

TrakSYS™ MOM Template Overview

Version 1.2

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Prepared for:



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Revision History

Date Revised	Primary Author	Version	Summary of Changes
2019-01-31	Bill Rokos	1.0	Initial version.
2019-02-13	Bill Rokos	1.1	Added new functional modules and interfaces that are to be developed so they can be referenced by new proposals.
2019-02-19	Bill Rokos	1.2	Removed references to new functionality based on JM request to delay implementation of these features (quality label printing and PO management limit mode). Added Batch Characteristic Update Interface wrapper description.

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1. Overview

This document describes the TrakSYS MOM Template application developed for Johnson Matthey (JM) Clean Air North America (NA). At the current time, this template has been deployed to three (3) sites in North America and slated to be deployed to new Clean Air sites around the world (this is known internally as Track 1). Further template modifications and interfaces are currently under configuration and deployment to support the upcoming SAP rollout (this is known internally as Track 2). **The Standard TrakSYS MOM Template (the “Template” for short) described below is a combination of the Track 1 and Track 2 work.**

The intention of this description is to convey the high-level module descriptions and assumptions. This will be used as the baseline for preparing a standard cost per site and per line for later deployments.

NOTE

As of this writing (Version 1.2, Dated 19 February 2019), not all functional modules and interfaces described and/or mentioned herein have already been designed, configured, tested, and deployed within the pilot sites (three NA sites). However, the document includes those functional modules or interfaces that have been identified [and agreed to] that must be included in the Standard TrakSYS MOM Template. The new functional modules or interfaces have been highlighted in **bold blue text** throughout this document.

1.1. Assumptions

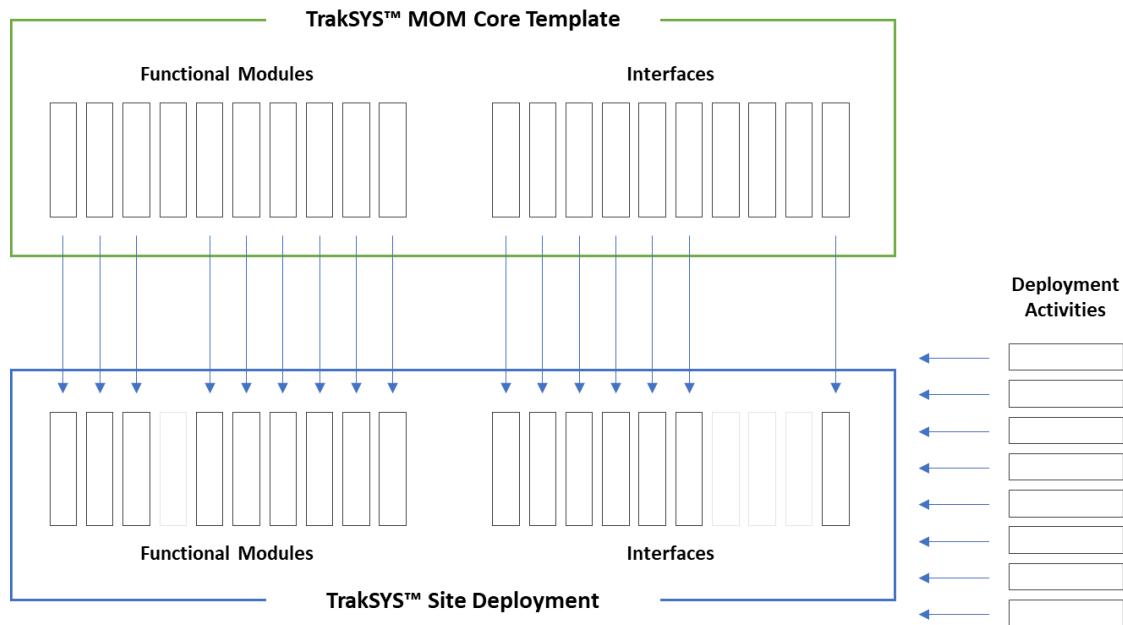
In each relevant section specific assumptions are listed. These should be carefully considered as they depict and clarify key boundaries of the template scope.

1.2. Implementation Team

The deployment of the Template will require resources from both Parsec and JM. Where applicable it is noted that JM internal resources have responsibility for certain aspects. Initially it is assumed that Parsec will supply the primary implementation teams, however, in the future, this could also include Parsec partners, or even an internal JM TrakSYS MOM team.

1.3. Deployment Visualization

A TrakSYS deployment consists of drawing common elements (functional modules and interfaces) from the TrakSYS MOM Template and combining site specific configurations. A series of deployment activities will be executed to install, configure, test and train in the site environment. The diagram below characterizes a sample deployment...

