

Biol/Chem 4900/4912

Forensic Internship

Lecture 8

Quality Assurance/Quality Control

Control Charts

Control Chart - Quality control (QC) measuring device that visually represents the QC data.

Information in a control chart can aid in determining:

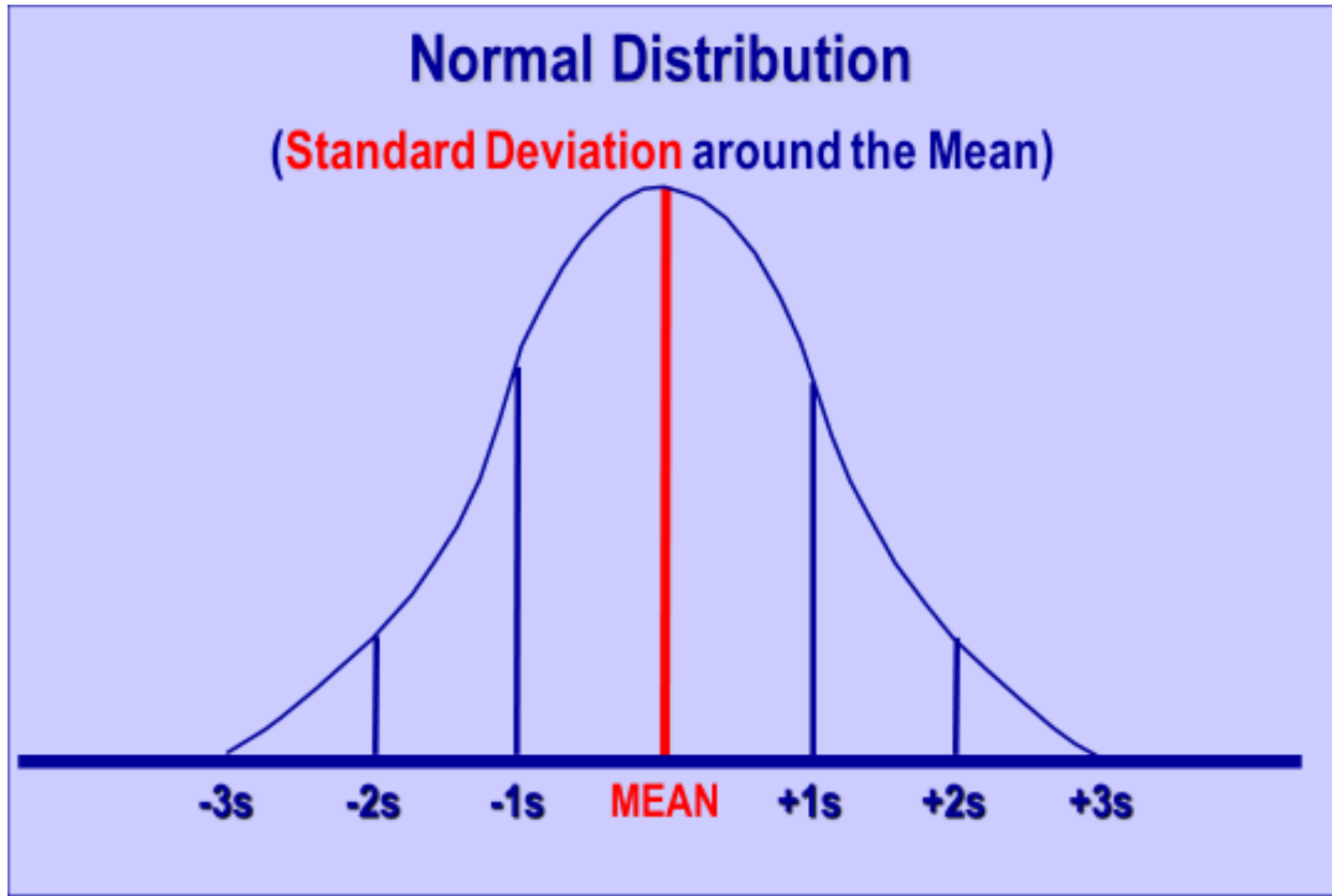
- ▶ Probable source of measurement variability
- ▶ Whether or not a process is in statistical control

