



MICRO ELN

(Microbiological Analysis Electronic Laboratory Notebook)
A Modern Automated Solution for Coliform Analyses

NEMC Speaker: Devon Morgan

CCWRD

Challenges During LIMS Implementation

-Diverse sample types, analytical techniques, and methods



SDMS: Sample Data Management System

- A plug-in module
- Easily implemented
- A supplement to LIMS
 - Provides functionality that most LIMS do not
- Able to manage customization of raw data entry, calculations, and reporting guidelines
- Generate reports and alerts

SDMS Template Builder

SpreadsheetTemplateBuilder

LIMS File Home Insert Page Layout Formulas Data Review View Mail Merge

Exit Export To Excel Add New Save Save As Cancel Clear Edit Update Report Mapping Scientific Data Utility Default Settings Rounding Off Settings Sequence Setup

File Script Develop... Utility Default Settings Switch

Template

Test	Method	Matrix	Template Type	Template ID
Alkalinity as CaCO ₃ , Total	SM 2320 B	Liquid	Colorimetric	1001
Anions	EPA 300.0	Liquid	Colorimetric	1014
BOD	SM 5210 B	Liquid	Colorimetric	1028
cbOD	SM 5210 B	Liquid	Colorimetric	1011
cBOD	SM 5210 B	Liquid	Colorimetric	1032
Chlorophyll-a	EPA 445.0	Liquid	Colorimetric	1022
COD	HACH 8000	Liquid	Colorimetric	1003
Conductivity, us/cm	SM 2510 B	Liquid	Colorimetric	1016
E. coli, MPN	SM 9223 B	Liquid	Colorimetric	1033
Enterococcus, MPN	IDEXX Enterolert	Liquid	Colorimetric	1013
Nitrate plus Nitrite	EPA 353.2	Liquid	Colorimetric	1015
Nitrogen, Ammonia as N	SM 4500 NH3 D	Liquid	Electrode	1030
Oil and Grease (HEM)	EPA 1664	Liquid	Colorimetric	1031
pH, Aqueous (Standard Units)	EPA 150.1	Liquid	Colorimetric	1027
TDS	SM 2540 C	Liquid	Colorimetric	1005
TDS	SM 2540 C	Liquid	Colorimetric	1025
TKN	SubMethod	Liquid	Colorimetric	1021
TKN	EPA 351.2	Liquid	Colorimetric	1023
TKP	EPA 365.4	Liquid	Colorimetric	1024
Total Coliform (P/A)	SM 9223 B	Liquid	Colorimetric	1012
Total Phosphorus-P	SM 4500 P E	Liquid	Colorimetric	1004
TSS	SM 2540 D	Liquid	Colorimetric	1026
Turbidity, NTU	SM 2130 B	Liquid	Colorimetric	1009
VSS	EPA 160.4	Liquid	Colorimetric	1029

General Info Field Info Parsing Data Data Transfer And Reporting DataSource Mapping

Test Assignment

Operation ☒ ELN ☐ Sampling

Template Name Alkalinity

Template Type Colorimetric

Test Alkalinity as CaCO₃, Total

Calibration Level 0 ☐ Active ☒ Created By service

Data Transfer SheetID 0 ☐ Retire ☐ Created Date 11/5/2019 5:51 PM

Updated By: admin

Updated Date 6/20/2022 3:37 PM

Template

A1 Alkalinity

Alkalinity										
0.02 N H2SO4 Lot#					Analyst		[ANALYZEDBY]		Spike Conc. (mg/L)	
25,000 mg/L CaCO ₃ Lot#					Analysis Date		[ANALYZEDDATE]		Spike Volume (mL)	
Pipette Size					Analysis Time		[ANALYZEDDATE]			
Pipette ID										
Total Alkalinity is titrated to an endpoint of pH 4.5										
Sample Volume (mL)	Titrant Start (mL)	Titrant End (mL)	Titrant Total (mL)	Alkalinity (mg/L)	Numeric Result	Result	Spike Amount	% Recovery	RPD	Rec CtrlLimit
			0.0	=(F8*0.0	=G8{(H8,3,"")})	[SPIKEAMOU				[%RECCTRLIM

