life. To fully capture the TCO with regards to operating costs, be sure to consider wear parts, hours required to properly maintain machinery daily, weekly and annually (or based on operating hours), and materials.

R Asset Reliability

Sample of basic KPIs for Asset Reliability

- **Production Maintenance Latbor Cost:** Maintenance direct labor cost average hourly rate + benefits + overtime x the total number of maintenance people/shifts.
- **Operations Labor Cost:** Operations average hourly rate + benefits + overtime x the total number of operations people/shifts.
- **Contractor cost** is the total third party service/maintenance cost that is performed on the selected equipment/production line to be measured. Source would be actual contractor invoices associated with selected equipment/production line
- **Average downtime:** sum of recorded planned and unplanned downtime
- **Production hours scheduled:** Production hours actual scheduled hours for selected equipment /production line.
- **Total Maintenance, Repair & Operating supplies (MRO):** The total value of maintenance, repair, and operating supplies (MRO) stocked on site to support maintenance

OPERATING COSTS

Maintenance

SERVICE COSTS

OEMs provide estimate for their recommended service requirements

G

While the technologies enabling remote equipment access have been present for quite some time, adoption has been slow. This is partially attributable to the disparate needs and goals of CPGs' information technology (IT) and operations technology (OT) functions. More progress has been made in remote monitoring of equipment for predictive maintenance and improved OEE, but for security reasons, less has been made on in-bound troubleshooting, as fear of data breaches and cyber-security risks mount.

To help bridge this gap the Remote Equipment Access Options Analysis document provides descriptions of five of the most predominant industry methodologies enabling remote equipment access as alternatives to onsite technician access. Each of them is evaluated on seven key attributes regarding skills required, costs, reliability, and security. Additionally, the relative pros and cons of each industry methodology are identified.

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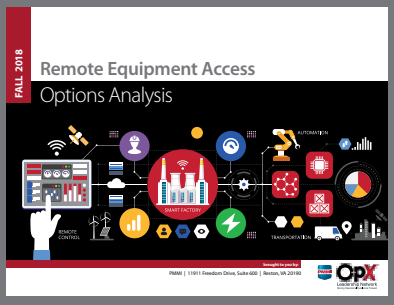
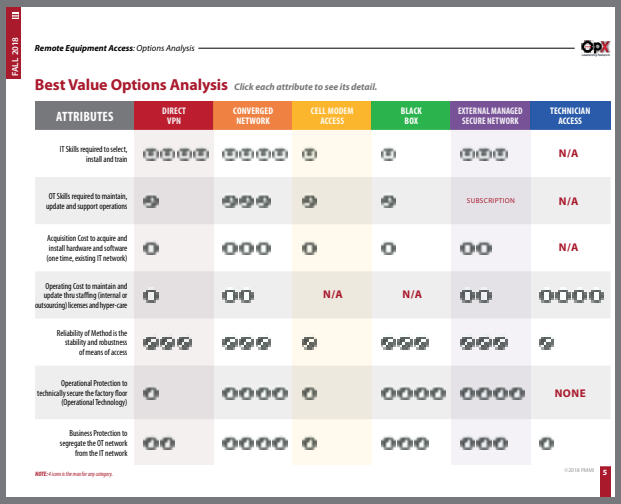
Remote Access





OPERATING COSTS

Maintenance

ALIGNMENT REQUIREMENTS & TOOLS

CPG and OEM define additional setting requirements and associated costs

G Equipment should be provided with alignment features and documentation of initial settings that help identify the extent of time and labor for operators to make adjustments. An OEM should also provide a recommended list of spare parts, components and materials.

SPARE PARTS, LUBE, ETC.

OEM provides costs (e.g. recommended spare parts kit)

G An OEM should provide a recommended list of spare parts, components and materials and the the quantity to keep on hand, the cost of keeping them on the inventory, consignment programs if available, and of course lead time for the orders.

OPERATING COSTS

Cleaning & Sanitation

The equipment cleaning processes whether it be wet, dry or the level of accessibility for your operator or technicians while performing cleaning procedures, time for cleaning occurrences and the frequency of those occurrences. You will also want to understand if there are any special conditions or special tools required for this type of cleaning.

CIP, COP

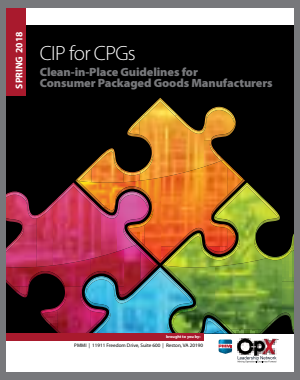
CPG provides sanitary requirements and OEM provide requirements for utiliity, chemicals, etc.