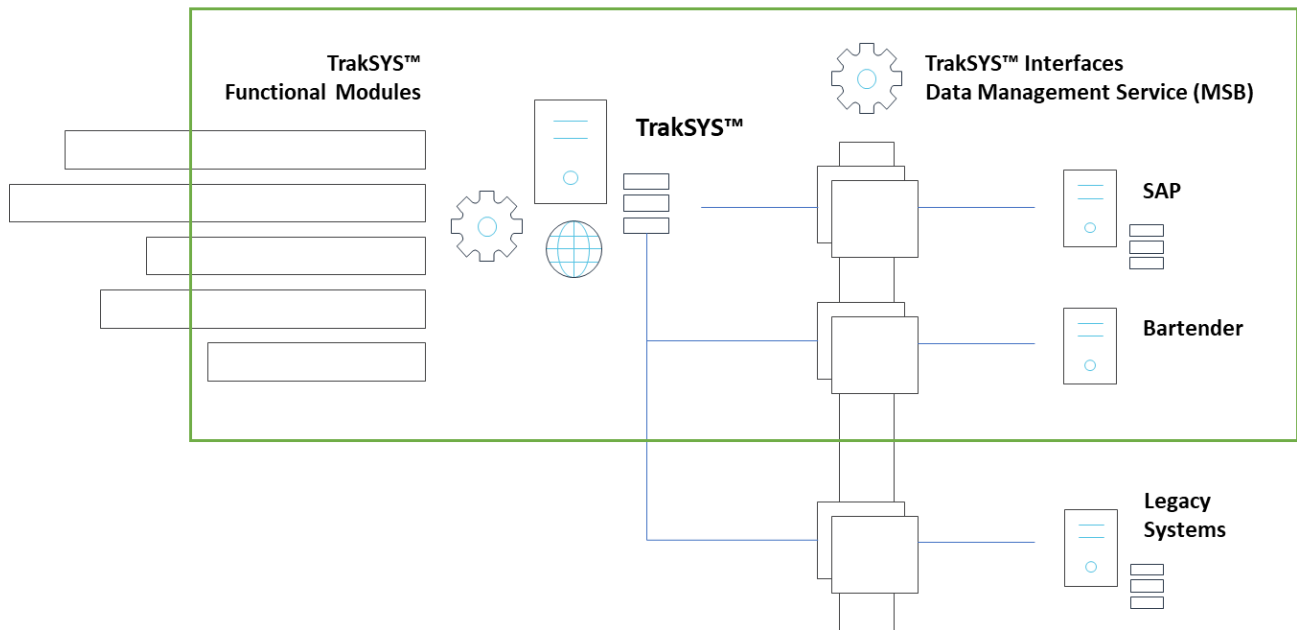


1.4. Core vs. Site Localizations

It is expected that any JM site receiving the TrakSYS MOM template will have some site-specific needs. These may include user interface modifications, specialized reports, and interface connectors with legacy or existing manufacturing systems. In these cases, new requirements specifications must be developed following a JM approved procedure, and cost estimations for development, integration to the core and deployment must be agreed upon.

The diagram below depicts the TrakSYS MOM template core boundaries (for a site) in relation to likely site-specific requests. Note that the TrakSYS deployment includes server instances for SQL Development, TEST and PROD but is depicted as a single entity for simplification. Additional functional module and interface needs that fall outside the MOM Core Template boundaries (the green box below) will require additional scoping, configuration and/or development.

TrakSYS™ MOM Core Template



2. Functional Modules

The TrakSYS MOM template is comprised of several distinct functional modules. Each module covers a collection of configurations, user interfaces, data collection and reports. Note that while these modules are conceptually separate, the implementations are built upon common base configurations and user interfaces. Separating or excluding these is not always straight forward. The functional modules that make up the TrakSYS MOM template are...

- Downtime and OEE
- Process Order Management
- PRR (Pre-Production Readiness)
- Changeover
- SPC (Statistical Process Control)
- Parameter Monitoring
- Non-Conformance / Block Status
- Start of Line (Material Consumption)
- End of Line (Production Logging)
- Order Reconciliation

2.1. Downtime and OEE

The Downtime/OEE module covers the collection of stoppage and slow events and production counts (pieces) on the Coating lines. This enables real-time and historical analysis of downtime, as well as OEE (Availability, Performance and Quality). As stoppage events are logged by TrakSYS, they accumulate in a list visible to operators on the plant floor. Users are expected to select a downtime reason (Event Category in TrakSYS) for a hierarchical list. They can also add notes as needed.

- Configuration of downtime reason hierarchy (machines, categories, codes, etc...).
- Automated downtime recording where possible
- Manual downtime recording and categorization where required.
- Real-time visibility to equipment stoppages and notification of responsible department.
- Force equipment stoppage (interlock) for specific downtime reasons/duration.
- Force downtime categorization/acknowledgement before line equipment can be re-started.
- Handling of slow running and short stops.
- Downtime reporting and analysis.
- Real-time and historical OEE, Availability, Performance and Quality reporting.

2.1.1. Configuration

The following lists key configuration considerations for this module...

- List of distinct Coating Lines for the site.
- For each Coating Line...
 - [Production Counter] For each input stream (nearest to the start of the line as possible), an integer Production Counter Tag must be specified. It must increment by 1 for each block entering the process.
 - [Cycle Time] For each Production Counter, a corresponding Cycle Time Tag must be provided. The Cycle Time Tag must report a floating-point value representing the seconds between the most current Production Counter change, and the previous Production Counter change.
 - A Product list containing an entry for each Product Class made on the line. This Product list will ultimately come from some future SAP import/sync interface, but currently must be provided and imported into TrakSYS. There are many product attributes that are required, but the most critical is the target cycle time for the Product on the line.

- A line-specific downtime reason list (Event Categories) must be provided. JM has agreed on a standardization for levels 1 and 2 of the hierarchy. Levels 3 and 4 are optional and can be site or line specific.
- A shift schedule for each line (or group of lines sharing the same schedule) must be defined. This includes Shift names and start/end times and patterns per day.

2.1.2. Reporting

The following lists template reports for this module...

- Reporting | [Line] | Shift Reports | Overview
- Reporting | [Line] | PO Reports | Overview
- Reporting | [Line] | OEE Reports | OEE
- Reporting | [Line] | OEE Reports | Availability
- Reporting | [Line] | OEE Reports | Performance
- Reporting | [Line] | OEE Reports | Quality
- Reporting | [Line] | OpEx Reports | OEE
- Reporting | [Line] | OpEx Reports | Performance
- Reporting | [Line] | Event Reports | Event Overview
- Reporting | [Line] | Event Reports | Maintenance View
- Reporting | [Line] | Event Reports | Production View

2.1.3. Assumptions

The following lists key assumptions for template deployment...

- JM will provide the correctly functioning Production Counter and Cycle Time counters as Tags accessible by the Kepware OPC server.
- Line stoppages will be triggered based of the Production Counter stopping for a configurable period. TrakSYS supports additional automation trigger conditions which can be added as site specific localizations.
- Slow running events will be triggered when the calculated average real-time cycle time exceeds a pre-determined limit.
- OEE (and its child components) are calculated based on the standard OEE definitions as implemented in the TrakSYS software.
- While the interlock equipment capability is an option, it has not been implemented yet at any site.

2.2. Process Order Management

The PO Management module covers the display and manipulation of Process Orders (POs) that have been imported from SAP (including the Bill of Materials) via the Released PO Interface.

The requirements can be summarized as follows...