QA/QC Control Charts

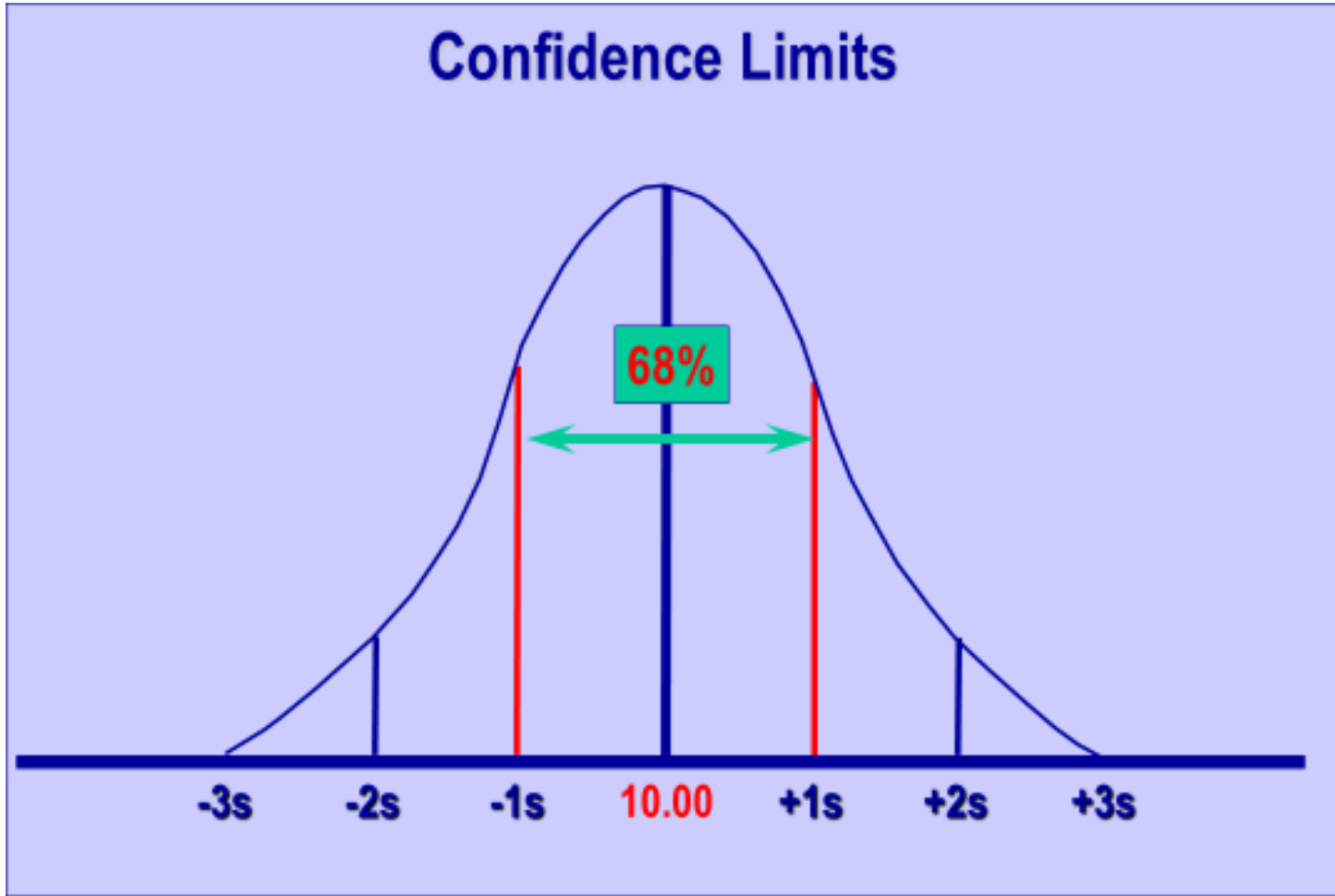
If the chart displays other than random variation around the expected result, it suggests a problem with the measurement process.

