SAP EHS Environment Management

Greenhouse Gas Emissions

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SAP

SAP Cloud for Sustainable Enterprises

HOLISTIC STEERING AND REPORTING

Go from averages to actuals and record data on transactional level

Zero Emissions
with Climate Action

Decarbonize your entire value chain (scope1-3) based on actual business transactions

SAP EHS Environment Management

Zero Waste
with Circular Economy

Incorporate **circularity** into your supply chain & create sustainable business models

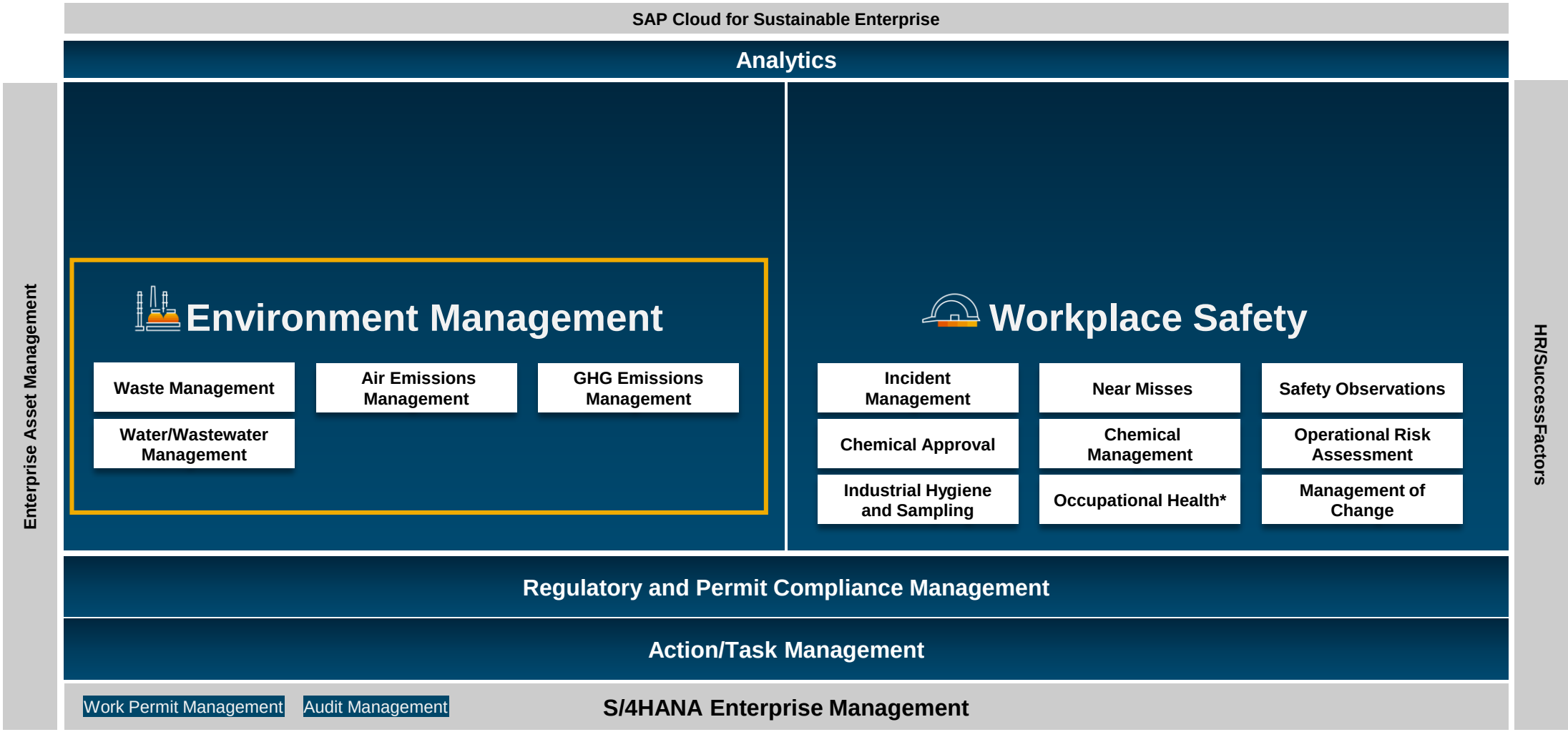
SAP EHS Environment Management

Zero Inequality
with Social Responsibility

Understand the **impact of** your **business** on **people and the society**

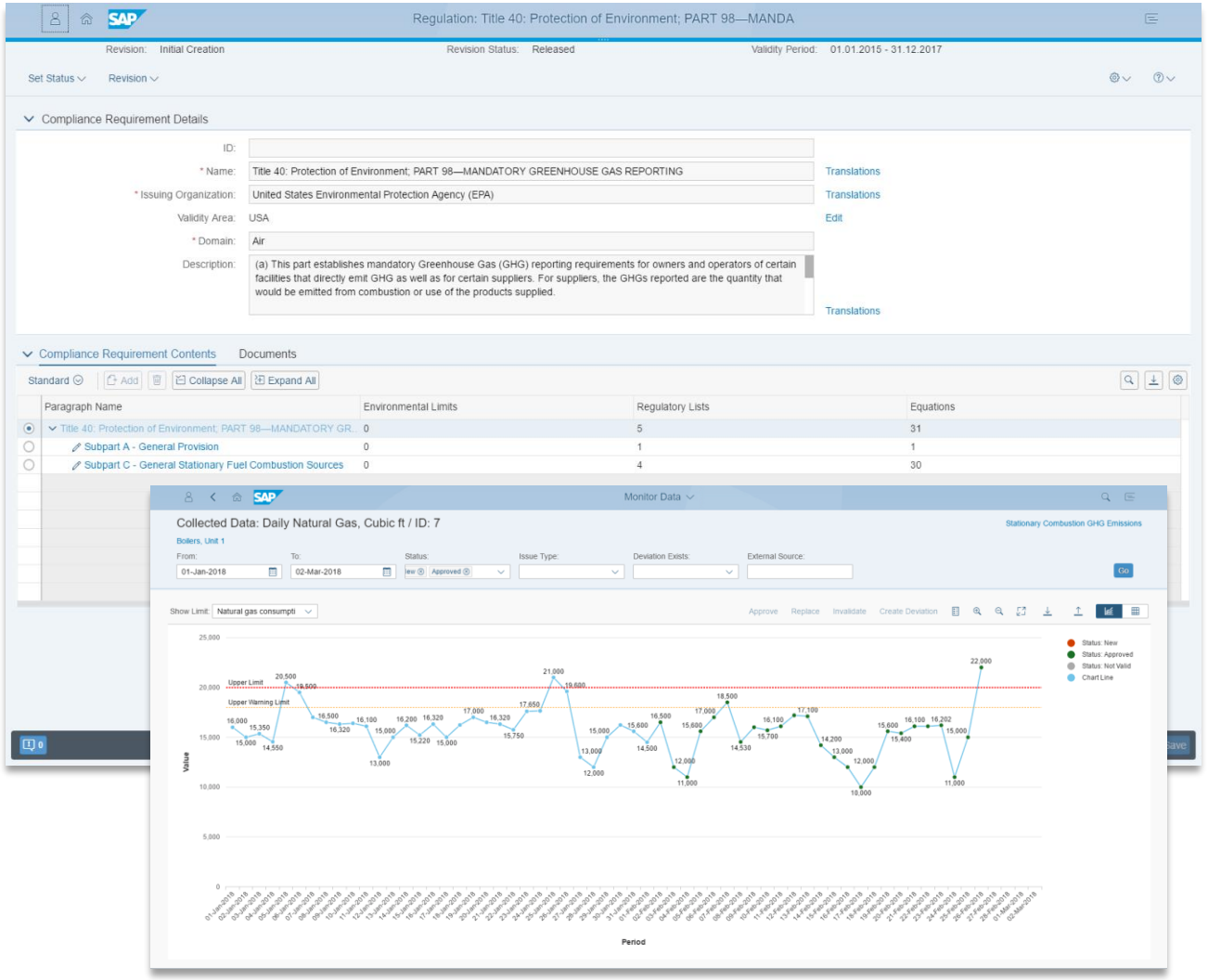
SAP EHS Workplace Safety

SAP EHS Solution Portfolio for Sustainable Operations



**OH licensed separately*

GHG Emissions Management



Objective

Support an end-to-end process for calculating actual greenhouse gas emissions from initial data collection to reporting that is auditable

Capabilities

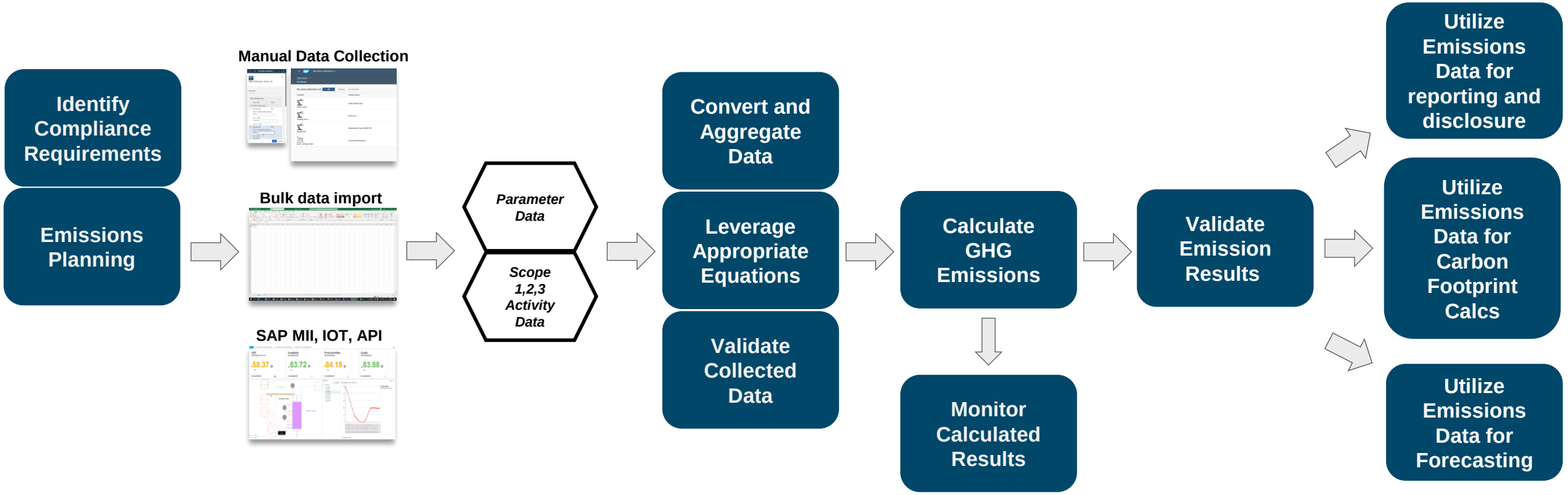
- Multiple options for data collection and interfacing to sources of information
- Calculation of greenhouse gas inventories to comply with voluntary and corporate reporting requirements
- Equations, regulations, and emission factor content built-in for Scope 1 and 2 GHG Protocol emission outputs
- Calculate and aggregate emissions while fostering data transparency
- Multiple options for validation of collected data and also emissions results
- Emissions forecasting