- Automatically receive released POs from the SAP interface.
- Include the PO BOM as part of the transferred information.
- Display “packaging specification” for the active PO on the line.
- Visualize the imported BOM for any PO within a TrakSYS user interface (select a PO, see BOM items on-screen).
- Re-sequencing the PO list for a selected Coating Line (effecting the PRR evaluation order).
- Splitting PO into two pieces to be executed at different times.
- Initiating production (starting) the next PO in the list for a selected Coating Line.

2.2.1. Configuration

The following lists key configuration considerations for this module...

- List of distinct Coating Lines for the site.
- Identifiers that allow incoming POs from the SAP interface to be mapped to Coating Line Systems configured in TrakSYS.
- An import of site-specific Products. This Product list must be Coating Line specific as many of the attributes are line specific. This also includes any site-specific identifiers (when they differ from the SAP identifiers). This means that if a Product Class is run on more than one line, the provided master data must include a different record for each line. Note that currently an automated interface for keeping the TrakSYS database current with this information does not exist.
- An import of site-specific raw/intermediate Materials. This includes any site-specific identifiers (when they differ from the SAP identifiers). Note that currently an automated interface for keeping the TrakSYS database current with this information does not exist.

2.2.2. Assumptions

The following lists key assumptions for template deployment...

- POs will arrive in TrakSYS using the core Released PO Interface.
- As there is no core template interface defined for Product information synchronization, the template deployment includes populating the TrakSYS

Product tables with an initial import. Subsequent updates to Product attributes must be made manually through the TrakSYS configuration capabilities.

- As there is no core template interface defined for Material information synchronization, the template deployment includes populating the TrakSYS Material tables with an initial import. Subsequent updates to Material attributes must be made manually through the TrakSYS configuration capabilities.

2.3. PRR (Production Readiness Review)

The PRR module enables the ability to track key activities that must be completed in a timely fashion, leading up to the start of production for POs. TrakSYS allows plant floor manipulation of the released POs to form a production schedule sequence. The next 3 POs scheduled to run for a line are populated with a configurable list of Tasks and Steps that must be completed. As users complete pre-production activities, they utilize TrakSYS user interfaces to mark Steps complete. When all Steps for a Task are completed, the Task is automatically marked as complete. As the predicted production start time is approached, TrakSYS will send configured notification alerts to key supervisory personnel to alert them of the situation.

The requirements can be summarized as follows...

- Specification of the PRR Tasks and Steps for each Coating Line.
- Specification of the Task alert thresholds, message content and target users for notifications.
- Tracking of the next 3 POs for each line to initiate Tasks and Steps.
- Display of Task and Step status for the next 3 POs.
- PRR specific notification engine for tracking and sending alerts (emails/texts).

2.3.1. Configuration

The following lists key configuration considerations for this module...

- Specification of line specific Tasks to be completed before each PO begins.
- Specification of sub-Steps for each Task that must be completed before each PO begins.
- Time limits before a PO starts when notifications should be sent for each Task.
- Users/groups to be notified when a Task is not completed within the configured time limit before PO start.
- Notification message content.

2.3.2. Reporting

The following lists template reports for this module...

- There are currently no standard PRR reports defined, however it is expected that one or two basic PRR overviews will be developed before the completion of Track 1.

2.3.3. Assumptions

The following lists key assumptions for template deployment...

- The typical template line contains 5 to 10 Tasks.
- The typical template Task contains 3-5 Steps.
- While it is possible to complete Steps using automated site-specific integrations to automation or other systems, the current template supports only manual completion (via TrakSYS user interface) of PRR Steps.
- The exception to the above statement is the PRR Inventory Check interface which will automatically complete “bring substrate to the line” Steps based on when valid substrate lots are moved into the proper staging location.

2.4. Changeover

The Changeover module allows the tracking of Coating Line, Cell, and Role specific Steps that must be completed as part of the line changeover process. Due to the nature of the JM coating process, each line can be broken up into 1 or more distinct Cells, each being capable of running its changeover process independently of the other Cells on the line. This allows changeover activities to start at the beginning of a line (Cell 1), while the remaining production completes from the previous PO on the end of the line. Within each Cell, several operator Roles can be defined, each having their own set of Steps to complete. Target durations are specified for individual Steps, Roles, and the overall Cell. Changeover for the line is considered to start when the next PO is started, this typically triggers the start of changeover in the first Cell of the line. Subsequent Cell changeovers must be started manually by users.

As the changeover activities are completed, operators are expected to mark of Step completion via TrakSYS user interface. If a Step exceeds the target duration, the user is expected to add notes to explain the delay. When the final Step in a Cell is complete, the changeover is considered complete and is ended in TrakSYS. The overall line changeover tracking (for downtime purposes) is considered complete when the first Cell’s changeover is complete.

When a PO is started, a line specific algorithm is consulted to determine the type of changeover that should be started.

- Configuration of different types of changeover based on transitions from types of products.
- Support a line-specific changeover algorithm.
- Configuration of expected changeover steps, including expected durations.
- User interfaces for operators to move through the expected changeover steps (starting and ending as needed).

- Display of current changeover progress.
- Notifications if changeover steps exceed expected durations.

2.4.1. Configuration

The following lists key configuration considerations for this module...

- For each Coating Line, the Cells must be defined. This includes an overall Cell target duration.
- For each Cell, the different user Roles conducting changeover must be defined.
- For each Line, the changeover types that are possible to run must be defined.
- For each changeover type, the Steps for each Cell Role must be defined. This includes an overall Role target duration, and individual Step durations.
- For each line, a changeover algorithm must be defined which considers variables like the previous and next Product, to determine the type of changeover to be run.
- Users/groups to be notified when a Cell, Role or Task is not completed within the configured target time.
- Notification message content.

2.4.2. Reporting

The following lists template reports for this module...

- Reporting | [Line] | CO Reports | Overview
- It is expected that a few additional changeover reports will be developed before the completion of Track 1.

2.4.3. Assumptions

The following lists key assumptions for template deployment...

- The typical template Task contains 1-3 Cells.
- The typical template Cell contains 4-6 Roles.
- The typical template Role contains 5-10 Steps per changeover type.
- Algorithm must be clearly defined and any attributes or real-time data which must be considered must be made available to the TrakSYS system via PO/Product master data, or integration. Cases where excessive integration work is required to obtain algorithm variables is considered outside the template.