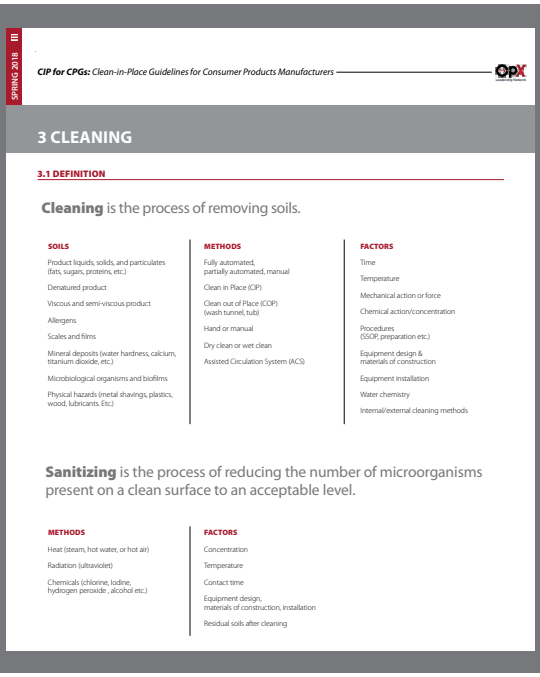
G Beyond the obvious sanitation considerations, be sure to factor the following:

- Accessibility
- Frequency
- Materials and components - could include any specialized solvents, cleaners that are needed all of which can have a significant cost impact.

R

CIP for CPGs





Download the **TCO Workbook**

Go to OpX Leadership Network to download our work products

OPERATING COSTS

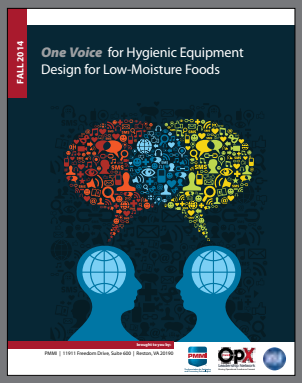
Cleaning & Sanitation

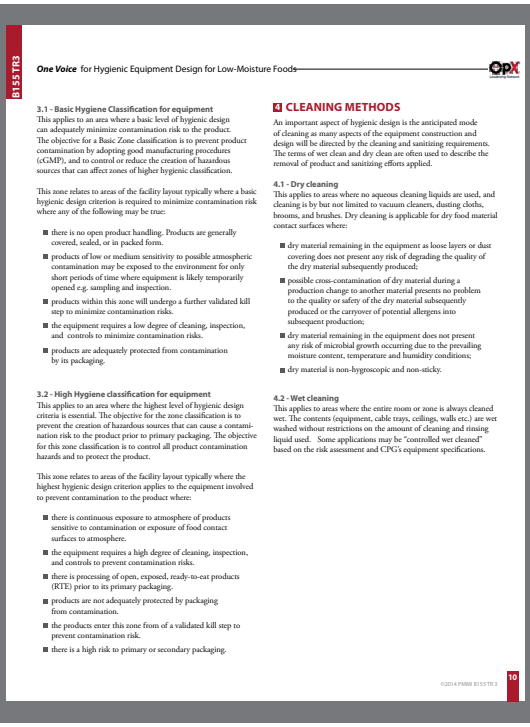
WET CLEAN/DRY CLEAN

CPG provides possible contaminents and the parts of the equipment to be wet cleaned. OEM provides procedures and special tools. Both identify special requirements."

R

One Voice for Hygenic Equipment Design for Low-Moisture Foods

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One Voice for Hygienic Equipment Design for Low-Moisture Foods

3.1 - Basic Hygiene Classification for equipment
This applies to an area where a basic level of hygienic design can adequately minimize contamination risk to the product. The objective for a Basic Zone classification is to prevent product contamination by adopting good manufacturing procedures (cGMP), and to control or reduce the creation of hazardous sources that can affect zones of higher hygienic classification.

This zone relates to areas of the facility layout typically where a basic hygienic design criterion is required to minimize contamination risk where any of the following may be true:

- there is no open product handling. Products are generally covered, sealed, or in packed form.
- products of low or medium sensitivity to possible atmospheric contamination may be exposed to the environment for only short periods of time where equipment is likely temporarily opened e.g. sampling and inspection.
- products within this zone will undergo a further validated kill step to minimize contamination risks.
- the equipment requires a low degree of cleaning, inspection, and controls to minimize contamination risks.
- products are adequately protected from contamination by its packaging.