Benefit

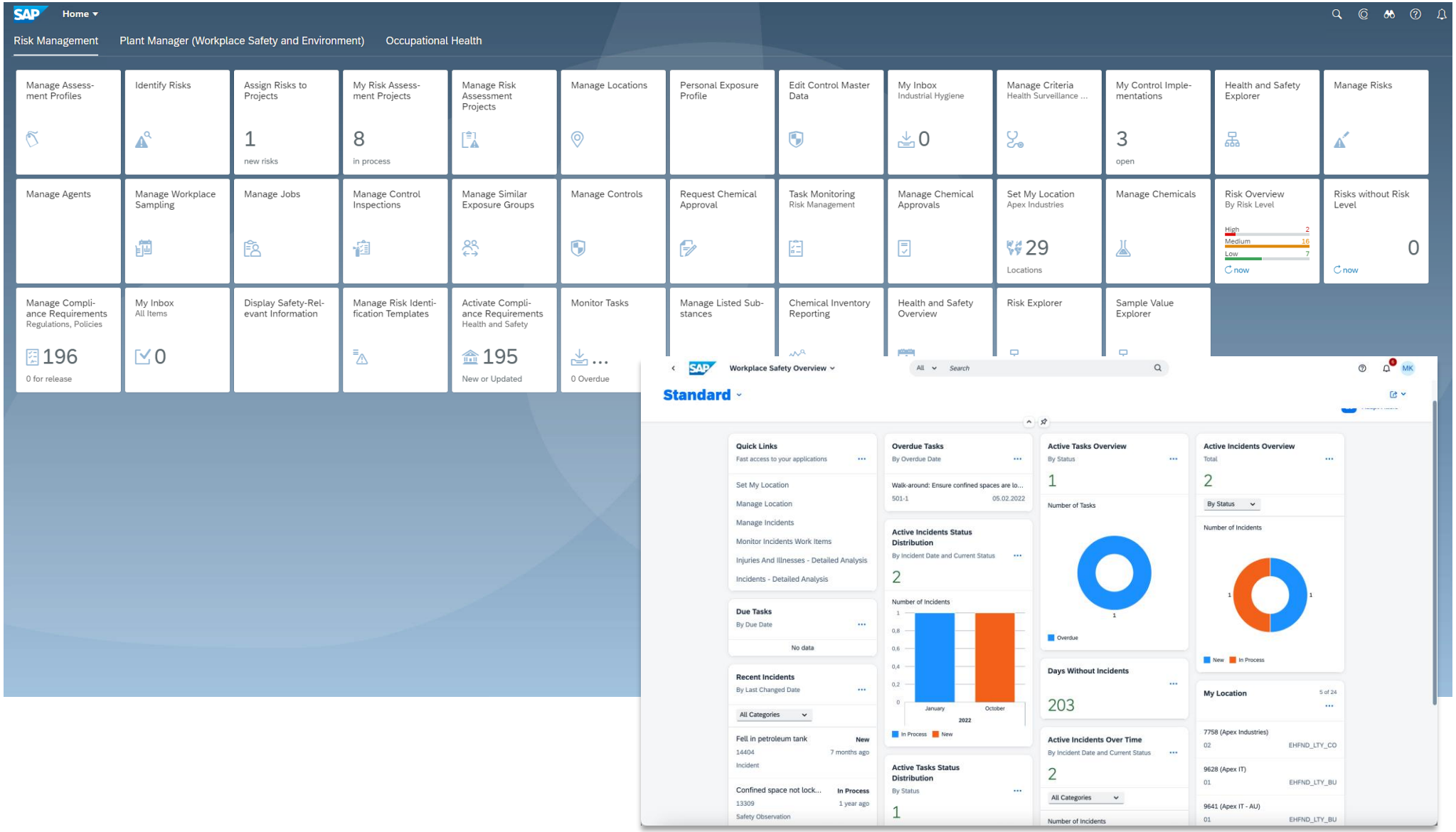
- Closely monitor performance and environmental impact
- Improved accuracy and consistency
- Reduced effort and cost for data collection and calculations
- Real-time visibility into the enterprise for better insight into reducing energy usage and carbon emissions

GHG Emissions Management

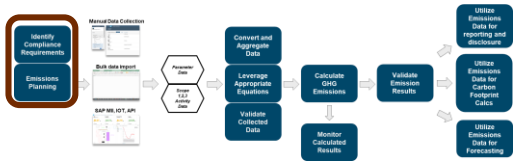
Business Process



GHG Emissions – Role-based Entry Screen



Emissions Planning



Data Collection: Daily Natural gas, Cubic ft / ID: 1617

Status: Inactive | Location: TESTING > Storage Facility_T182988 > Storage tank_T182988 | Compliance Scenario: Emissions from loading ... | Validity Period: 01.01.2018 - Indefinite

Data Collection Definition

Details

Name: Fuel gas consumption

Title: Daily Natural gas, Cubic ft / ID: 1617

Input Method: ○ Manual ◉ Automatic

External Source: TAG001NG

Allow Overwrite: ☐

Automatic App...: ☑ The system will automatically approve data without assigned limits and data with ...

Schedule: Daily

Schedule

The system will generate a data record and require value for it on the start of each day

Start Date: 01.01.2018

* Due Within: 1 Days

Environmental Technicians Responsible for Location

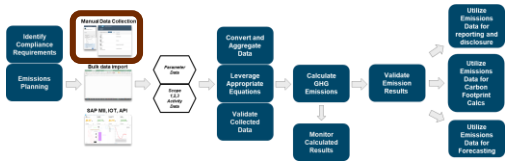
Name	Phone Number	E-Mail	Location
T182988			Storage Facility_T1829...

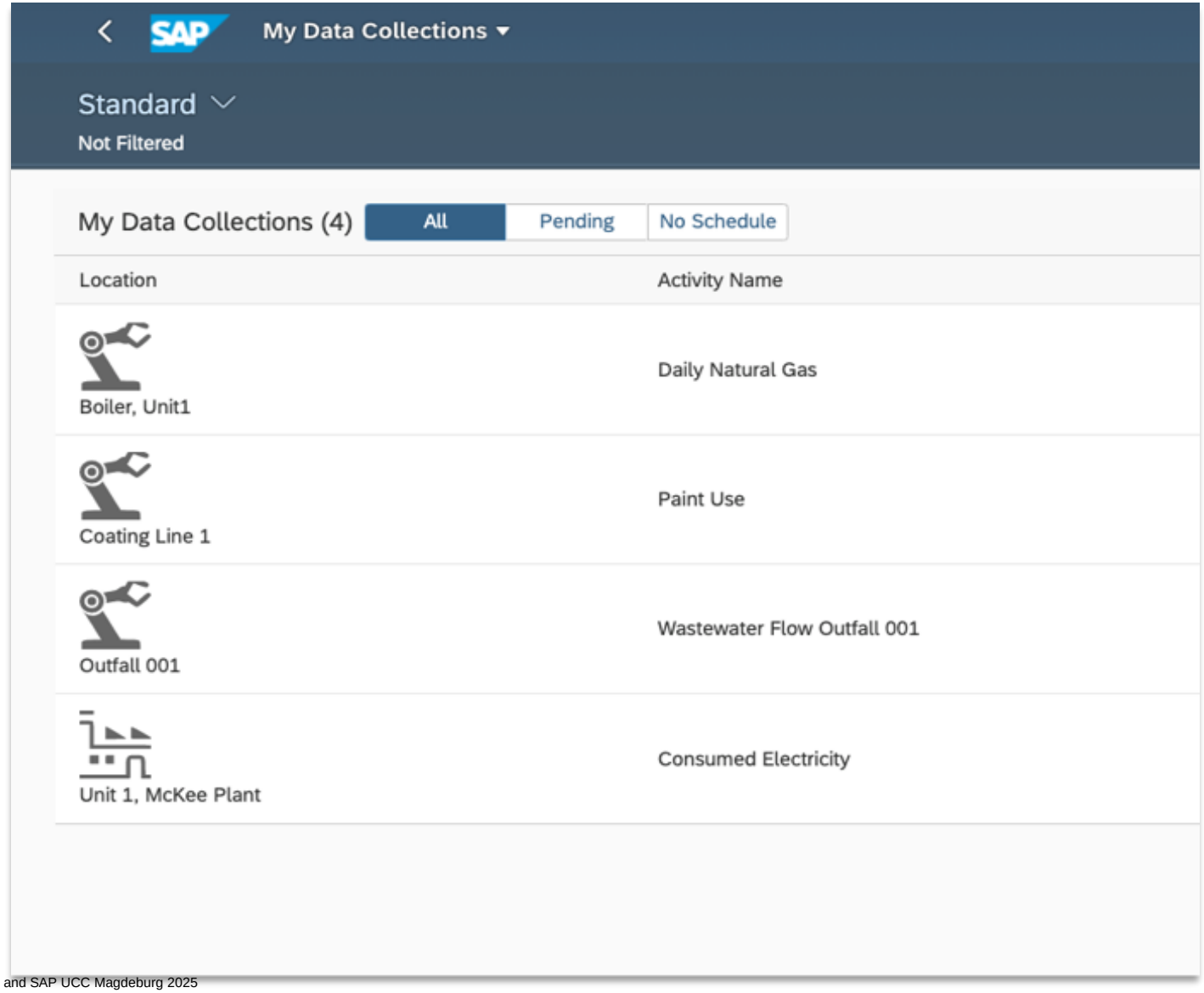
Record and track all relevant requirements for calculating emissions, whether they are based on regulations, permits, company policy, corporate goals, etc.