Record 1 of 24

Alkalinity

Sequence Set-up

frmSequenceSetup

File Edit

Exit AddNew Save Update Edit Cancel Reset Delete Test

Sequence Setup View

Matrix	Test	Method
Liquid	Alkalinity...	SM 2320 B
Liquid	Nitrogen...	SM 4500 ...
Liquid	COD	HACH 8000
Liquid	TDS	SM 2540 C
Liquid	Oil and G...	EPA 1664
Liquid	Total Ph...	SM 4500 ...
Liquid	Anions	EPA 300.0
Liquid	Chloroph...	EPA 445.0
Liquid	Nitrate pl...	EPA 353.2
Liquid	TSS	SM 2540 D
Liquid	BOD	SM 5210 B
Liquid	cBOD	SM 5210 B
Liquid	VSS	EPA 160.4
Liquid	Conduct...	SM 2510 B
Liquid	Turbidity...	SM 2130 B
Liquid	TKP	EPA 365.4
Liquid	E. coli, MPN	SM 9223 B
Liquid	TKN	EPA 351.2
Liquid	pH, Aqu...	EPA 150.1
Liquid	Enteroco...	IDEXX En...

Sequence Setup Sequence Test

Test

Matrix: Liquid

Test: Alkalinity as CaC...

Method: SM 2320 B

Frequency (F) Of QC Analysis, Once Per Every: 10 Samples

Insert a Duplicate Sample In a Batch After the No.: 1 Sample

Insert a Spike Sample In a Batch After the No.: 2 Sample

Rate QC Preference

Initial QC test run

QCType	QCRole	QCRootRol...	Order
Method Blank	Blank	Blank	1
LCS	Spike	Spike	2
LCSD	Duplicate	Spike	3
LOQ	Spike	Spike	4

Sample QC test run

QCType	QCRole	QCRootRol...	Order
Duplicate	Duplicate	Duplicate	1

Closing QC test run ☐

QCType	QCRole	QCRootRol...	Order
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Record 1 of 4

Record 1 of 1

Record 0 of 0

[illegible]

Addressing the Needs of Micro Analyses

- Manual entries in excel sheet
- Lack of method and procedure intelligence
- Keeping up with HT and incubation
- Copy and paste (human error)
- Limited visualization of historical data
- Various QC checks and COA's to keep up with