2.5. SPC (Statistical Process Control)

The SPC module allows for the automated collection of process variables and measurements to be logged and displayed for analysis. In addition, configurable real-time SPC violation rules and alerts can be configured to notify key personnel when critical measurements are drifting.

- Taking and storing sample data for specification limit analysis.
- Taking and storing sample data for control limit analysis.
- Taking and storing sample data for CPK and PPK analysis.
- Real-time SPC trend per block/measurement.
- Ability to control/stop line if SPC measurements violate business rules.
- Ability to send notifications based on business rule violations.

2.5.1. Configuration

The following lists key configuration considerations for this module...

- For each automated measurement (Sample Definition) ...
 - [Measurement Value] For each measurement, a Tag must be specified that holds the last measured value. This Tag must change each time a new measurement is taken.
 - [Measurement Trigger] For each measurement, a Tag must be configured that changes value when new Measurement Value is available for recording. The purpose of this Tag is to notify the TrakSYS data recording service of when to capture the new value. It is not possible to only monitor the Measurement Value Tag for changes, as subsequent measurements of the same exact value would not trigger a Tag change and be missed. The timing of the Trigger Tag change in relation to the value is critical. The Trigger Tag must change at the same time or after the Value Tag is changed. This Trigger Tag is typically implemented as a counter that increments after a new value is placed in the Measurement Value Tag.
 - A set of Tags must be provided that contain the Upper and Lower specification limits for the measurements. These Tags must be populated at the start of the PO or before the first measurement is taken. As an alternative, the specifications limits can be recorded in the TrakSYS Product configuration (per Product). JM would maintain these as configuration as values changed in the future.
- Real-time rule violations to be configured per measurement. These can be standard Western Electric/Nelson rules, or custom variations.
- Users/groups to be notified when a rule violation is triggered.

- Notification message content.

2.5.2. Reporting

The following lists template reports for this module...

- Real-time (last 30 points) view of up to 4 key SPC measurements on the Line Overview screen.
- Larger real-time (last 30 points) view of all configured SPC measurements from the left navigation on the Line Overview screen. This includes selecting a recorded point and viewing the recorded rule violations.
- Reporting | [Line] | SPC Reports | SPC Details

2.5.3. Assumptions

The following lists key assumptions for template deployment...

- JM will provide the correctly functioning Production Counter and Cycle Time counters as Tags accessible by the Kepware OPC server.
- While the interlock equipment capability is an option, it has not been implemented yet at any site.
- While capturing the serialized block number for each measurement is an option, it has not been implemented yet at any site. This would require an additional Measurement Identifier Tag to be provided, that changes value at exactly the same time as the Measurement Value Tag.
- While the TrakSYS platform can collect SPC values manually via user interface entry, the core template does not include the setup and configuration of these screens. This could be added as site-specific localization.

2.6. Parameter Monitoring

The Parameter Monitoring module consists of TrakSYS monitoring a configurable list of equipment parameters per Coating Line Cell (segment). Initial Parameter values are recorded at the start of production as a baseline. As production continues and Parameter values are changed (either directly in the level 2 systems or via TrakSYS user interfaces), the new values are captured. If changed via TrakSYS, user interfaces allow the capture of the user and optional (or required) notes. As with the Changeover module, a Coating Line can be modeled as one or more segments, where it is possible to download and monitor parameters independently from the rest of the line. This supports scenarios where changeover is completed and production starts at the front of line, while the end of line completes the previous PO (with different setpoints).

This module can optionally support pulling the initial Parameter values from an external data source (typically some sort of Parameter database). For each segment of a line, one or more “calls” can be defined. Each call reaches out to an external data source and retrieves a configurable set of parameters to be passed down to the automation.

Users can review and modify the initial values before initiating a “push” or download to automation Tags. When ready, the user initiates the download, at which point all Parameter values are written to the corresponding Tag addresses.

Alternatively, the Parameters can be pushed to the PLCs via a level 2 system (outside of TrakSYS). The level 2 system must provide a clear signal via pre-arranged Tag changes that signal TrakSYS that a download has occurred. On that signal, TrakSYS will snapshot all configured Parameter Tags and record the initial state.

- Configuration of Parameter Tags to be downloaded to and monitored per line segment.
- Allow parameter changes to be made during a PO, by an authorized user (if enabled to make these changes in TrakSYS).
- Allow a reason to be selected for changing a parameter.
- Recording details on who, when and why parameters are changed for analysis.
- Parameter changes should only apply for the current PO. Successive POs revert to the originally configured values.
- Recording the exact Parameters in use on a per block basis.
- Monitoring the automation for a level 2 driven Parameter download and recording values.

2.6.1. Configuration

The following lists key configuration considerations for this module...

- For each Coating Line, define one or more segments. Each segment represents a collection of Parameter Tags to be written to or monitored.
- For each line segment...
 - Define a call to an external data store that can return a list of Tag/value pairs to be written to the automation.
 - Define the Parameter Tag addressed in the PLC.

2.6.2. Reporting

The following lists template reports for this module...

- There are currently no standard Parameter Download reports defined, however it is expected that one or two basic Parameter overviews will be developed before the completion of Track 1.

2.6.3. Assumptions

The following lists key assumptions for template deployment...

- The data source that stores the Parameter values per Product Class per line segment is external to TrakSYS.

- The external data store must be capable of returning Parameter values for a given Coating Line, segment, and Product Class based on arguments passes to a SQL or similar type of API call.
- If the initial download is to occur from a TrakSYS independent level 2 system, a clear signal from automation must be provided that tells TrakSYS that the Parameters have been downloaded. This can only occur after the PO has been started in TrakSYS.

2.7. Non-Conformance / Block Status

The NC / Block Status module allows users to create entries for individual, or groups of blocks that have some sort of defect. In addition, additional block status categories allow additional categorization of blocks for other SAP required states. After block status are added or changed, Goods Receipt messages to SAP will be triggered (including reversals for mistakes and corrections).

The requirements can be summarized as follows...