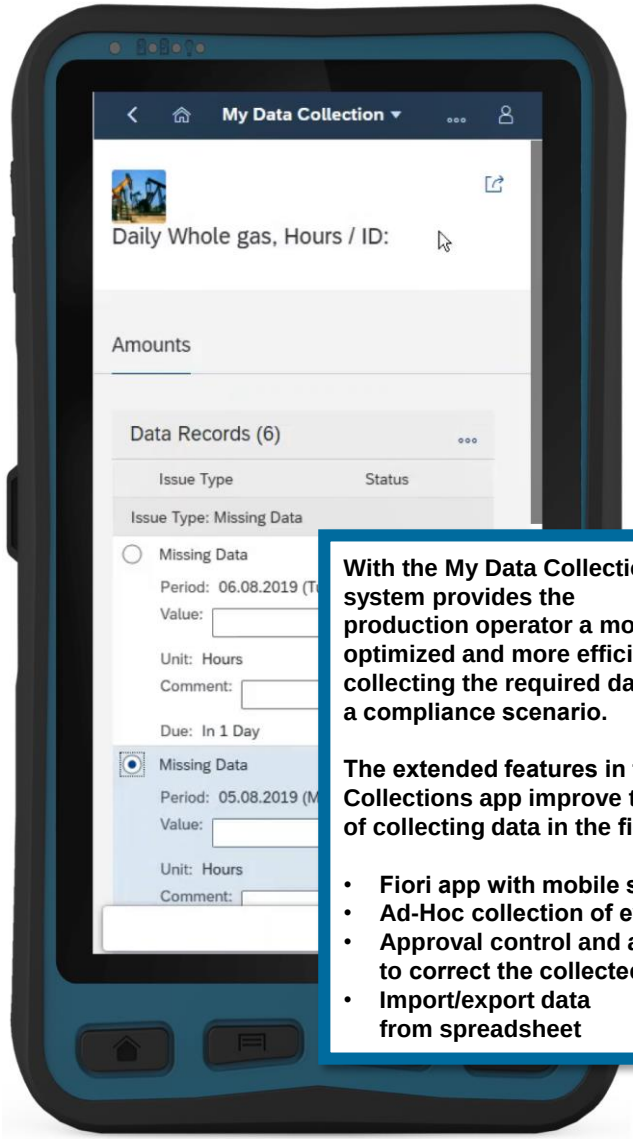
After that, use the compliance scenario to link up the appropriate equations, factors, locations, and other information to structure how the emissions will be calculated and managed.

0 | Save | Back to Compliance Scenario

Data Collection – Manual Process





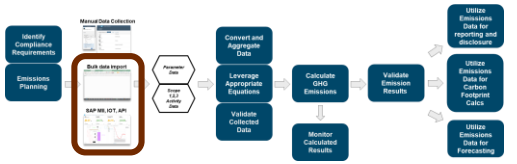


With the My Data Collections app the system provides the production operator a mobile, optimized and more efficient way of collecting the required data related to a compliance scenario.

The extended features in the My Data Collections app improve the process of collecting data in the field with:

- **Fiori app with mobile support**
- **Ad-Hoc collection of event data**
- **Approval control and ability to correct the collected data**
- **Import/export data from spreadsheet**

Data Collection – Automated



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Start Date: 01.01.2018

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Environmental Technicians Responsible for Location

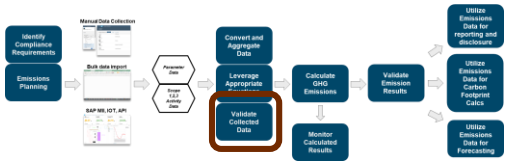
Name	Phone Number	E-Mail	Location
T182988			Storage Facility_T1829...

The Data Collection activity is defined by assigning Environmental Limits and responsible Persons to perform the measurement.

Additionally, the schedule of the data collection can be maintained as well as manual versus automated collection setting.

0 | Save | Back to Compliance Scenario

Data Validation



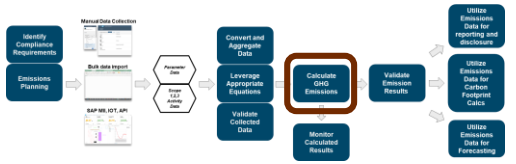
Data Issues: 4 Issues

Approve | Replace | Invalidate | Create Deviation Incident

Issue Type	Date	Time	Value	Data Type	Activity Name	Title	Preliminary Result	Location
⚠	04 January 2018	00:00	Value: 19000, unit: Cubic ft	Collected Data	Daily Natural Gas, Cubic ft / ID: 8	Daily Natural Gas, Cubic ft / ID: 8	☐	Boilers, Unit 2
⚠	09 January 2018	00:00	Value: 19871, unit: Cubic ft	Collected Data	Daily Natural Gas, Cubic ft / ID: 8	Daily Natural Gas, Cubic ft / ID: 8	☐	Boilers, Unit 2
⊗	12 January 2018	00:00	Value: 22400, unit: Cubic ft	Collected Data	Daily Natural Gas, Cubic ft / ID: 8	Daily Natural Gas, Cubic ft / ID: 8	☐	Boilers, Unit 2
⊗	27 July 2021	00:00	Value: 21500, unit: Cubic ft	Collected Data	Daily Natural Gas, Cubic ft / ID: 8	Daily Natural Gas, Cubic ft / ID: 8	☐	Boilers, Unit 2

Collected and Calculated data is automatically compared to associated limits and flagged if exceeded.
Limit warnings and exceedances are displayed in the Data Issues – Exceedances & Warning Tile.

Calculate GHG Emissions



Paragraph: Subpart C - General Stationary Fuel Combustion Sources

Compliance Requirement: Title 40: Protection of Environment; PART 98—MANDATORY GREENHOUSE GAS REPORTING | Revision Status: Released | Validity Period: 01.01.2018 - Indefinite

Basic Information | Documents | Environmental Limits | Regulatory Lists | Equations | Tasks

Standard | Add | Where Used | Check Consistency | Check Dimensions

Name
Equation C-05
Equation C-04
Equation C-03
Equation C-02c
Equation C-02b
Equation C-02a
Equation C-01b
Equation C-01a
Equation C-01
Equation C-17
Equation C-15a
Equation C-16
Equation C-15
Equation C-14
Equation C-13
Equation C-12
Equation C-11
Equation C-10 N2O
Equation C-10 CH4
Equation C-09b CH4

* Equation Name: Equation C-01

Description: Use Equation C-1 except when natural gas billing records are used to quantify fuel usage and gas consumption is expressed in units of therms or million Btu. In that case, use Equation C-1a or C-1b, as applicable.

Translations

Result

Add

Result Type	Title	Rolling	* Output V...	Expression	Ac
Final			CO2	0.001*FUEL*HHV*EF	

Input Variables

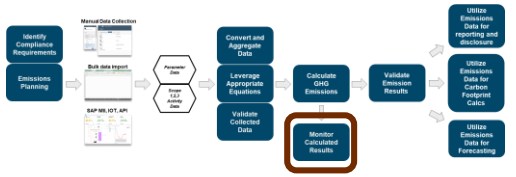
Add | Scan Variables from Expressions

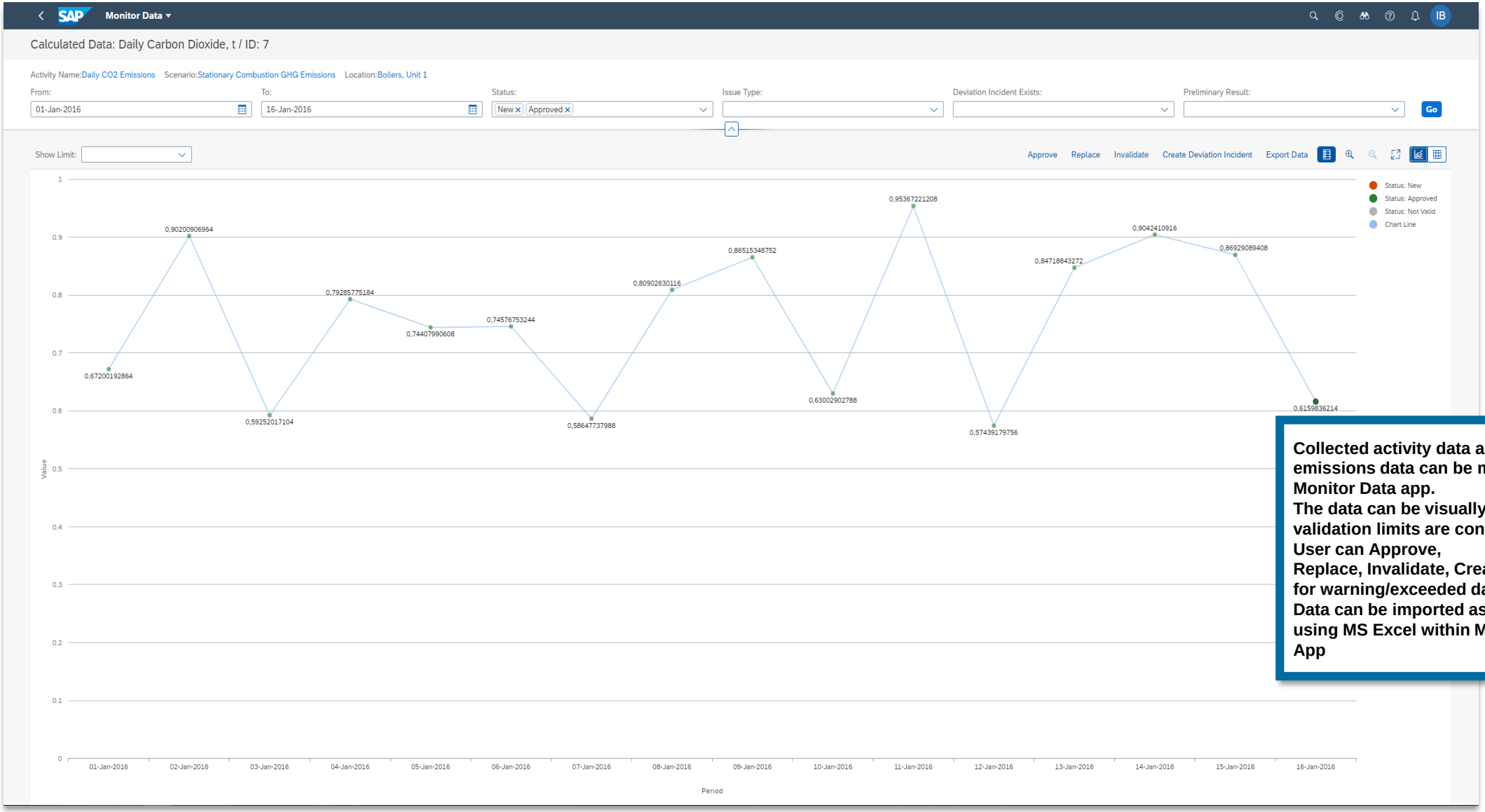
Name	Description	Unit
HHV	HHV = Default high heat value of the fuel (mmBtu ...	
FUEL	Fuel = Mass or volume of fuel combusted per year	

Save | Back to Compliance Requirement

Equations can be defined within the compliance requirement and can be used for calculating emissions for one or more locations.
Predefined equation library for certain country/region are available out of the box.
Regulatory list such as emission factors can be stored and used for emission calculation.