Micro ELN Features Overview

**Backlog View
Colilert-18**

**Prep Batch
Colilert-18
& MTF**

**Colilert-18 &
MTF Result
Validation**

**Media QC
Prep Batch**

**Wet Chem
SDMS Result
Entry**

**Backlog View
MTF**

**Colilert -18 &
MTF Set up**

**Colilert-18 &
MTF Result
Approval**

**Media
Preparation**

**Wet Chem
Raw Data
Batch Review**

**Hold Time
Alerts**

**Colilert-18
Readback**

**Result
Submission to
LIMS**

**Organism
Preparation**

**Maintenance
and Settings**

**Overall
Dashboard**

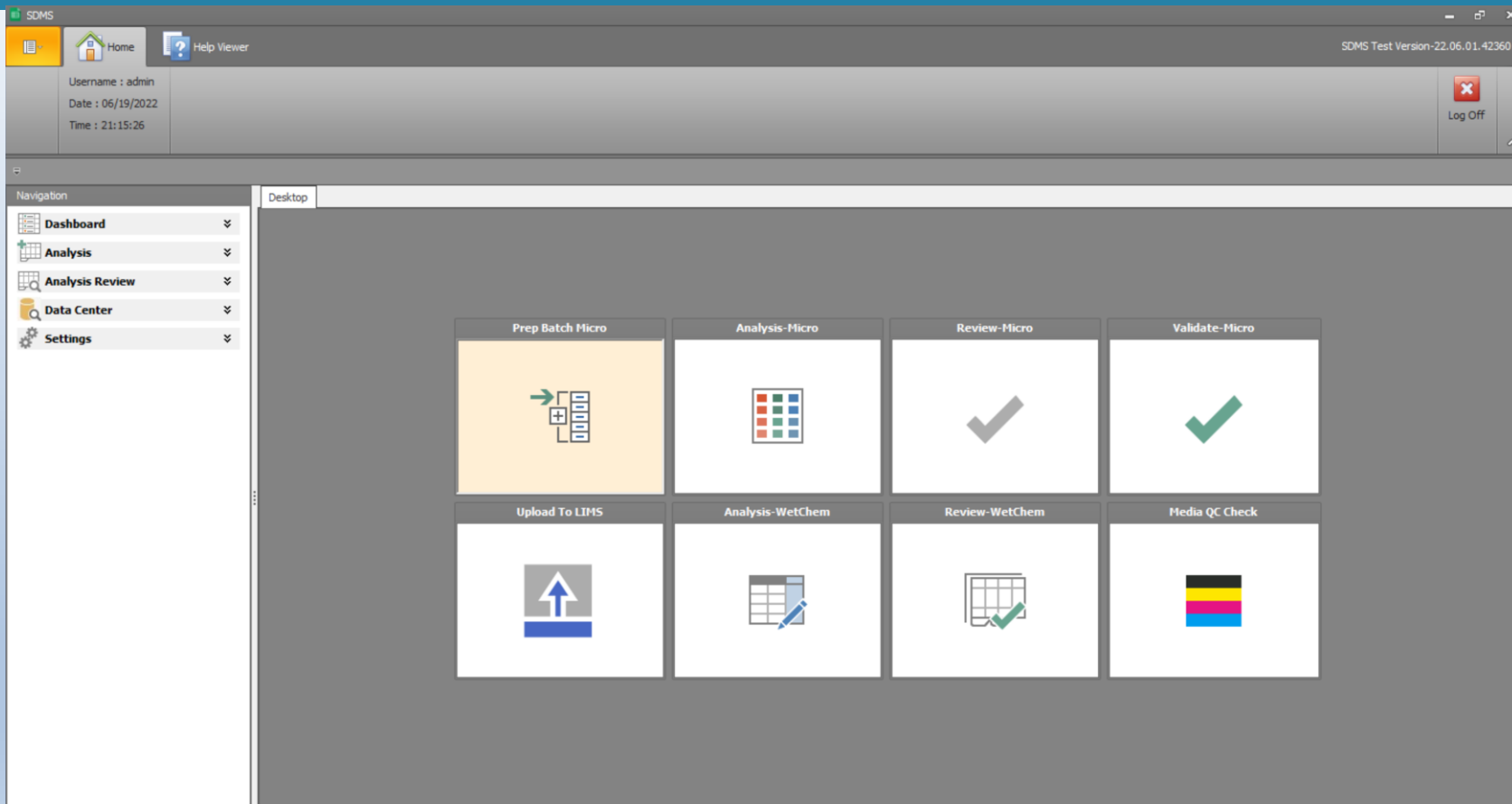
**MTF
Readback**

Audit Trail

**Media QC
Check
Approval**

**Security
Permission**

Micro ELN Home Control Panel



Workflow – Select a Test & LIMS Batch ID

Prep Batch

Username : admin | SDMS Test Version : 22.07.01.33442

Analysis - Prep Batch

Navigation: Prev, Next, Home, Refresh, Start Set-Up, Save, Delete, **Retrieve**, Edit, Clear, Link Unbatched Samples

File: MTF, Collert, Review MTF, Review Collert, Validate MTF, Validate Collert, Upload To LIMS, Utility

Mode: View, Enter | Test: Collert 18 | LIMS Batch ID: [Dropdown]

Collert 18 Quanti-Tay

Analytical Batch Prep Information

Test: [Text Field]
Method: [Text Field]
Setup Date/Time: [Text Field]
Setup Analyst: [Text Field]
Assistant: [Text Field]
Incubator ID: [Text Field]
Incubation Shelf: [Text Field]
Incubator Temp °C: [Text Field]
Water Bath ID: [Text Field]
Water Bath Temp °C: [Text Field]
Quanti-Tray Lot#: [Text Field]
Media Lot#: [Text Field]
Sterile H2O StdLog: [Text Field]
COC Upload: [Text Field]