- Allow creation of new block entries (either single block or group of blocks).
- Update SAP with Goods Receipt messages in near real-time as they are entered, or at end of Shift / PO as configured.
- Assignment of blocks to 5 new block status types.
- Assignment to reason codes based on the selected block status type.
- View historic block status allocation per PO.
- Notify users when outstanding Live-Rework blocks remain on a PO.

2.7.1. Configuration

The following lists key configuration considerations for this module...

- A list of possible block statuses must be provided. This list can site-specific but must map to a global SAP specific list of statuses.
- A common list of Reason Codes (OEE Count Categories) must be defined. This list must be global to the site but can differ per site.
- A list of line “area” (OEE Counter Type) must be defined. These are typically different cells or sections of the line (Cell 1, Cell 2, End of Line, etc...). These areas can be line specific. This can be selected when applying block statuses for reject or bad pieces, to aid in analysis.
- For each line area, a list of specific equipment (OEE Counter). This can be selected when applying block statuses for reject or bad pieces, to aid in analysis.

2.7.2. Reporting

The following lists template reports for this module...

- Reporting | [Line] | NC Reports | Overview
- This functionality is currently under development as part of Track 2. This content will be updated as Track 2 is completed.

2.7.3. Assumptions

The following lists key assumptions for template deployment...

- This functionality is currently under development as part of Track 2. This content will be updated as Track 2 is completed.

2.8. Start of Line (Material Consumption)

The Start of Line module allows the use of a fixed or mobile device to scan Handling Units of materials prior to being loaded onto the front of the production line. As HUs are scanned, the scanned material should be validated against the BOM within the active Process Order. Scans are either rejected, or approved for use on the line, and the HU information should be recorded against the Process Order and a Goods Issue message triggered to be sent to SAP.

The requirements can be summarized as follows...

- Scan pallets at the start of production.
- Display an error to the user if the scanned HU contains a material or batch that has not been allocated to the current PO (based on the SAP PO information).
- Allow manual entry of HU, material and batch if the scanning hardware is not functional.
- Automatically update the appropriate PRR tasks when substrates arrive at the designated staging areas (related to the PRR module).
- Display the active PO in each line “segment”.
- Detect and reject incorrect materials and batches (based on the PO BOM) when a HU is scanned.
- Record the HUs and related information scanned to a PO for later reporting (Non-Serialized).
- Pass scanned consumption information on to SAP via the Goods Movement interface.

2.8.1. Configuration

The following lists key configuration considerations for this module...

- There are no significant TrakSYS configurations specific to this module. All needs are covered in configurations from other modules.

2.8.2. Assumptions

The following lists key assumptions for template deployment...

- This module assumes that accurate PO BOM material is being passed down to TrakSYS in the template Released Process Orders interface.
- This module utilizes the template Coating Material Consumption interface to update SAP with GI movements.

2.9. End of Line (Production Logging)

The End of Line module manages and visualizes the end of line packing processes, which include the option to pre-print box and pallet labels for upcoming POs, and the use of fixed or mobile scanners to record and track pieces being packed into boxes and then boxes onto pallets (based on the packing instructions for the produced material). The scanning of a complete pallet will record the production information against the PO and trigger the creation of a Goods Receipt message to SAP. Additionally, the ability to print or reprint labels on demand, the ability to identify the last box & pallet (usually a partial quantity) for the process order and manually update the actual quantity and print new labels with the updated values, and the ability to query previous Process Orders to list the pallets and associated boxes.

The requirements can be summarized as follows...

- Store and maintain packaging instructions per Product. This will be Product specific information either configured directly in the TrakSYS Product tables. Initial upload can be performed with a mass import from an Excel/data dump.
- Display the packaging instructions for the active PO to the end of line packaging area.
- Store and display options for multiple packing instructions per Product.
- Scan a serialized Product item into a box.
- Scan a box of serialized Product items into a pallet (HU).
- Scan a tray of non-serialized Product items onto a pallet (HU).
- Generate box, tray and pallet labels (via Bartender interface).
- Automatically determine if a Product requires item to box scanning.
- Allow switching to and from “item to box” scanning mode (permitted user).
- Allow switching to and from “box to pallet” scanning mode (permitted user).
- Pre-print box labels (at start of PO).
- Scan pre-printed box labels and record that the label has been used.
- On PO close, delete records for pre-printed labels that have not been used.
- Print box labels on demand (as needed vs. pre-print).

- Re-print a box or pallet label.
- Record information for reporting for pallet (HU) to box and box to item relationships for both serialized and non-serialized Products.
- Record information about the individual user who is packing pieces (using JM badge scans or clock number).
- Support packing from multiple stations at the same line simultaneously.

2.9.1. Configuration

The following lists key configuration considerations for this module...

- This functionality is currently under development as part of Track 2. This content will be updated as Track 2 is completed.

2.9.2. Assumptions

The following lists key assumptions for template deployment...

- This functionality is currently under development as part of Track 2. This content will be updated as Track 2 is completed.

2.10. Order Reconciliation

The Order Reconciliation module manages and visualizes the PO reconciliation processes required to balance the materials used against the materials produced (commonly known as Piece Balancing). Piece Balancing is performed entirely in TrakSYS, including triggering updates to SAP. Washcoat consumption and remnants production will be performed in an external batching solution, interfaced to TrakSYS for recording against the PO and triggering updates to SAP. The Process Order must balance before it can be closed and will adopt a 2-step approach.

The requirements can be summarized as follows...

- Display the piece balance for a selected PO (active order).
- Update SAP with production and reject block status values (Goods Receipt) is near-real time, as well as the closure of a PO.
- Notify on screen when a piece balance does not balance for the active PO.
- Notify on screen when a piece balance does not balance for and completed but un-closed POs.
- Edit block status information to balance a PO.
- Write-off a PO that is not balanced (permitted user) so that a PO can be closed even when piece information is missing. Require a categorization and notes.
- Generate an escalation if a piece balance does not balance.

2.10.1. Configuration

The following lists key configuration considerations for this module...

- This functionality is currently under development as part of Track 2. This content will be updated as Track 2 is completed.

2.10.2. Assumptions

The following lists key assumptions for template deployment...