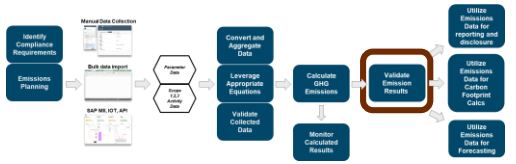
GHG Emissions Monitoring





Collected activity data and calculated emissions data can be monitored with Monitor Data app.
The data can be visually displayed if validation limits are configured.
User can Approve,
Replace, Invalidate, Create Deviation for warning/exceeded data.
Data can be imported as well using MS Excel within Monitor Data App

Validate Emissions



SAP Monitor Data

Calculated Data: Daily Carbon Dioxide, t / ID: 7

Activity Name:Daily CO2 Emissions Scenario:Stationary Combustion GHG Emissions Location:Boilers, Unit 1

From: 01-Jan-2016 To: 16-Jan-2016 Status: New, Approved Issue Type: Deviation Incident Exists: Preliminary Result: Go

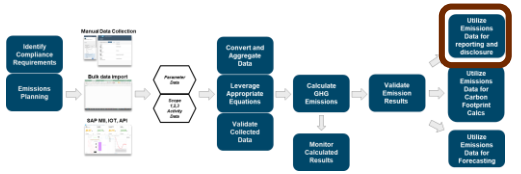
Data records (16)

Approve Replace Invalidate Create Deviation Incident Export Data

Issue Type	Status	Value	Period	History	Replaced	Incident ID	Responsible Person	Comment
Correct Data	Approved	0,6159836214 t	16-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,86929089408 t	15-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,9042410916 t	14-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,84718843272 t	13-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,57439179756 t	12-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,95367221208 t	11-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,63002902788 t	10-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,86515348752 t	09-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,80902630116 t	08-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,58647737988 t	07-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,7457675324400001 t	06-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,74407990608 t	05-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,79285775184 t	04-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,59252017104 t	03-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,9020090696400001 t	02-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically
Correct Data	Approved	0,67200192864 t	01-Jan-2016	History			Ian Bell	Saved by the calculation carried out automatically

There are multiple steps in the emissions process to allow users to validate, correct, and audit emissions results.
There are tabular views of collected and calculated data, data change logs for auditing, and data deviation tracking.

Utilize GHG Emissions results for reporting



Environmental Stewardship

SAP Environmental Stewardship

Facility: Blue Jeans Production

Current Date: Oct 9, 2022

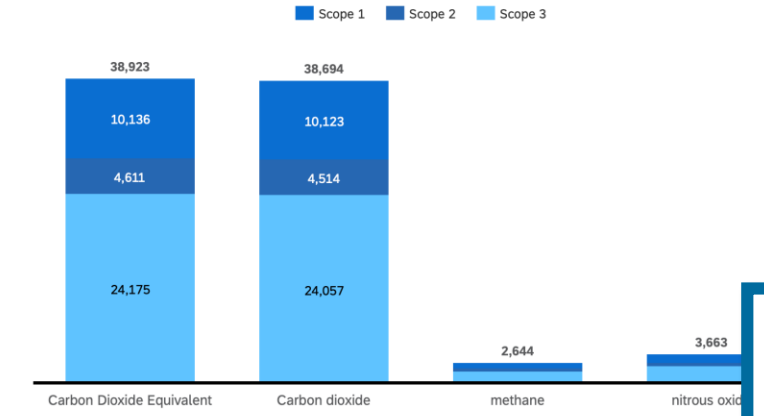
Water Discharge (ML)	Waste Generated (T)	Air Emissions (T)	GHG Emission (T)
258,615	1,967	5,495	84

Year (5) (All)

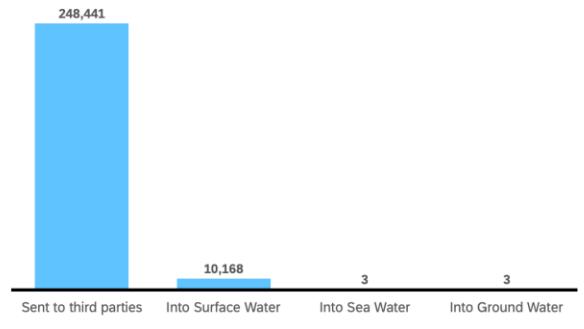
Plant (All)

Plant Selection Map (Total Waste Generated)

GHG Emissions by Scope

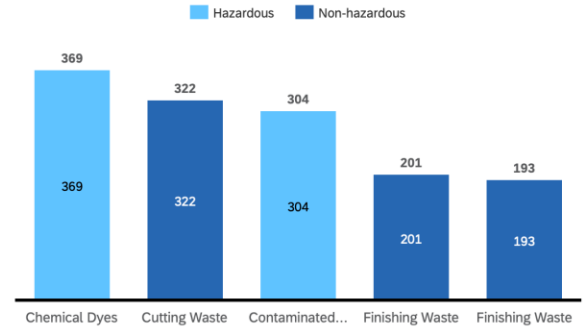


Total Water Discharge (ML)

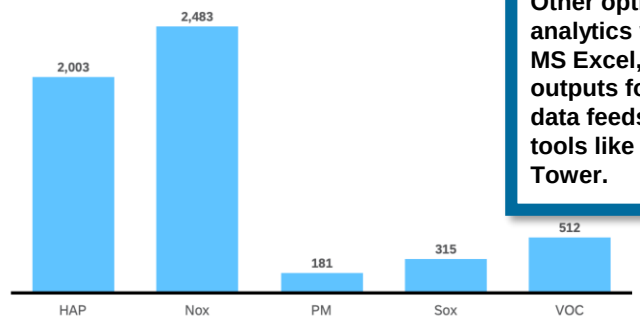


Waste Stream Totals

Top 5 - Waste Stream

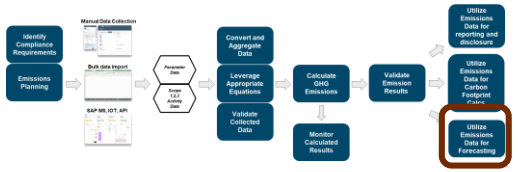


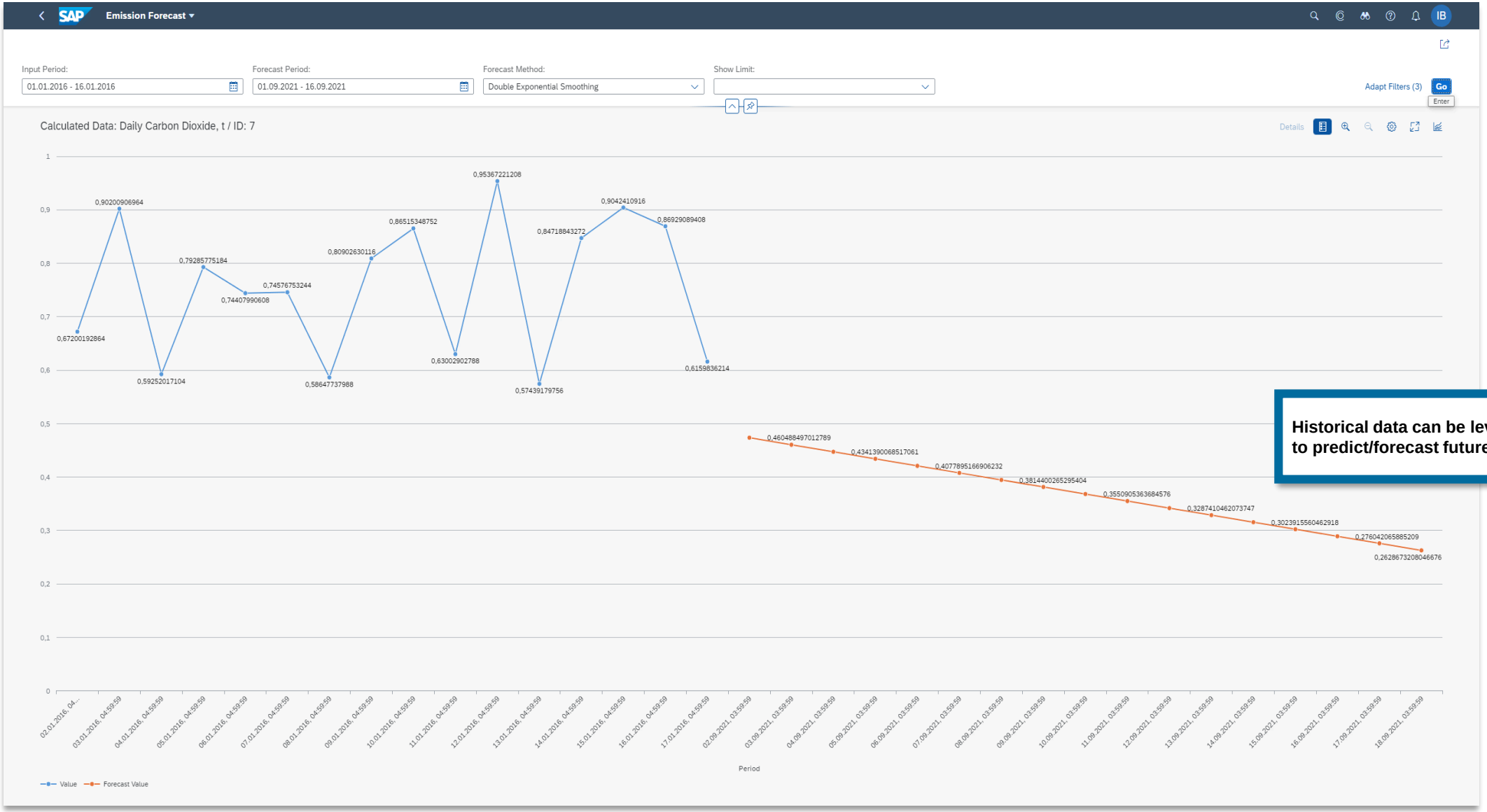
Air Emissions (T)



Emissions results can be outputted in multiple ways. One is through a set of a dashboards in SAP Analytics Cloud focused on plant operations and the emissions and waste being generated.
Other options include embedded analytics within SAP EHS, exports to MS Excel, Emission Declaration outputs for regulations, and direct data feeds to sustainability reporting tools like SAP Sustainability Control Tower.