- ▶ **Control limits are plotted on the chart, to assess whether this has happened. The measurement results are expected to remain within these limits.**

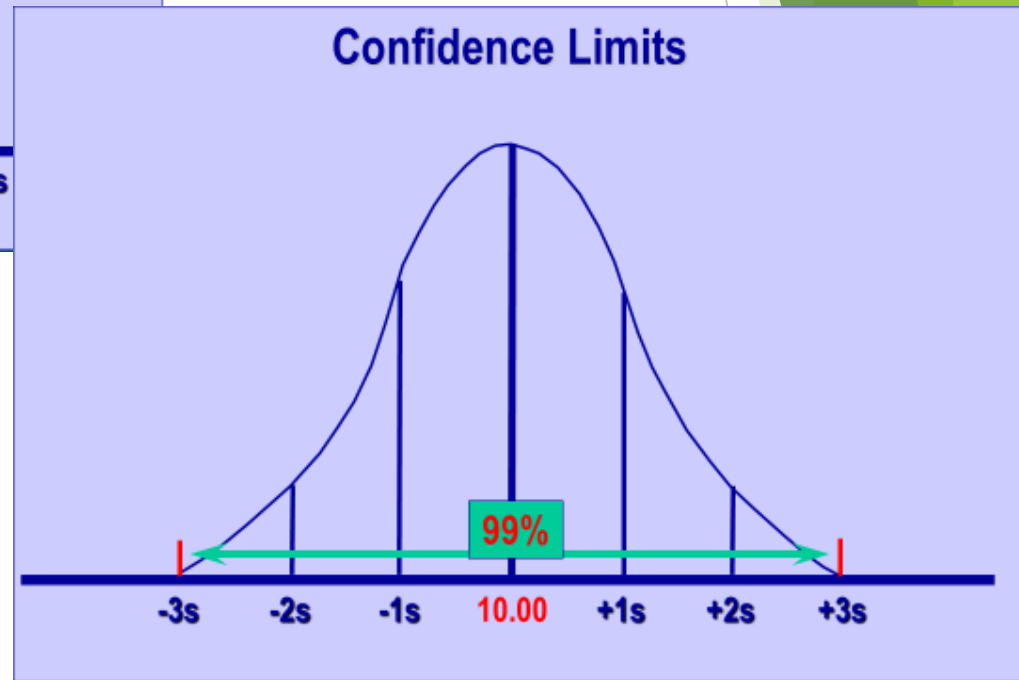
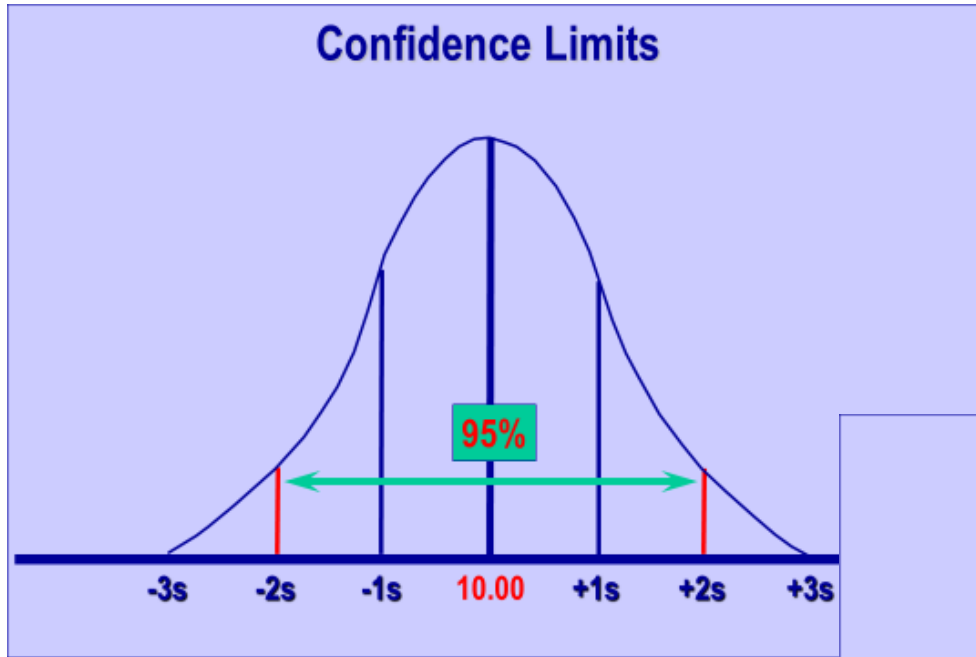
QA/QC Control Charts