- This functionality is currently under development as part of Track 2. This content will be updated as Track 2 is completed.

3. Interfaces

The following interfaces are part of the “core template”. They should function similarly at each Clean Air site and require minimal configuration and testing at each deployment. The interfaces are separated into related groupings. For each site deployment, a sub-set of the available interfaces will be used and the which will drive the interface deployment costs (configuration, testing, etc...).

Note that the initial development of these interfaces is assumed to have occurred in a separate agreement.

The following table can be used to select and specify the interfaces to be used for a specific site's services agreement.

Interface	Required	Notes
SAP Interfaces		
Released Process Orders Interface (SAP to TS)		
PRR Inventory Check Interface (SAP to TS)		
Coating Material Consumption Interface (TS to SAP)		
Coating Production Logging Interface (TS to SAP)		
Material Master Interface (SAP to TS)		
ITS Interfaces		
ITS Washcoat Planning Interface (SAP to TS to ITS)		
ITS Inventory Update Interface (SAP to TS to ITS)		
ITS Batch Material Consumption Interface (ITS to TS to SAP)		
ITS Batch Production Logging Interface (ITS to TS to SAP)		

ITS Coating WC Consumption Interface (ITS to TS)		
ITS Coating Remnants Logging Interface (ITS to TS to SAP)		
WRMS Interfaces		
WRMS Batch Material Consumption Interface (WRMS to TS to SAP)		
WRMS Batch Production Logging Interface (WRMS to TS to SAP)		
WRMS Coating WC Consumption Interface (WRMS to TS)		
WRMS Coating Remnants Logging Interface (WRMS to TS to SAP)		
Common Legacy Interfaces		
Piece Serial Number Interface (Legacy to TS)		
Scanned Pallet Quantity Interface (TS to Legacy)		
Material Master Interface (TS to Legacy)		
Released POs Interface (TS to Legacy)		
Bartender Interfaces		
Bartender (TS to Bartender)		

3.1. SAP Interfaces

The SAP interfaces transfer information between TrakSYS and SAP. It is expected that all sites will utilize these interfaces.

3.1.1. Released Process Orders Interface (SAP to TS)

This interface pulls POs from SAP into the TrakSYS database for use in local TrakSYS operations, as well as to later expose to legacy manufacturing systems with additional interfaces. This includes initial PO releases, as well as any updates released subsequently (the interface will only allow certain fields to be updated after the initial release). Both coating and batching POs are received and stored. This interface will support receiving other types of POs in the future.

3.1.2. Inventory Update Wrapper Interface (SAP to TS)

This interface will serve as a generic wrapper around querying SAP for the contents of specified inventory locations. Several other MES interfaces will utilize this wrapper as part of a larger workflow.

Note this interface is used by others. It is a library for other interfaces to call.

3.1.3. PRR Inventory Check Interface (SAP to TS)

This interface will be utilized by the MES PRR function (Production Readiness Review). TrakSYS will monitor upcoming POs for readiness and query the SAP inventory for the location of needed raw materials (using the generic Inventory Update interface).

3.1.4. Goods Movement Wrapper Interface (TS to SAP)

This interface will serve as a general wrapper around the Goods Movement Web Service exposed by SAP. Both Goods Issue and Goods Receipt transactions can be executed through this interface. Several other MES interfaces will utilize this wrapper functionality to execute GR and GI operations.

Due to the asynchronous nature of this interface (TrakSYS will call a web service in SAP to submit, and sometime later SAP will call a Web Service on TrakSYS with the results), this interface requires that a Web Service be developed within TrakSYS to receive the operation feedback.

Note this interface is used by others. It is a library for other interfaces to call.

3.1.5. Batch Characteristics Update Interface (TS to SAP)

This interface will serve as a general wrapper around the ability to send information regarding the characteristics of a washcoat batch to SAP. This involves encoding batch characteristic information into an XML file and uploading it to an FTP location which is being monitored by SAP. This will be done as part of several of the Goods Movement updates just before the actual movement is executed.

Note this interface is used by others. It is a library for other interfaces to call.

3.1.6. Coating Material Consumption Interface (TS to SAP)

This interface will regularly pass material consumption data recorded in the TrakSYS tMaterialUseActual table to SAP (using the generic Goods Movement interface). TrakSYS user interfaces will be developed to allow scanning of raw materials at the front of line (to be recorded in tMaterialUseActual). Note that material consumption records can find their way into this table in a variety of ways, including direct scanning via TrakSYS, or by other interfaces that pull consumption data in from legacy systems.

3.1.7. Coating Production Logging Interface (TS to SAP)

This interface will transfer finished (and intermediate) produced goods to the SAP inventory by calling the generic Goods Movement interface as each new pallet is scanned at the end of line. TrakSYS user interfaces will be developed to allow scanning of pallets at the end of line (to be recorded as tItem records).

Note this interface also covers passing up non-conformance and block status information to SAP as GR transactions (using the generic Goods Movement interface).

3.1.8. Material Master Interface (SAP to TS)

This interface will sync material master information (raw, intermediate and final) from SAP to TrakSYS. A material master change in SAP will trigger the call of a Web Service exposed by TrakSYS. This includes BOM and packing instructions. Material information will be stored in the TrakSYS Product and Material tables.

3.2. ITS Interfaces

The ITS interfaces primarily exchange information between TrakSYS and the ITS system. In some cases, the interfaces pass information to/from SAP within the same process. These interfaces are only relevant in the Devon and Smithfield sites where ITS is used.

3.2.1. ITS Washcoat Planning Interface (SAP to TS to ITS)

This interface accepts additional batching PO data from SAP to pass onto the ITS system in NA by means of a CSV file published to a pre-determined FTP location. PO information is passed directly into ITS and is not maintained in the TrakSYS database.

3.2.2. ITS Inventory Update Interface (SAP to TS to ITS)

This interface pulls inventory information from SAP and updates directly to inventory tables in ITS (using the generic Inventory Update interface). The ITS inventory tables must be kept current for raw, intermediate and remnant materials in the general vicinity of the manufacturing process. Inventory information pulled is passed directly to ITS and is not maintained in the TrakSYS database.