Utilize GHG Emissions data for forecasting





Historical data can be leveraged to predict/forecast future period data.

GHG Emission Management

Functional Components

Emissions Planning

Link applicable compliance requirements to locations and equipment

Plan data collection, calculations, sampling and aggregation activities

Equations

Define emission limits

Collect and Calculate Data

Task-driven data collection

Data based on hourly, daily, monthly and yearly intervals

Automatic data collection from data historians and sensors

Aggregation based on location hierarchy

Equations, factors, and calculations supporting the GHG Protocol and other emission reporting frameworks

Monitor Data

Monitoring views for data validation issues and compliance deviations

Deviation investigation and correction

Data analysis with Environment Data Explorer

Audit trail of changes

Outputs

Emissions Forecasting Tool

Direct data feed to SAP Sustainability Control Tower

Embedded analytical views for GHG emission results

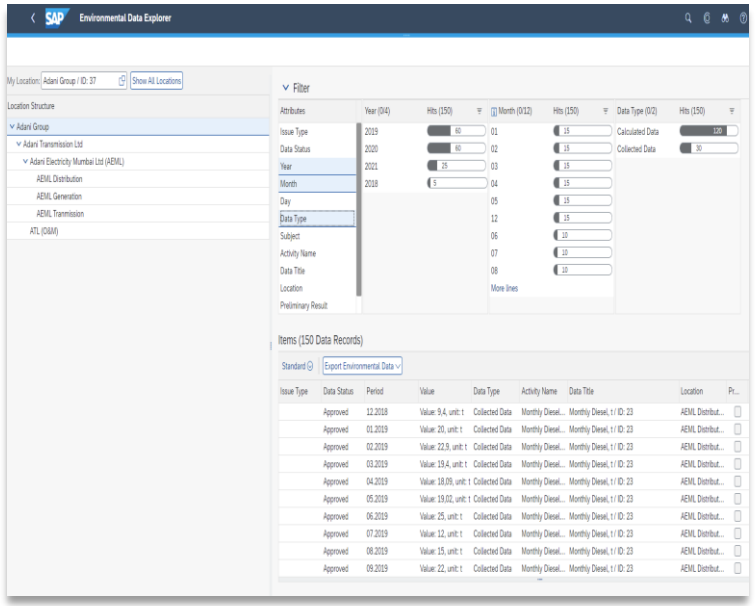
Data Export of results for carbon footprint calculations

Emissions Declarations

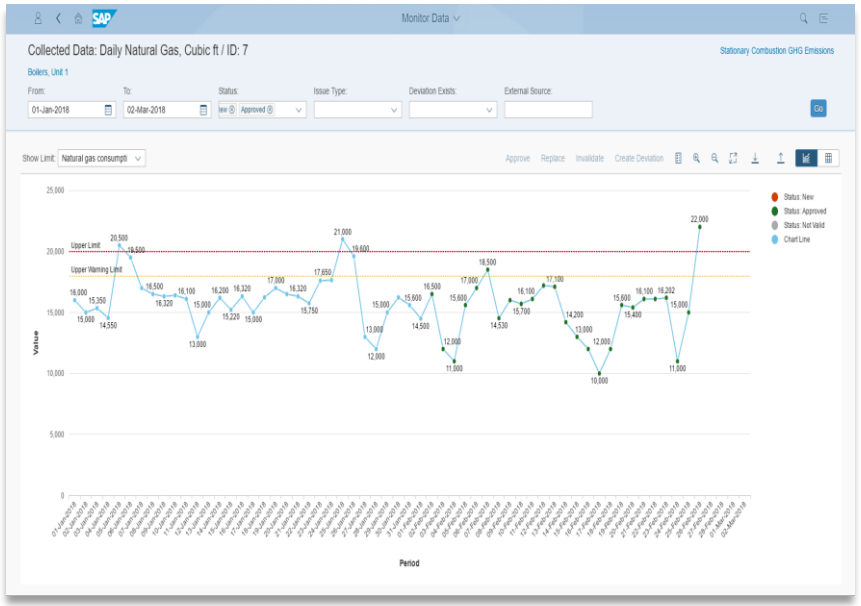
GHG Emissions Management

Outputs

Data Explorers



Trend Monitoring



Analytics

CO2e versus actual GHG Inventory

Greenhouse Gas Inventory (actuals)

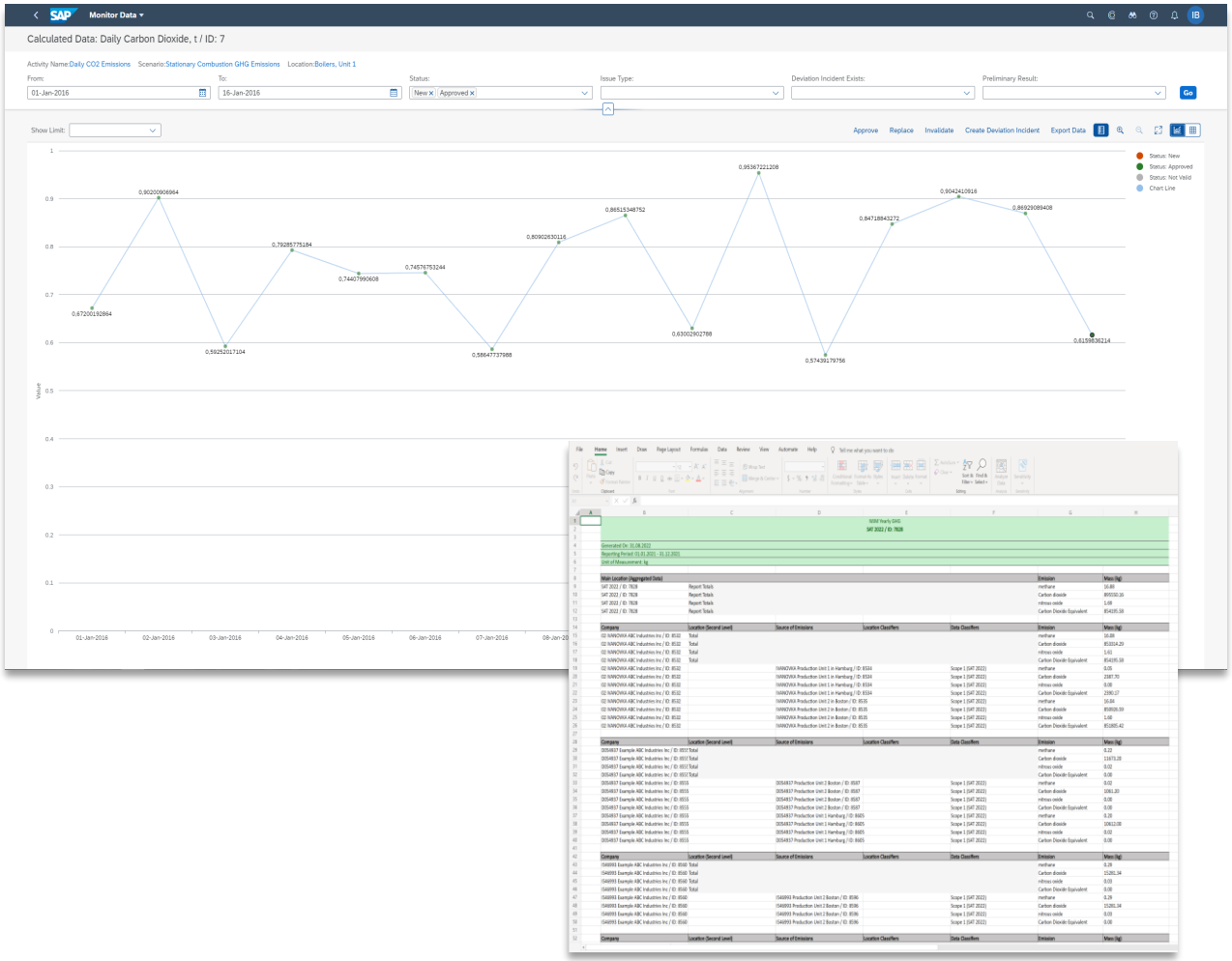
Calculation of specific amounts of specific gases
(CO2, SF6, N2O, Methane, etc)

Some of the regulations and frameworks calling for actual emission amounts

- **US EPA 40CFR Part 98**
- **US SEC Disclosure Rule**
- **Australian NGERS**
- **GHG Protocol Scope 1 and 2**
- **Global Reporting Initiative**

All covered by functionality and standard content in EHS-EM

GRI wants the final submittal in CO2e, but specific emission amounts of CO2, CH4, N2O, HFCs, PFCs, SF6, NF3 are needed for Scope 1 and 2 emission (305-1 and 305-2 respectively) and intensity ratios (305-4) disclosures.



CO2e

Used to measure and compare emissions from greenhouse gases based on how severely they contribute to global warming

EHS-EM is designed to handle actuals due to regulatory compliance focus and can calculate a true GHG inventory along with CO2e.

Integration

Process

- Handoffs and triggers that occur in your real-life business processes can be driven by the system with no drops in communication or responsibility
- Process improvement is not only enabled by the system, but the system becomes a source of new ideas and innovation

Data

- Provides context not matched by point solutions
- Data entry at all levels is quicker and less error-prone
- Processes run on a consistent source of truth
- EHS department does not need to deal with maintaining enterprise data

Reporting

- Consistent user-interfaces across multiple parts of SAP
- No need to maintain separate interfaces to other reporting tools
- Leverage central SAP ERP hierarchies as a source of truth like Plant, Functional Locations, Cost Centers, and Org Structure to enable both roll-up and drill-down reporting in real time
- Consistent security paradigm between process data and reporting logic
- Gain additional insight with ability to pull data from disparate processes within the SAP landscape

Why SAP EHS is best to help you calculate emissions

The combination of the calculation and forecasting engine within SAP EHS Environment Management with analytical outputs from SAP Analytics Cloud provides an end-to-end solution for tracking GHG emissions integrated with business processes across the enterprise.