Record 0 of 0

Batch Comments: [Text Area]

Collert 18 Quanti-Tay

Sample prep details per 10

LIMSBatchID	NoSx	CreatedBy	DateCreated	PreparedBy	PreparedDate	Status	BITPrepBatchID
16126	4	1868	07/07/2022			Pending Prep Batch	

Record 0 of 0

ResCL SysSampleCode

Colilert-18 / Sample Run Sequence

Prep Batch Username : admin | SDMS Test Version : 22.07.01.33442

Home Analysis - Prep Batch

Prev Next Home Refresh Start Set-Up Save Delete Retrieve Edit Clear Link Unbatched Samples

Navigation File

Mode View Enter

Colilert 18

Analytical Batch Prep Information

Test

Method

Setup Date/Time

Setup Analyst

Assistant

Incubator ID

Incubation Shelf

Incubator Temp °C

Water Bath ID

Water Bath Temp °C

Quant-Tray Lot#

Media Lot#

Sterile H2O StdLog

COC Upload

Record 0 of 0

Batch Comments

Sample Run Sequence

Test: Colilert 18 LIMS Batch ID: 16126

Created By: admin Incubator: INC-12

Reset

Add QC

Add Samples

Colilert 18 Coliform

<input checked="" type="checkbox"/>	SampleType	Sort	LabID	SampleID	DilutionCount-TC/EC	DilutionCount-FC	DateCollected
<input checked="" type="checkbox"/>	QC		563695	MB	1, 100	10	07/07/2022 01:25
<input checked="" type="checkbox"/>	SAMPLE		563696	ERW WEST-DUP	1	1	07/07/2022 08:56
<input checked="" type="checkbox"/>	SAMPLE		C2207070026	LAU EFF	1	1	07/07/2022 06:33
<input checked="" type="checkbox"/>	SAMPLE		C2207070029	ERW WEST	1	1	07/07/2022 08:56

Record 1 of 4

Previous Sort

Colilert-18 / Ready to Start

Prep Batch Username : admin | SDMS Test Version : 22.07.01.33442

Home Analysis - Prep Batch

Prev Next Home Refresh **Start Set-Up** Save Delete Retrieve Edit Clear Link Unbatched Samples

Navigation File Menu

Mode ☐ View ☒ Enter Test Colilert 18 LIMS Batch ID 16126

Colilert 18 Quanti-Tray

Analytical Batch Prep Information

Test

Method

Setup Date/Time

Setup Analyst

Assistant

Incubator ID

Incubation Shelf

Incubator Temp °C

Water Bath ID

Water Bath Temp °C

Quanti-Tray Lot#

Media Lot#

Sterile H2O StdLog

COC Upload

Record 1 of 1

Batch Comments

For testing purposes

Colilert 18 Quanti-Tray

Sample prep details per 100mL

	LIMS Batch ID	Lab ID	Sample ID	Date Collected	HT (Hrs)	Parameter	Dilution	Instrument	pH	Res CL	Sys Sample Code
✓	16126	563695	MB	07/07/2022 13:25		E.coli, Total Coliforms	1	INC-12			ABID-01
✓	16126	563695	MB	07/07/2022 13:25		Fecal Coliforms	1	WB-03			ABID-01
✓	16126	563695	MB	07/07/2022 13:25		E.coli, Total Coliforms	10	INC-12			ABID-01R1
✓	16126	563696	ERW WEST-DUP	07/07/2022 08:56		E.coli, Total Coliforms	1	INC-12	7.00	1.87	ABID-02
✓	16126	563696	ERW WEST-DUP	07/07/2022 08:56		Fecal Coliforms	1	WB-03	7.00	1.87	ABID-02
✓	16126	563696	ERW WEST-DUP	07/07/2022 08:56		Fecal Coliforms	10	WB-03	7.00	1.87	ABID-02R1
✓	16126	C2207070026				E.coli, Total Coliforms	1	INC-12	7.29	<0.05	ABID-03
✓	16126	C2207070026				Fecal Coliforms	1	WB-03	7.29	<0.05	ABID-03
✓	16126	C2207070029				E.coli, Total Coliforms	1	INC-12	7.00	1.87	ABID-04
✓	16126	C2207070029				Fecal Coliforms	1	WB-03	7.00	1.87	ABID-04
✓	16126	C2207070029				E.coli, Total Coliforms	100	INC-12	7.00	1.87	ABID-04R1

Colilert 18 Coliform Sample Preparation

Do you want to start Colilert 18 setup?