QA/QC Control Charts



QA/QC Control Charts



QA/QC Control Charts

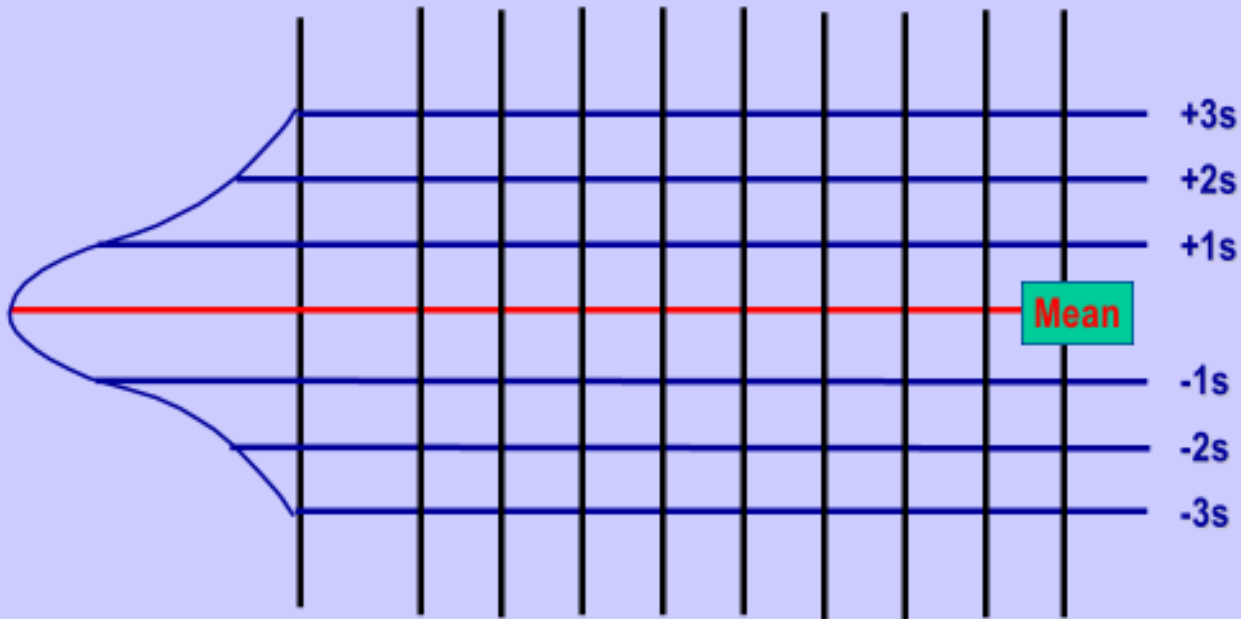
A control chart is essentially a normal distribution flipped on its side

A control chart is a plot of:

- ▶ **Test units on the vertical scale**
- ▶ **Sequence of time on the horizontal scale**