Corporate

- **Real-time visibility into the enterprise for better insight into reducing energy usage and carbon emissions**
- **Reduced risk of non-compliance**
- **Primary source of emissions data that can be provided for overall corporate sustainability reporting and carbon credit accounting**

EHS Practitioner

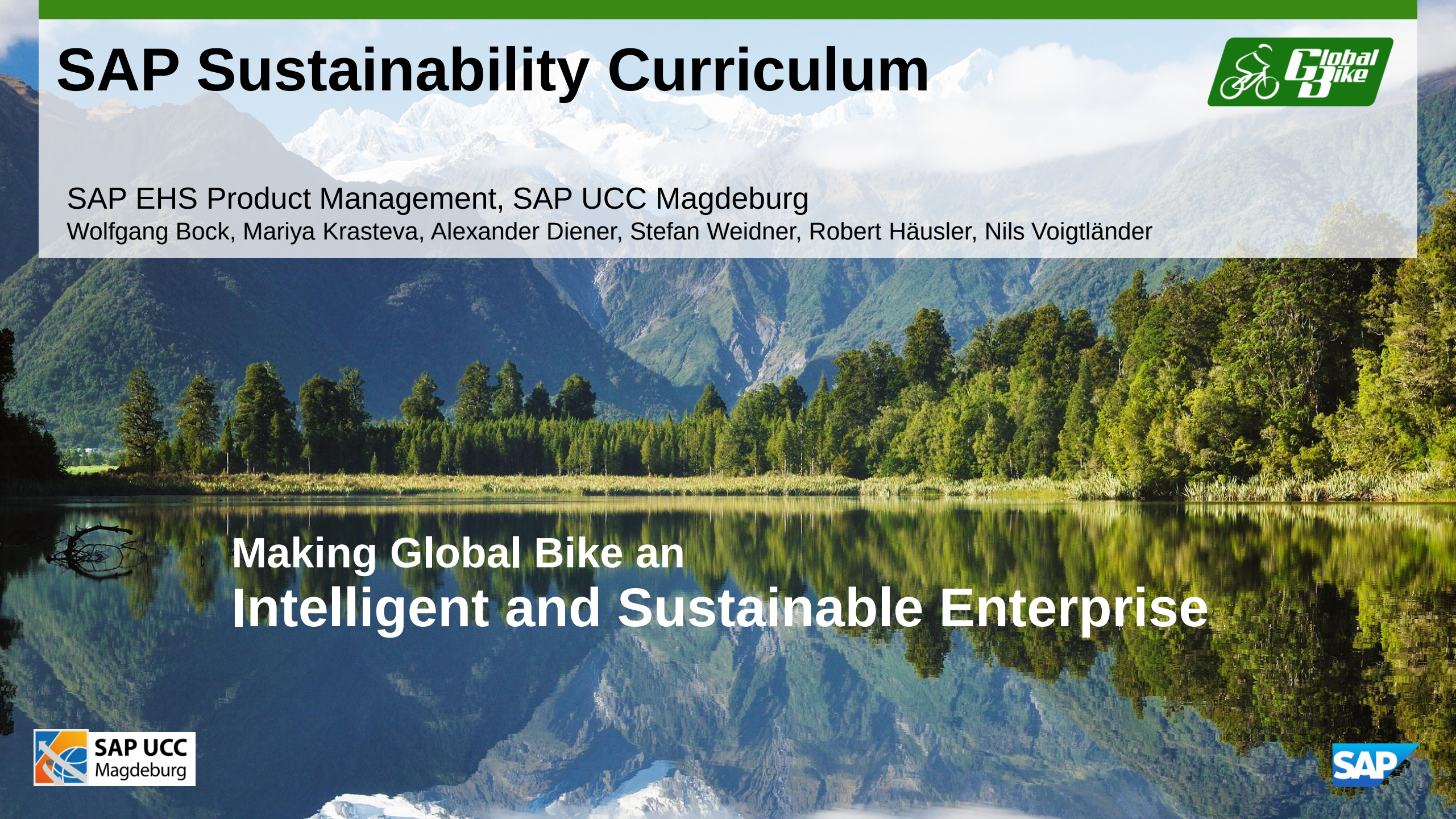
- **Real time analytical reporting across all processes**
- **Direct integration to sources of truth for equipment, locations, people, and chemicals**
- **Flexible calculations engine to model and forecast plant-specific processes and resulting emissions**

Operations

- **Empowerment to drive reductions in carbon emissions and improve sustainability performance**

SAP Sustainability Curriculum

SAP EHS Product Management, SAP UCC Magdeburg
Wolfgang Bock, Mariya Krasteva, Alexander Diener, Stefan Weidner, Robert Häusler, Nils Voigtländer



Making Global Bike an
Intelligent and Sustainable Enterprise

Global Evaluation Project 2023

SAP S/4HANA Environment Management

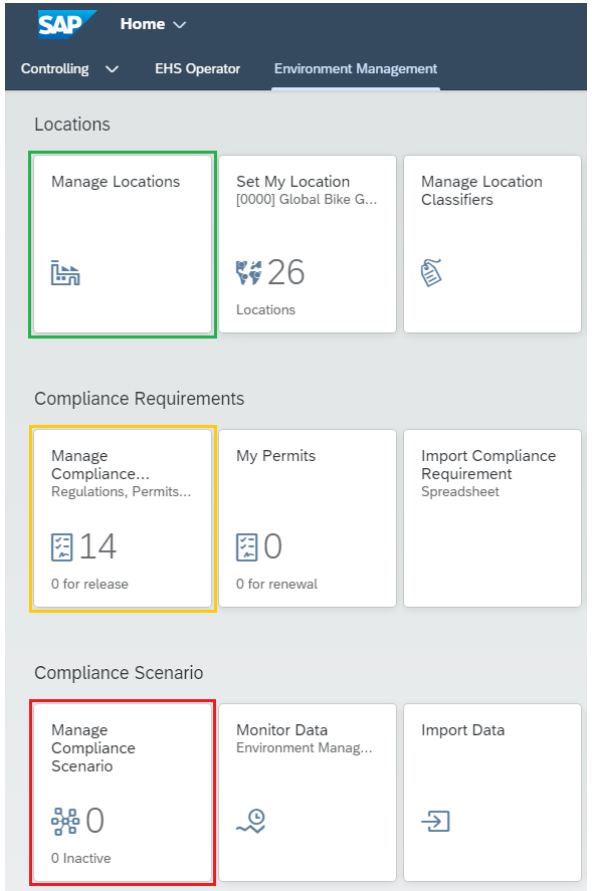
- 10 pilot universities from around the globe