Yes No

Record 1 of 11

Colilert-18 / Inoculation and Incubation Process

Colilert 18 - Inoculation

Username : admin SDMS Test Version : 22.07.01.33442

Analysis - Colilert 18 Analysis - Prep Batch

Navigation: Analysis - Prep Batch, Next, Home, Refresh, Submit to review, Save, Start, Start Inoculation, Prev, Next, Restart, Clear, Edit Readback, Retrieve, COC Preview, Comment, Audit Summary

Prep Batch, MTF, Review MTF, Review Colilert, Validate MTF, Validate Colilert, Upload To LIMS, Utility

Mode: View Enter Test: Colilert 18 LIMS Batch ID: 16126 BT PrepBatch ID: 22070802

Samples in Batch

LabID	SampleID	Dilution	Status	Flag	
<input checked="" type="checkbox"/>	563695	MB	1	Pending Start	
<input checked="" type="checkbox"/>	563695	MB	10	Pending Start	
<input checked="" type="checkbox"/>	563696	ERW WEST-DUP	1	Pending Start	HTV
<input type="checkbox"/>	563696	ERW WEST-DUP	10	Pending Start	HTV
<input type="checkbox"/>	C2207070026	LAU EFF	1	Pending Start	HTV
<input type="checkbox"/>	C2207070029	ERW WEST	1	Pending Start	HTV
<input type="checkbox"/>	C2207070029	ERW WEST	100	Pending Start	HTV

Analytical Process MPN Table

Batch Prep Info

SysSampleCode: 22070802-02

Lab ID: 563696

Sample ID: ERW WEST-DUP

Collection Date: 07/07/2022 08:56

LIMS Batch ID: 16126

Dilution: 1

pH: 7.00

Residual CL: 1.87

Setup Date/Time: 07/08/2022 09:43

Setup Analyst: admin

Second Analyst: admin

Incubator ID: INC-12

Incubation Shelf: LS

Incubator Temp °C: 34.5

Water Bath ID: WB-03

Water Bath Temp °C: 44.5

Quant8-Tray Lot#: COL0125-21

Media Lot#: COL0116-21

Inoculation Time: 07/08/2022 09:44:57

Inoculator Start Date/Time: 07/08/2022 09:45:36

HTV: HTV

Sample Comment

Audit

Colilert18 Result Entry

Incubation started successfully.

OK

Total Coliform

Sample Volume (ml): 100

Dilution Factor: 1

Positive Large Wells

Positive Small Wells

Table Value

Final Result (MPN/100ml)

E. Coli - Fluorescence

Readback Date/Time

Image

Parameter Image Capture

Record 0 of 0

Fecal Coliform

Sample Volume (ml): 100

Dilution Factor: 1

Positive Large Wells

Positive Small Wells

Table Value

Final Result (MPN/100ml)

Readback Date/Time

Analyst

Image

Parameter Image Capture

Record 0 of 0

Water Bath Readback

Sample Volume (ml): 100

Dilution Factor: 1

Positive Large Wells

Positive Small Wells

Table Value

Final Result (MPN/100ml)

Readback Date/Time

Analyst

Image

Parameter Image Capture

Record 0 of 0

Colilert-18 / Sample Analysis Readback

Colilert 18 - Submission

Username : admin | SDMS Version : 22.07.01.33442

Analysis - Colilert 18

PrevNextHomeRefreshSubmit to reviewSaveStartStart InoculationPrevNextRestartClearEdit ReadbackRetrieveCOC PreviewCommentAudit Summary