3.2 - High Hygiene classification for equipment
This applies to an area where the highest level of hygienic design criteria is essential. The objective for the zone classification is to prevent the creation of hazardous sources that can cause a contamination risk to the product prior to primary packaging. The objective for this zone classification is to control all product contamination hazards and to protect the product.

This zone relates to areas of the facility layout typically where the highest hygienic design criterion applies to the equipment involved to prevent contamination to the product where:

- there is continuous exposure to atmosphere of products sensitive to contamination or exposure of food contact surfaces to atmosphere.
- the equipment requires a high degree of cleaning, inspection, and controls to prevent contamination risks.
- there is processing of open, exposed, ready-to-eat products (RTE) prior to its primary packaging.
- products are not adequately protected by packaging from contamination.
- the products enter this zone from of a validated kill step to prevent contamination risk.
- there is a high risk to primary or secondary packaging.

4 CLEANING METHODS
An important aspect of hygienic design is the anticipated mode of cleaning as many aspects of the equipment construction and design will be directed by the cleaning and sanitizing requirements. The terms of wet clean and dry clean are often used to describe the removal of product and sanitizing efforts applied.

4.1 - Dry cleaning
This applies to areas where no aqueous cleaning liquids are used, and cleaning is by but not limited to vacuum cleaners, dusting cloths, brooms, and brushes. Dry cleaning is applicable for dry food material contact surfaces where:

- dry material remaining in the equipment as loose layers or dust covering does not present any risk of degrading the quality of the dry material subsequently produced;
- possible cross-contamination of dry material during a production change to another material presents no problem to the quality or safety of the dry material subsequently produced or the carryover of potential allergens into subsequent production;
- dry material remaining in the equipment does not present any risk of microbial growth occurring due to the prevailing moisture content, temperature and humidity conditions;
- dry material is non-hygroscopic and non-sticky.

4.2 - Wet cleaning
This applies to areas where the entire room or zone is always cleaned wet. The contents (equipment, cable trays, ceilings, walls etc.) are wet washed without restrictions on the amount of cleaning and rinsing liquid used. Some applications may be "controlled wet cleaned" based on the risk assessment and CPG's equipment specifications.

ACCESSIBILITY

OEM demonstrates access and layout for cleanability special requirements.

ALIGNMENT REQUIREMENTS OR SPECIAL TOOLS

CPG and OEM define additional setting requirements and associated costs.

MATERIALS REQUIRED

OEM provides specifications detailing requirements to clean components.

OPERATING COSTS

Training

When you consider the factors inherent to any workforce, whether it be enhancing employee technical skills or responding to employee turnover, training needs to be a continual process to ensure the effective operation of any asset. A refresher on training consider: Ongoing costs associated with training during the life of the equipment for operators, craftsmen, and electricians. Need to consider equipment complexity Need for outside resources and personnel turnover Training level required [beginner, intermediate and advanced].

G

Engagement is defined as "a high degree of emotional attachment, intellectual commitment, and behavioral actions creating ownership and generating individual, team and organizational performance."

Engagement is characterized by high levels of discretionary effort, a bias for action, initiative, and pride in one's work and commensurate results.

- Highly engaged teams are trusting and are committed to the effort. When engagement is high, one can feel the passion and energy.
- Highly engaged teams are committed to the overall objective. As a result, they are generally flexible and adaptable feeling fulfilment with each step of progress towards the overall goal.
- Highly engaged teams are excited by the ability to contribute to the success of the organization and are willing find ways to overcome challenges.
- Highly engaged cultures feel valued and respected.