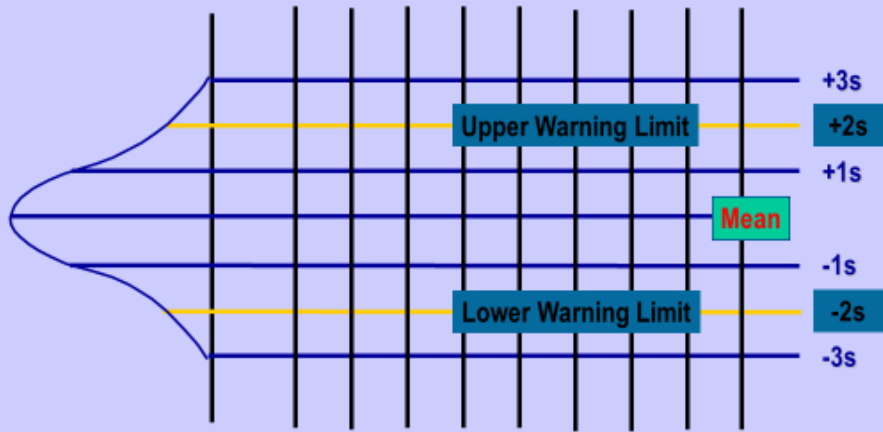
QA/QC Control Charts

Control Chart

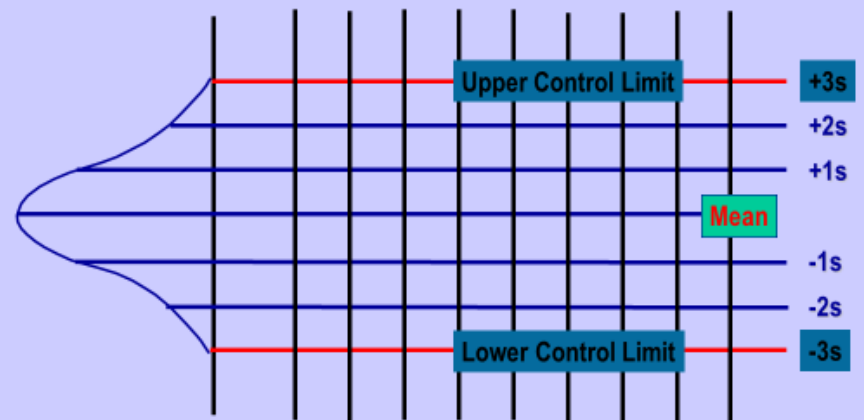


QA/QC Control Charts

Control Chart



Control Chart



QA/QC Control Charts

Warning Limits

- ▶ Set at $\pm 2s$
- ▶ Standard Methods suggests:
 - ▶ If 2 of 3 points are outside warning limits, analyze another sample. If it is within warning limits, continue. If it is outside warning limits, stop and troubleshoot.

Control Limits

- ▶ Set at $\pm 3s$
- ▶ Standard Methods suggests:
 - ▶ If any point is outside control limits, analyze another sample. If it is within control limits, continue. If it is outside control limits, stop and troubleshoot.

QA/QC Control Charts

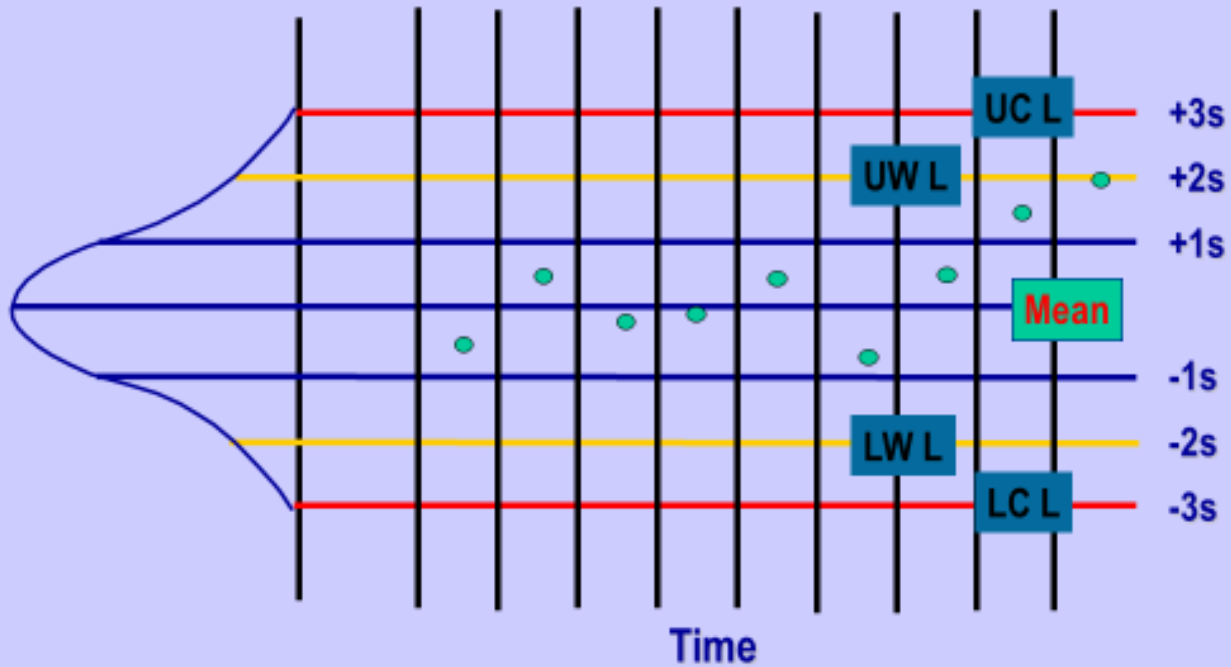
A standard is measured regularly, and the results are plotted on the control chart.

Control chart is a graph of **concentration** versus **time**.