Step 1: Define locations and location hierarchy

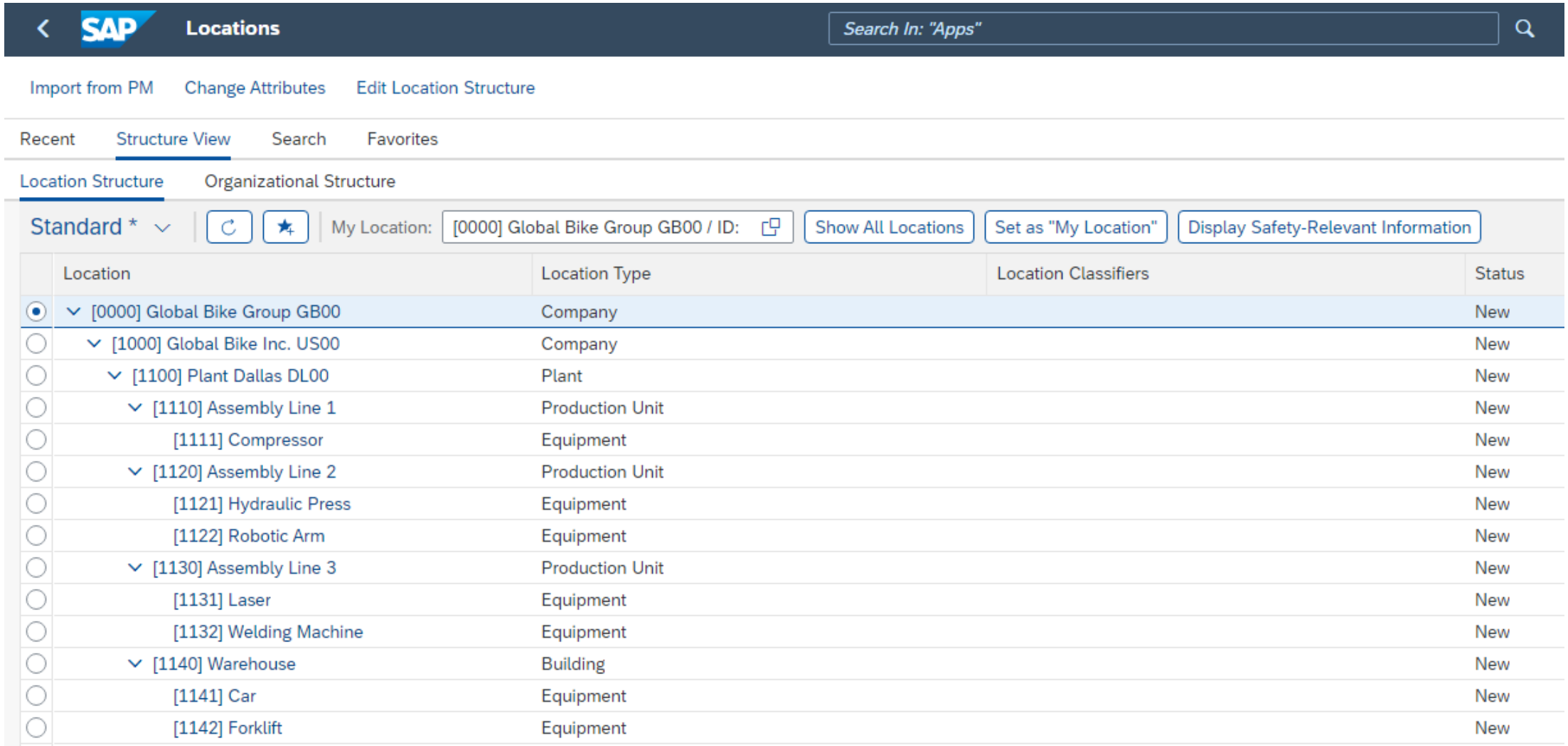
Step 2: Define Compliance Requirements

Step 3: Define Compliance Scenarios with

- Data collections
- Samplings
- Calculations
- Aggregations
- Tasks

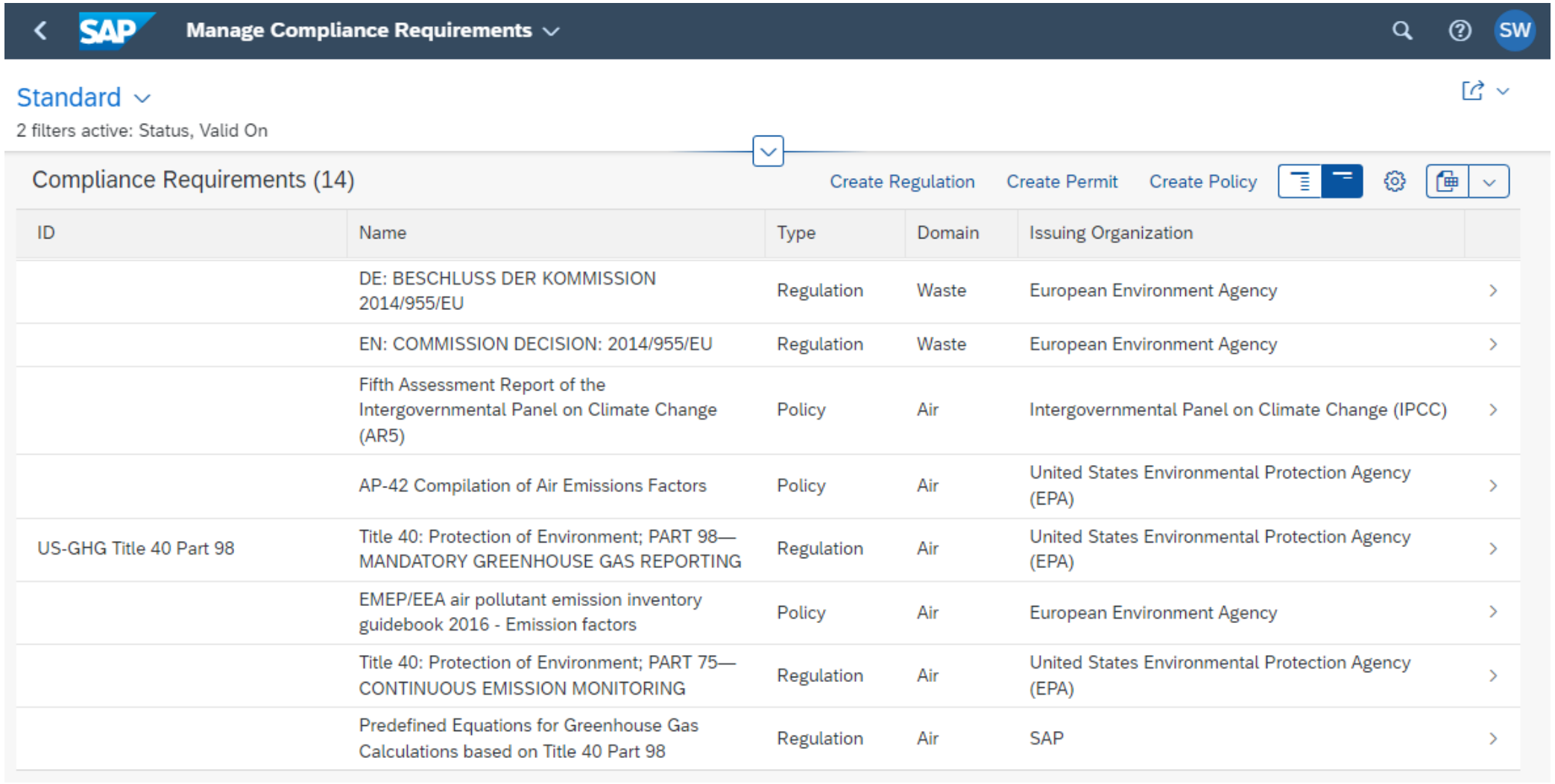


Demo – Location Structure



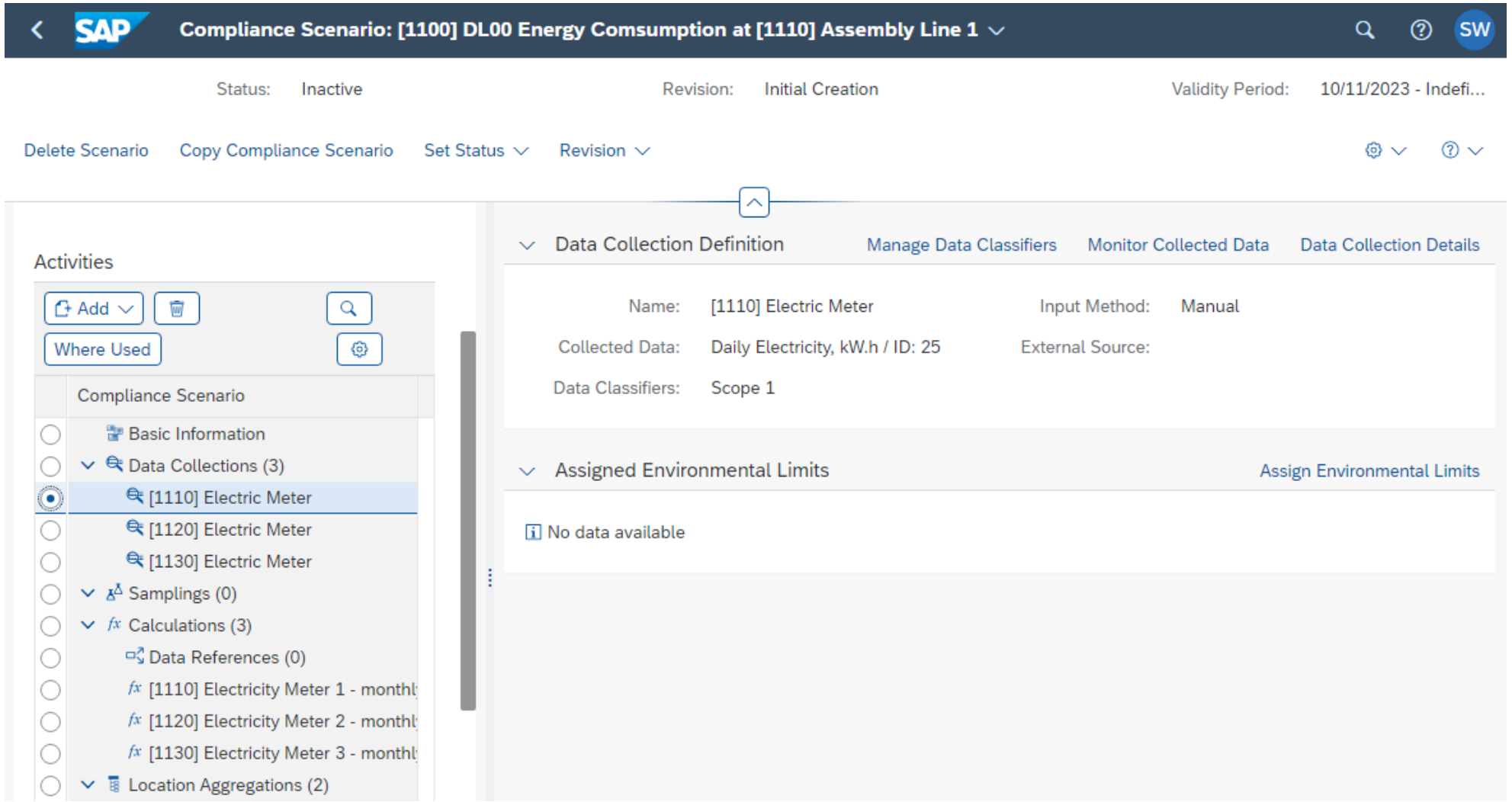
Location	Location Type	Location Classifiers	Status
[0000] Global Bike Group GB00	Company		New
[1000] Global Bike Inc. US00	Company		New
[1100] Plant Dallas DL00	Plant		New
[1110] Assembly Line 1	Production Unit		New
[1111] Compressor	Equipment		New
[1120] Assembly Line 2	Production Unit		New
[1121] Hydraulic Press	Equipment		New
[1122] Robotic Arm	Equipment		New
[1130] Assembly Line 3	Production Unit		New
[1131] Laser	Equipment		New
[1132] Welding Machine	Equipment		New
[1140] Warehouse	Building		New
[1141] Car	Equipment		New
[1142] Forklift	Equipment		New