NavigationFileToolsMenu

ModeViewEnterTest Colilert 18LIMS Batch ID 16122BT PrepBatch ID 22070602

Samples in Batch

LabID	SampleID	Dilu...	Status	Flag
✓ 563430	MB	1	Read back Completed	
✓ C2207060037	LAU EFF	1	Read back Completed	HTV
✓ 563431	LAU EFF-DUP	1	Read back Completed	HTV
✓ C2207060019	E-FLT-EFF	10	Read back Completed	HTV
✓ C2207060022	INTLABLV	1	Read back Completed	HTV
✓ C2207060022	INTLABLV	100	Read back Completed	HTV

Analytical Process

MPN Table

Batch Prep Info

SysSampleCode22070602-04

Lab IDC2207060019

Sample IDE-FLT-EFF

Collection Date07/06/2022 07:12

LIMS Batch ID16122

Dilution10

pH7.50

Residual CL

Setup Date/Time

Setup Analystadmin

Second Analyst

Incubator IDINC-15

Incubation ShelfLS

Incubator Temp °C35.4

Water Bath IDWB-06

Water Bath Temp °C44.5

Quant-Tray Lot#COL0125-21

Media Lot#COL0116-21

Inoculation Time07/06/2022 13:40:11

Incubator Start Date/Time07/06/2022 13:40:11

HTVHTV

Sample Comment

Audit

Total Coliform,E.coli

Incubator Readback

Total Coliform

Sample Volume (ml)10

Dilution Factor10

Positive Large Wells49

Positive Small Wells43

Table Value1413.6

Final Result (MPN/100ml)14136.0

E. coli - Fluorescence

Large Wells45

Small Wells8

Table Value127.4

Final Result (MPN/100ml)1274.0

Readback Date/Time07/07/2022 10:08:15

Analystvlittlepage

Image

ParameterImageCapture

Fecal Coliform

Water Bath Readback

Sample Volume (ml)10

Dilution Factor10

Positive Large Wells46

Positive Small Wells8

Table Value137.6

Final Result (MPN/100ml)1376.0

Readback Date/Time07/07/2022 10:08:15

Analystvlittlepage

Image

ImageCaptureImage...

Record 4 of 6Record 0 of 0Record 0 of 0

MTF / Sample Analysis Readback



- Visualized data entry process
- View all analytical data in one frame or as individual readbacks

Analytical Result Review

- Single and multiple batch review
- Batch review audit trail summary
- Batch result detail view
- Batch review alert
- Easily access historical data

Colilert-18 / Batch Result Detail View

Colilert 18 - Submission

Username : admin | SDMS Version : 22.07.01.33442

Home

Prev Next Home Refresh Submit to review Save Start Start Inoculation Prev Next Restart Clear Edit Readback Retrieve COC Preview Comment Audit Summary

Prep Batch MTF Review MTF Review Colilert Validate MTF Validate Colilert Upload To LIMS Utility

Mode View Enter Test Colilert 18 LIMS Batch ID 16078 BT PrepBatch ID 22062401

Samples in Batch

LabID	SampleID	Dilution	Status	Flag
✓ 560797	MB	1	Read back Completed	
✓ 560798	LAU EFF-DUP	1	Read back Completed	
✓ 560798	LAU EFF-DUP	10	Read back Completed	
✓ C2206240025	LAU EFF	1	Read back Completed	
✓ C2206240025	LAU EFF	100	Read back Completed	