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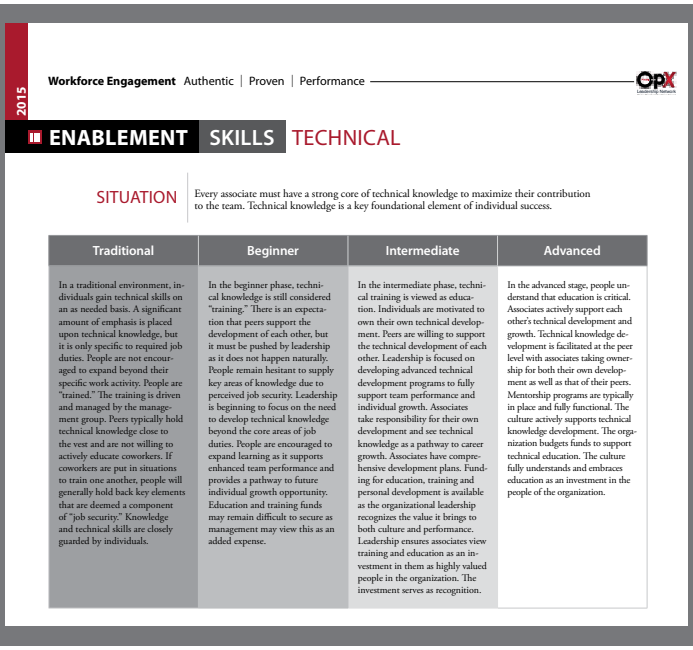
Workforce Engagement



2015

Workforce Engagement Authentic | Proven | Performance

ENABLEMENT SKILLS TECHNICAL

SITUATION Every associate must have a strong core of technical knowledge to maximize their contribution to the team. Technical knowledge is a key foundational element of individual success.

Traditional	Beginner	Intermediate	Advanced
In a traditional environment, individuals gain technical skills on an as needed basis. A significant amount of emphasis is placed upon technical knowledge, but it is only specific to required job duties. People are not encouraged to expand beyond their specific work activity. People are "trained." The training is driven and managed by the management group. Peers typically hold technical knowledge close to the vest and are not willing to actively educate coworkers. If coworkers are put in situations to train one another, people will generally hold back key elements that are deemed a component of "job security." Knowledge and technical skills are closely guarded by individuals.	In the beginner phase, technical knowledge is still considered "training." There is an expectation that peers support the development of each other, but it must be pushed by leadership as it does not happen naturally. People remain hesitant to supply key areas of knowledge due to perceived job security. Leadership is beginning to focus on the need to develop technical knowledge beyond the core areas of job duties. People are encouraged to expand learning as it supports enhanced team performance and provides a pathway to future individual growth opportunity. Education and training funds may remain difficult to secure as management may view this as an added expense.	In the intermediate phase, technical training is viewed as education. Individuals are motivated to own their own technical development. Peers are willing to support the technical development of each other. Leadership is focused on developing advanced technical development programs to fully support team performance and individual growth. Associates take responsibility for their own development and see technical knowledge as a pathway to career growth. Associates have comprehensive development plans. Funding for education, training and personal development is available as the organizational leadership recognizes the value it brings to both culture and performance. Leadership ensures associates view training and education as an investment in them as highly valued people in the organization. The investment serves as recognition.	In the advanced stage, people understand that education is critical. Associates actively support each other's technical development and growth. Technical knowledge development is facilitated at the peer level with associates taking ownership for both their own development as well as that of their peers. Mentorship programs are typically in place and fully functional. The culture actively supports technical knowledge development. The organization budgets funds to support technical education. The culture fully understands and embraces education as an investment in the people of the organization.

OPERATING COSTS

Training

TRAINING (DURING OPERATIONS)

CPG needs to communicate level of additional training needed.
Depends upon level and complexities of technologies.

REFRESHER/UPDATE

Depending upon technology and complexity of equipment, CPG needs to communicate the level of additional training needed to OEMs to come back after initial period to do retrain and requalify.

TYPE (CLASSROOM, HANDS-ON, DIGITAL)

Dialogue should occur between CPG and OEM on type of training most suitable.

OPERATING COSTS

Utilities & Environment

Consider how to manage the impact of this equipment energy and utilities usage in relation to the baseline usage. Discuss how upcoming changes and all future changes will be incorporated into the baseline, and analyze the cross-metric impact.

UTILITY COSTS

Expected Usage Rate or on Gradient with throughput and associated unit cost for each

- Compressed
- Electrical
- Gas
- Water Usage
- Water Treatment

ENVIRONMENTAL COSTS

Expected Usage Rate or on Gradient with throughput and associated unit cost for each