3.2.3. ITS Batch Material Consumption Interface (ITS to TS to SAP)

This interface pulls material consumption data from the batch processes in ITS to pass them on to SAP (using the common Goods Movement interface). Consumption data is pulled directly from the ITS database and passed through to SAP. TrakSYS does not store any of the batch consumption data as it is passed through.

3.2.4. ITS Batch Production Logging Interface (ITS to TS to SAP)

This interface pulls WC batch production data (when Batch Characteristics are made available) and passes it to SAP. In addition, the Batch Characteristic update point is used to trigger a Goods Movement for GR to SAP. Production data is polled directly from the ITS database and passed through to SAP. Batch Characteristics are first sent to SAP, and then the Goods Movement follows. TrakSYS does not store any of the batch production data as it is passed through.

3.2.5. ITS Coating WC Consumption Interface (ITS to TS)

This interface handles retrieving the WC material consumption (for the coating process) from ITS and inserting it into the TrakSYS tMaterialUseActual table. The interface will poll ITS for WC consumption records and move them to TrakSYS where they will be later moved to SAP using the Coating Material Consumption interface.

3.2.6. ITS Coating Remnants Logging Interface (ITS to TS to SAP)

Towards the end of coating production, ITS logs remnants that are by-products of the process. This interface polls ITS for the appearance of these remnants and posts the Batch Characteristics of the remnants, as well as executes GR using the generic Goods Movement interface. Batch Characteristics are first sent to SAP, and then the Goods Movement follows.

3.3. WRMS Interfaces

The WRMS interfaces primarily exchange information between TrakSYS and the WRMS system. In some cases, the interfaces pass information to/from SAP within the same process. These interfaces will be used at sites where the WRMS system is in use.

3.3.1. WRMS Batch Material Consumption Interface (WRMS to TS to SAP)

This interface pulls material consumption data from the batch processes in WRMS to pass them on to SAP (using the common Goods Movement interface). Consumption data is pulled directly from the WRMS database and passed through to SAP. TrakSYS does not store any of the batch consumption data as it is passed through.

3.3.2. WRMS Batch Production Logging Interface (WRMS to TS to SAP)

This interface pulls WC batch production data (when Batch Characteristics are made available) and passes it to SAP. In addition, the Batch Characteristic update point is used to trigger a Goods Movement for GR to SAP. Production data is polled directly from the WRMS database and passed through to SAP. Batch Characteristics are first sent to SAP, and then the Goods Movement follows. TrakSYS does not store any of the batch production data as it is passed through.

3.3.3. WRMS Coating WC Consumption Interface (WRMS to TS)

This interface handles retrieving the WC material consumption (for the coating process) from WRMS and inserting it into the TrakSYS tMaterialUseActual table. The interface will poll WRMS for WC consumption records and move them to TrakSYS where they will be later moved to SAP using the Coating Material Consumption interface.

3.3.4. WRMS Coating Remnants Logging Interface (WRMS to TS to SAP)

Towards the end of coating production, ITS logs remnants that are by-products of the process. This interface polls WRMS for the appearance of these remnants and posts the Batch Characteristics of the remnants, as well as executes GR using the generic Goods Movement interface. Batch Characteristics are first sent to SAP, and then the Goods Movement follows.

3.4. Common Legacy Interfaces

The common legacy interfaces include functionality that moves data to/from TrakSYS and a legacy system (typically MES). These interfaces are designed to be generic, meaning the same interface could be used at different sites with different legacy system targets (without modification to the

core interface). As a result, it is expected that the legacy system would be altered as need to support the requirements of the interface.

3.4.1. Material Master Interface (TS to Legacy)

This interface exposes/passes along material master data received in the separate SAP to TS interface, to legacy MES applications. The mechanism for communication is either standard data views that legacy applications can poll at their convenience, or a continual call to a function call on the legacy application side that sends down updated material information.

3.4.2. Piece Serial Number Interface (Legacy to TS)

This interface facilitates moving serial numbers generated by a legacy MES system to the TrakSYS database. Along with the part serial number, the PO/batch/lot will be transmitted.

The serial numbers and associated data will be stored in TS and used during non-conformance entry and EOL packing verification. When a piece is scanned into a box or as non-conformance, TS can then check if the piece belongs to the correct PO/batch/lot.

TrakSYS provides a standard function call that any legacy system can call to pass this information.

3.4.3. Scanned Pallet Quantity Interface (TS to Legacy)

When a pallet is scanned (consumed/GI) at the infeed of the coating process, the piece quantity will be supplied to a legacy MES system. The legacy system will increment automation counters as this is called. If pieces are loaded/processed on the infeed machine that exceed the allowable count, the automation will prevent the line from continuing.

TrakSYS will call a standard function call to pass this information to the legacy system.

3.4.4. Released POs Interface (TS to Legacy)

This interface exposes/passes along PO information received in the separate SAP to TS interface, to legacy MES applications. The mechanism for communication will be standard views that the legacy applications can poll at their convenience.

3.5. Bartender Interfaces

The Bartender interfaces allow interact with the Bartender software for the creation of various labels. It is expected that all sites will utilize these interfaces.

3.5.1. Bartender (TS to Bartender)

This is a generic interface that enables the creation of various barcode labels at the end of line area of the coating processes. TrakSYS user interfaces will be created to indicate when new boxes or pallets are produced, or non-conformance is logged, and generate the necessary unique barcode values. These values will be passed to the Bartender software to create labels that will be applied to the physical HUs.

4. Deployment Activities

The following sections describe the major steps/areas of deployment for the JM TrakSYS MOM template to a new site. The overall effort is a combination of a base factor that is the same regardless of the size of the site, and a per-line factor that can be applied to the number of Coating Lines at the site. The effort below describes both outside integrator tasks as well as internal JM tasks to create an overall picture of a deployment. As a summary, the deployment areas are...

- Server Hardware
- Server Software
- Client Hardware
- Third Party Components
- Configuration Fact Finding
- Configuration Entry
- Interface Setup and Testing
- Site Deployment
- Adjustments
- Training
- SAP Go-Live Support
- Project Support

4.1. Server Hardware

A standard server model has been established by JM for the TrakSYS MOM implementations. It consists of 6 servers with responsibilities as follows.