Demo – Compliance Requirements

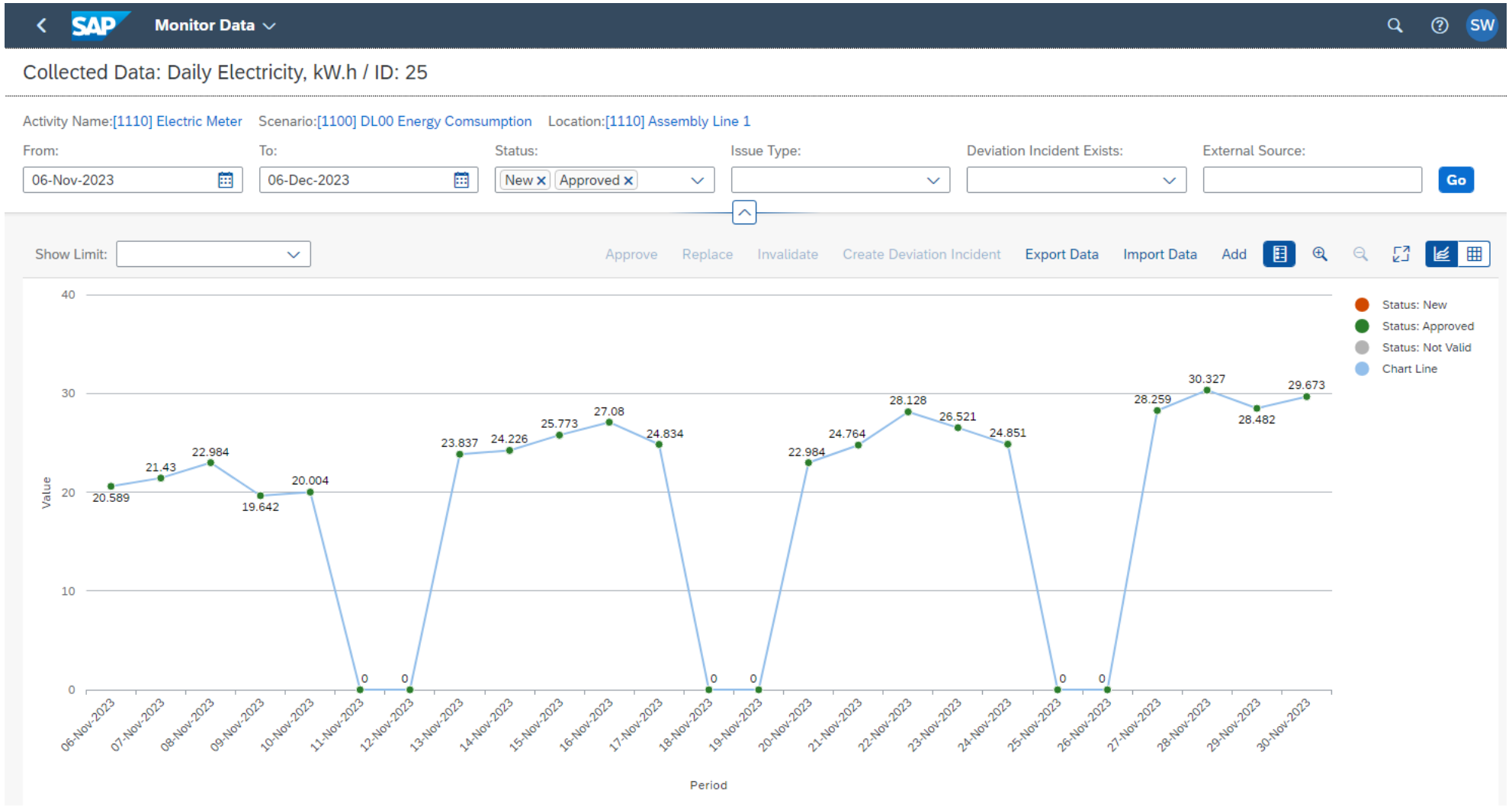


ID	Name	Type	Domain	Issuing Organization
	DE: BESCHLUSS DER KOMMISSION 2014/955/EU	Regulation	Waste	European Environment Agency
	EN: COMMISSION DECISION: 2014/955/EU	Regulation	Waste	European Environment Agency
	Fifth Assessment Report of the Intergovernmental Panel on Climate Change (AR5)	Policy	Air	Intergovernmental Panel on Climate Change (IPCC)
	AP-42 Compilation of Air Emissions Factors	Policy	Air	United States Environmental Protection Agency (EPA)
US-GHG Title 40 Part 98	Title 40: Protection of Environment; PART 98—MANDATORY GREENHOUSE GAS REPORTING	Regulation	Air	United States Environmental Protection Agency (EPA)
	EMEP/EEA air pollutant emission inventory guidebook 2016 - Emission factors	Policy	Air	European Environment Agency
	Title 40: Protection of Environment; PART 75—CONTINUOUS EMISSION MONITORING	Regulation	Air	United States Environmental Protection Agency (EPA)
	Predefined Equations for Greenhouse Gas Calculations based on Title 40 Part 98	Regulation	Air	SAP

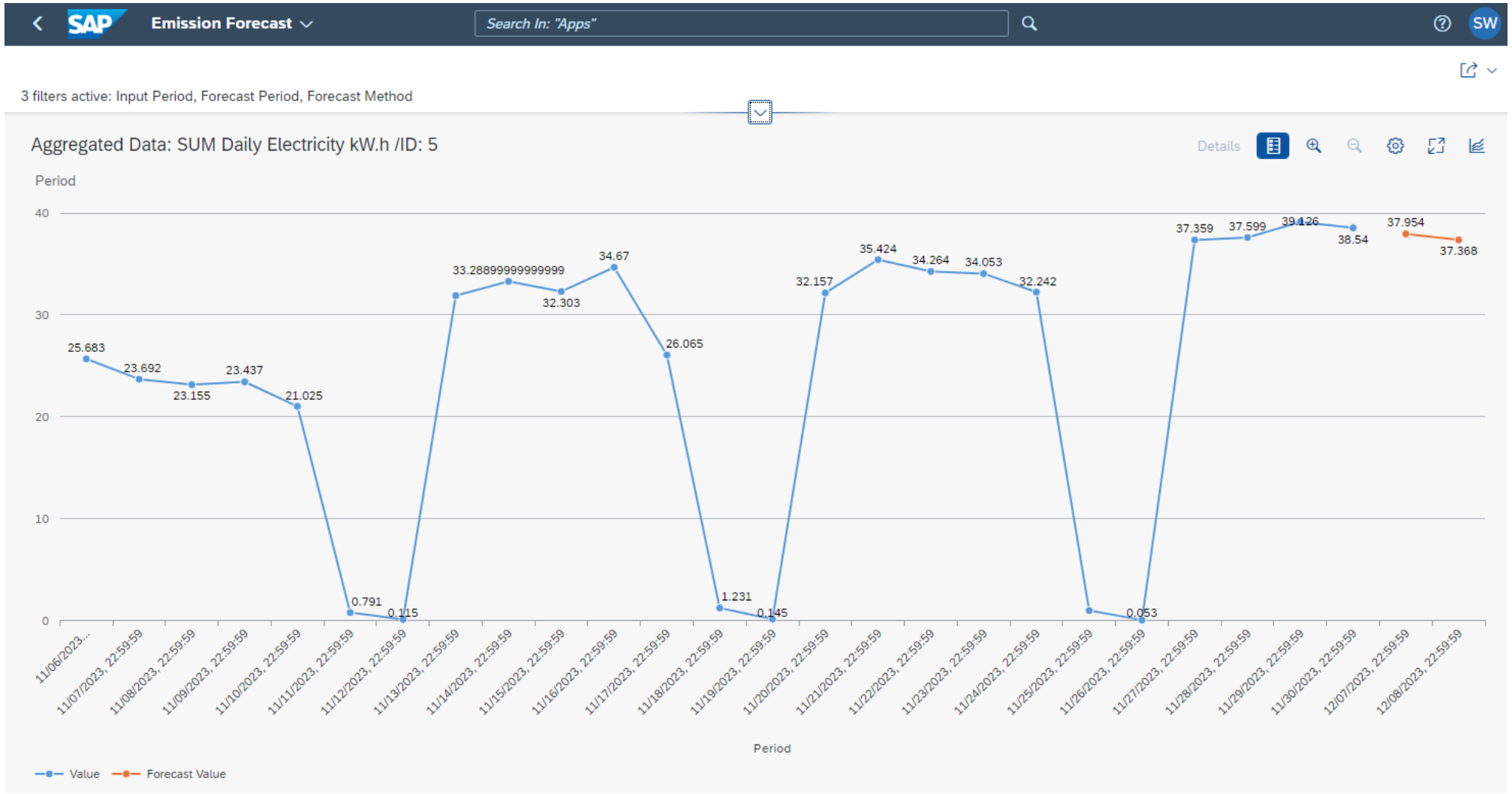
Demo – Compliance Scenario



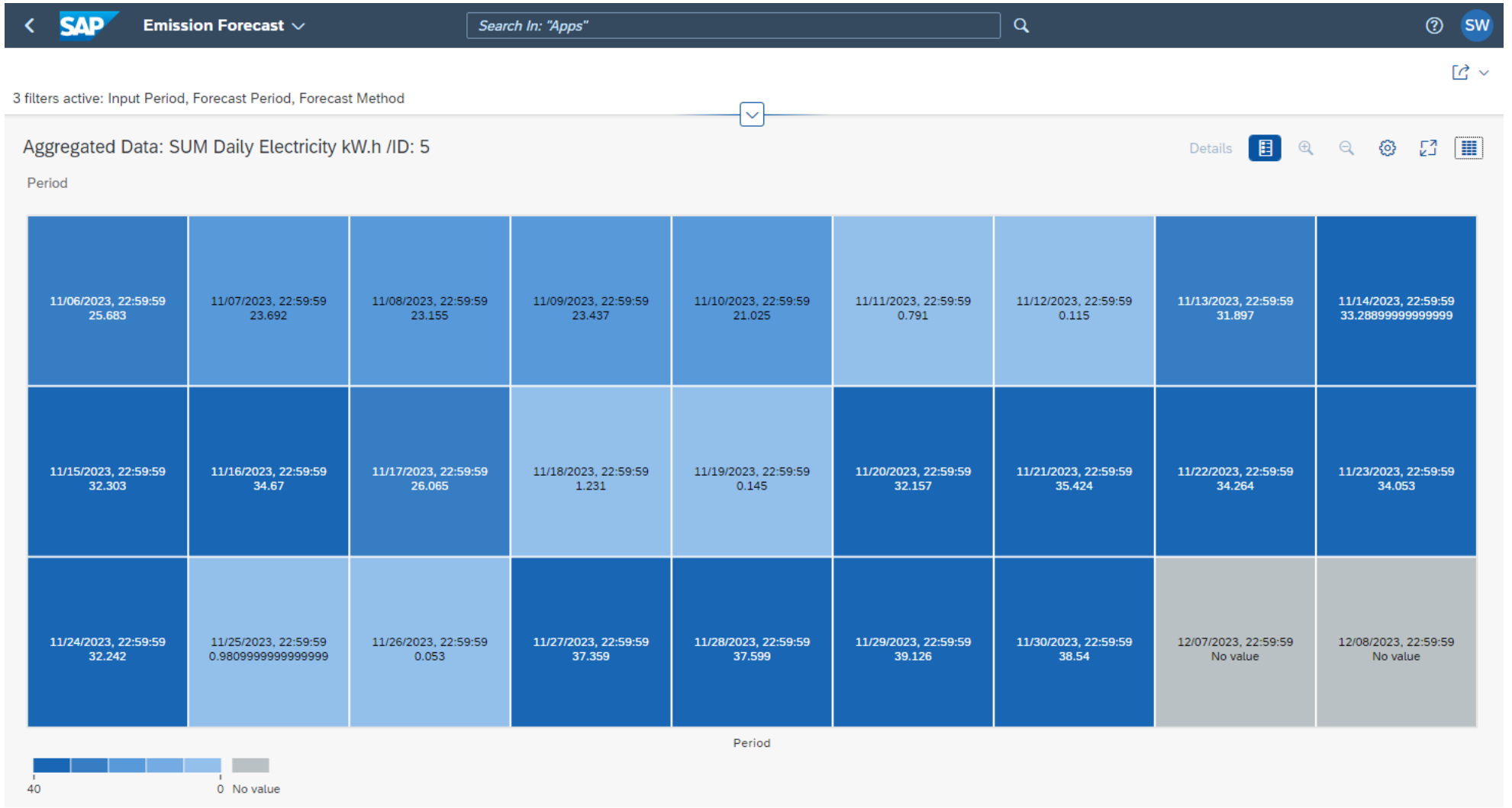
Demo – Data Collection



Demo – Emission Forecast



Demo – Sustainability Analytics



Thank you.

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