Analytical Process

MPN Table

Batch Prep Info

SysSampleCode 22062401-02

Lab ID 560798

Sample ID LAU EFF-DUP

Collection Date 06/24/2022 06:50

LIMS Batch ID 16078

Dilution 1

pH 7.41

Residual CL <0.05

Setup Date/Time 06/24/2022 09:49

Setup Analyst 1

Second Analyst

Incubator ID INC-11

Incubator Shelf US

Incubator Temp °C 35.5

Water Bath ID WB-04

Water Bath Temp °C 44.5

Quant-Tray Lot# COL0125-21

Media Lot# COL0147-21

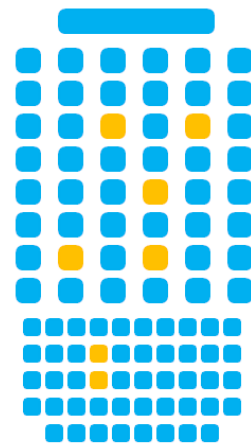
Inoculation Time 06/24/2022 09:50:58

Incubator Start Date/Time 06/24/2022 09:56:57

HTV

Sample Comment

Total Coliform,E.coli



Incubator Readback

Total Coliform

Sample Volume (ml) 100

Dilution Factor 1

Positive Large Wells 5

Positive Small Wells 2

Table Value 7.3

Final Result (MPN/100ml) 7.3

E. Coli - Fluorescence

Large Wells 0

Small Wells 0

Table Value <1

Final Result (MPN/100ml) <1

Readback Date/Time 06/25/2022 10:02:53

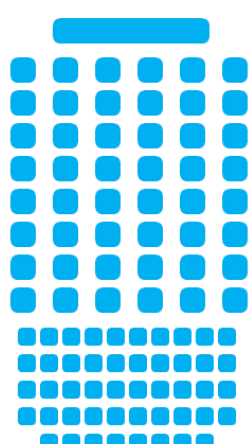
Analyst vlittlepage

Image

Parameter Image Capture

Total Coliform Preview Remove

Fecal Coliform



Water Bath Readback

Sample Volume (ml)

Dilution Factor

Positive Large Wells

Positive Small Wells

Table Value

Final Result (MPN/1

Readback Date/Tim

Analyst

Image

Parameter Parameter Im

Micro Media QC Checks

- Media Information
- Organism Information
- Tracks entire QC Process and COA's
- Seamless review of historical data
- Only approved media available for use

Micro Media QC Checks / Organism Information

Media QC Check

Home

Approve

Save

Cancel

Clear

Retrieve

Start

Start Incubation

Menu

Mode ☒ View ☐ Enter Test: MTF QCMID: QCM070122080704_01 Readback date time:

Media QC Prep Batch

QCMID Number: QCM070122080704_01

Date Start: 07/01/2022 08:38 AM

Start Chemist: vlittlepage

Assistant Chemist:

Date Complete: 07/01/2022 08:47 AM

Completed By: vlittlepage

Date Approved:

Approved By:

Status:

Process Log

Date

Process

Status

Organism Information

Media Information

QC Check Process

Organism

QC Check Process

ATCC Strain: ATCC 25922

Std Log ID: COL0051-22

Strain Expiration Date: 01/31/2023 12:00 AM

Pellet No.: 3

Pellet Aliquot ID: 3 of 6

Culture Agar Type: BHI slant

Culture Agar ID: 1349763

Plate/Slant Expiration Date: 06/10/2023

Incubator ID: INC-08

Incubator Temp (°C): 25

Date of Stock Culture: 06/16/2022 08:38 AM

Stock/Slant Prep Date: 06/16/2022 08:38 AM

Stock Prep Chemist: skarelova

Sub Culture Prep Date: 07/17/2022 12:00 AM

Sub Culture Sequence: 1

Sub Culture Chemist: vlittlepage

Stock/Slant Expiry Date: 07/16/2022 12:00 AM

Worksheet Data Entry

Organism Culture

Date: 07/01/2022

Media: LTBX2

Incubation Time: 09:36 AM

Incubator ID: INC-09

Incubation Start Time: 09:38 AM

Chemist: admin

Validation Process

24 HR. Results

24 Hour - Presumptive

Comment

testing feature

Date: 07/02/2022

Time: 08:42 AM

Chemist:

Incubator ID:

48 HR. Results

BGB & EC-MUG

48 Hour - Readback/Transfer

PASS - Positive BGB/EC-MUG/Fluoresc

End Test

Comment

testing

Date: 07/03/2022

Time: 08:39 AM

Chemist: mlofton

Incubator ID: INC-08

Test in feature

Summary

- Seamless integration with our current LIMS
- A great achievement with automation and data quality
- Visualized process makes it obvious and easy to work
- Improved productivity and data quality
- Interface access based on user roles and permissions
- Reached the goal of paperless

Thank You!

For more information contact

Devon Morgan

(702) 285-0989