4.1.1. TrakSYS Site Development Server

This server hosts a development version of the TrakSYS platform, including a stand-alone SQL Server database. This instance is used for making site specific configuration and verifying functionality before publishing to the live production server (and/or the Site Test/Training Server).

This server should not be confused with the JM shared Template Development Server. This server is currently hosted in the cloud and holds the common template user interface and business rule logic shared across all deployments.

4.1.2. TrakSYS Site Test/Training Server

This server hosts a development version of the TrakSYS platform, including a stand-alone SQL Server database. This instance is kept in-sync with the production instance (described below) and is used for training and troubleshooting for the local site.

4.1.3. TrakSYS Site Production Application Server

This server hosts the production instance of the TrakSYS platform (data collection and management services and web application). Note that for high availability reasons, the TrakSYS SQL Server database is housed on a separate Always-On SQL cluster.

4.1.4. TrakSYS Production Database Servers (2)

These two servers host mirror SQL Server instances configured for Always-On high availability. The TrakSYS production databases (base and historian) are hosted here. A single “virtual” database server name is exposed and all TrakSYS applications are connected.

4.1.5. Bartender Server

This server will host the Bartender barcode and label printing software used on the plant floor. Note that Bartender software setup and configuration is the responsibility of JM and outside the scope of the TrakSYS MOM implementation team.

The exact server capabilities and specifics are described in internal JM documents.

4.2. Server Software

Software setup on the server consists of a few significant components as described below. Some of the steps are to be taken care of by JM IT resource, those are marked with [JM]. These tasks are typically all done remotely via VPN and RDP access to the servers.

- [JM] Installation of a stand-alone instance of SQL Server on the Development and Training servers.
- Installation and base configuration of TrakSYS on the Development and Training servers. This includes data collection services, web application, and database creation.
- [JM] Installation of the SQL Server instances on production Always-On servers (2).
- Installation and base configuration of TrakSYS on the Production server. This includes data collection services, web application, and database restore from Test/Development (with some JM assistance as admin access to the production SQL Server is required).

4.3. Client Hardware

JM supplies all client hardware, installation and configuration. Relevant devices include...

- Plant floor TrakSYS workstations (PCs, monitors, mounts, etc...).
- Mobile devices (tablets, mobile phones, etc...) for PRR and Changeover management.
- Large screen displays for real-time information display.
- Scales, sensors, etc.... for SPC data collection.
- Barcode/label scanners.

- Barcode/label printers.

4.4. Third Party Components

JM supplies all 3rd party software purchase, installation and configuration. Significant platforms that fall into this category include...

- Kepware (instance on Test/Development server and Production server)
- Bartender

4.5. Configuration Fact Finding

In order to configure the functional modules, a significant amount of configuration information is required from the site and lines. A series of configuration templates are in development (primarily by JM with Parsec advisement) which can be used to collect and format the required information. This process must be driven by JM MOM experts as explanation to the local site is required. During a deployment the integration implementation team will participate on calls and meetings to assist with explaining and interpreting what is needed.

4.6. Configuration Entry

Once the configuration information is obtained, it must be entered in the TrakSYS environment. This process will be done primarily by the implementation team, however in some cases, the site or central JM TrakSYS MOM experts may assist with some of the entry.

4.7. Interface Setup and Testing

The template interfaces described earlier in this document must be configured for the site and run through a set of pre-existing integration test scenarios. This will involve an implementation engineer and another testing resource. It is assumed that the test case scenarios are pre-developed as part of the original interface development (separate from the site deployment). Significant participation from the JM SAP (and any local legacy application teams) is expected.

4.8. Language Translation

If required, the JM specific TrakSYS MOM Template user interfaces can be translated into the local language. An Excel dump of the applicable strings can be produced and delivered to a JM assigned resource for translation (this is typically the site champion or some other bi-lingual resource). Once translations are provided, the Excel structure is loaded back into TrakSYS. The TrakSYS software displays the UI to each user based on the language settings from their browser. TrakSYS users can also be configured with a specific language preference overriding the browser settings.

4.9. Site Deployment

In most cases, the deployment of the functional modules is done with members of the implementation team, along with JM TrakSYS MOM experts, and the site champion(s) as a combination of remote sessions and one or more trips on-site to the plant. The number and duration of remote sessions/on-site trips depends on the size of the site implementation, and the

phasing of module deployment. Except for very small sites, it is difficult to simultaneously deploy all the functional modules over multiple lines.

It is expected that these remote sessions/on-site deployment visits would occur in advance of the final SAP go-live for the site (see the SAP Go-Live Support section for more details).

As the required time for deployment may differ significantly between sites based on circumstances, this effort will be quoted separately in each site's statement of work/commercial proposal.

4.10. Adjustments

Even though the template is designed to be used at any site, there may be small adjustments that become apparent during an implementation. These items would be also fed back into the core template (so these would not be considered site-specific localizations).

4.11. Training

As established by the first site implementations, a standard training PPT was developed (by Parsec) explaining the relevant functionality for end users. Using this material, JM TrakSYS MOM experts and site champions schedule and execute a series of user training sessions. Direct involvement from the implementation team is minimal and usually limited to support and assistance for the first few sessions as needed based on the JM trainer knowledge level.

4.12. SAP Go-Live Support

The final stages of the TrakSYS MOM deployment involve cutting the site over to the SAP ERP back-end. As there are significant integrations with SAP that effect the TrakSYS functional modules, and the full TrakSYS capabilities cannot be completely utilized until SAP is deployed, the SAP go-live activities represent the logical culmination of the implementation. JM has requested that the TrakSYS MOM implementation team establish a significant on-site presence around the SAP go-live. One or more implementation team members will be present on-site during normal business hours and be available on-call during off hours (near the site) for emergencies. Depending on the site needs, this arrangement may take different forms including 24x5, 24x7, etc...

As the required time for go-live support may differ significantly between sites based on circumstances, this effort will be quoted separately in each site's statement of work/commercial proposal.

4.13. Project Support

As with any project, the implementation team must include some time after deployment for troubleshooting, and in some cases resolution of minor deployment issues. The typical period of 90 days after go-live is completed is included.