- Wastewater
- Air Emissions
- Disposal
- Lubricants
- Solvents

G Examples of cost analysis calculations

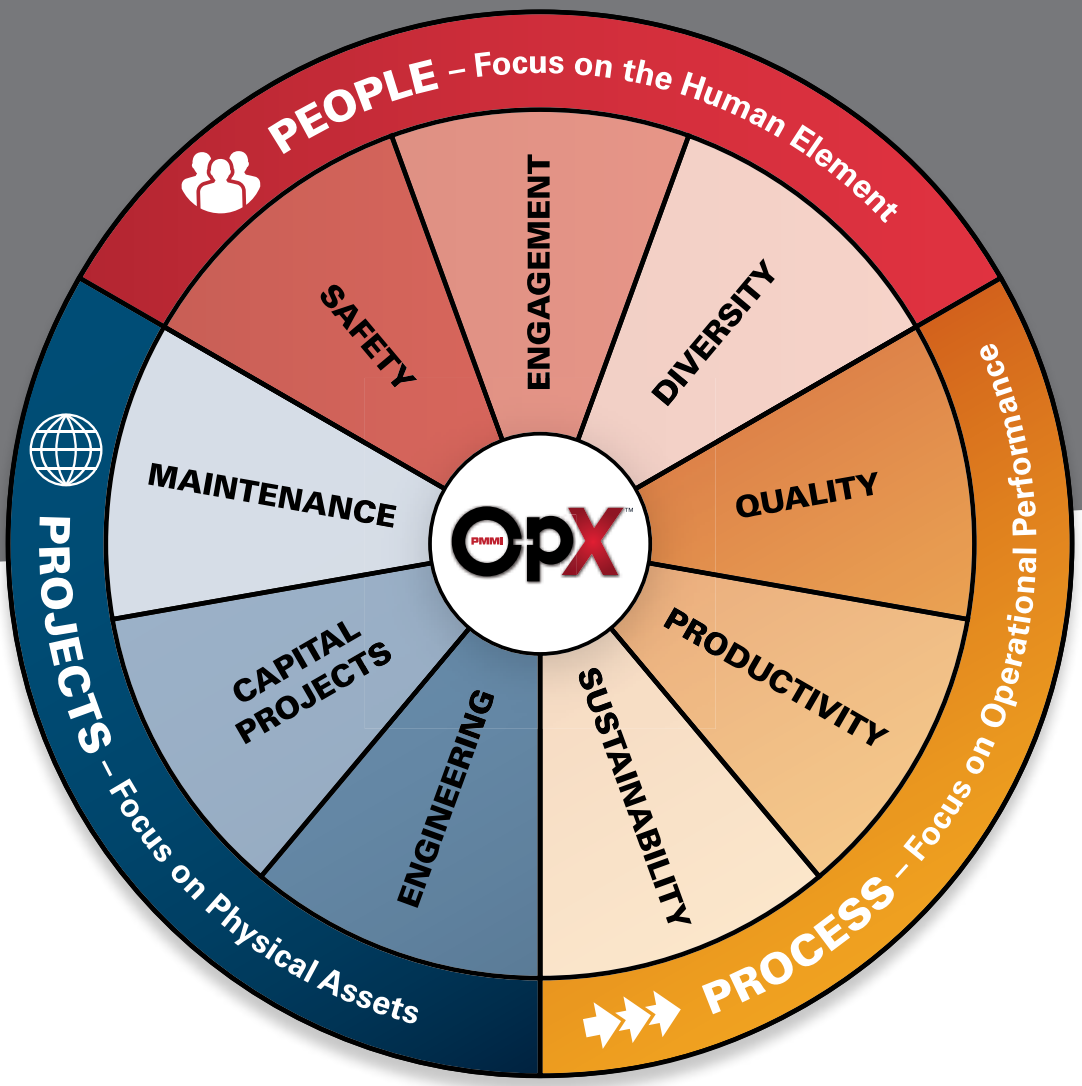
WATER SAVINGS (GALLONS/YEAR)
Calculation ▶ (e.g. 1,000 gals/day x 265 operational days/year = 265,000 gals/year)

ELECTRICITY SAVINGS (KWH/YEAR)
Calculation ▶ (e.g. 1,000 kWh/month x12 months/year = 12,000 kWh/year)

FUEL SAVINGS (SPECIFY TYPES)(GALLONS/YEAR)
Calculation ▶ (e.g. 30 gals/month x12months/year = 360 gals/year)

OTHER SAVINGS (SPECIFY UNITS/YEAR) (E.G. 5,000 GALS OF PICKLE/YEAR)
Calculation ▶ (e.g. 500 gals/month *12months/year = 6,000 gals/year)

By Industry, For Industry Best Practices



Please go to our website **www.opxleadershipnetwork.org** for access to the entire library of OpX Best Practices, Guidelines and other resources for CPG manufacturers and their suppliers

PMMI

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Moving Operational Excellence Forward

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