QA/QC Control Charts

Control Chart

Iron Standard, FerroVer Procedure



QA/QC Control Charts

Constructing a Control Chart

- ▶ Analyze 10-15 replicates of a standard.
- ▶ Determine the mean and standard deviation.
 - ▶ Calculate $\pm 2s$ and $\pm 3s$
- ▶ Construct the control chart around the mean value
 - ▶ Use $\pm 2s$ as the warning limits
 - ▶ Use $\pm 3s$ as the control limits

QA/QC Control Charts

Example - Iron Standard Replicates

Sample	mg/L Iron
1	1.003
2	1.010
3	0.995
4	1.007
5	0.993
6	1.018
7	1.000

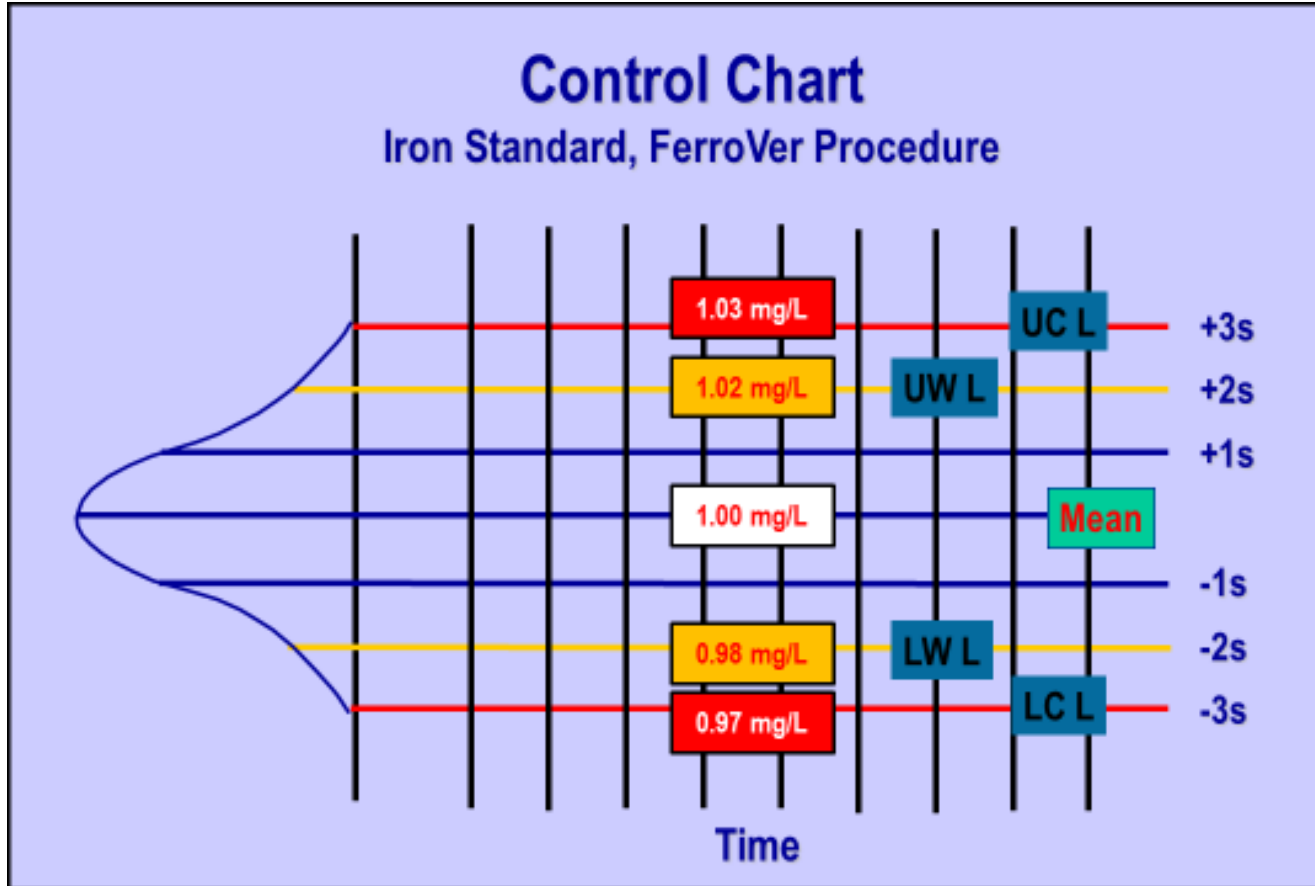
8	0.986
9	1.014
10	1.005
11	0.990
12	1.000
13	0.982
14	1.000
15	0.997

QA/QC Control Charts

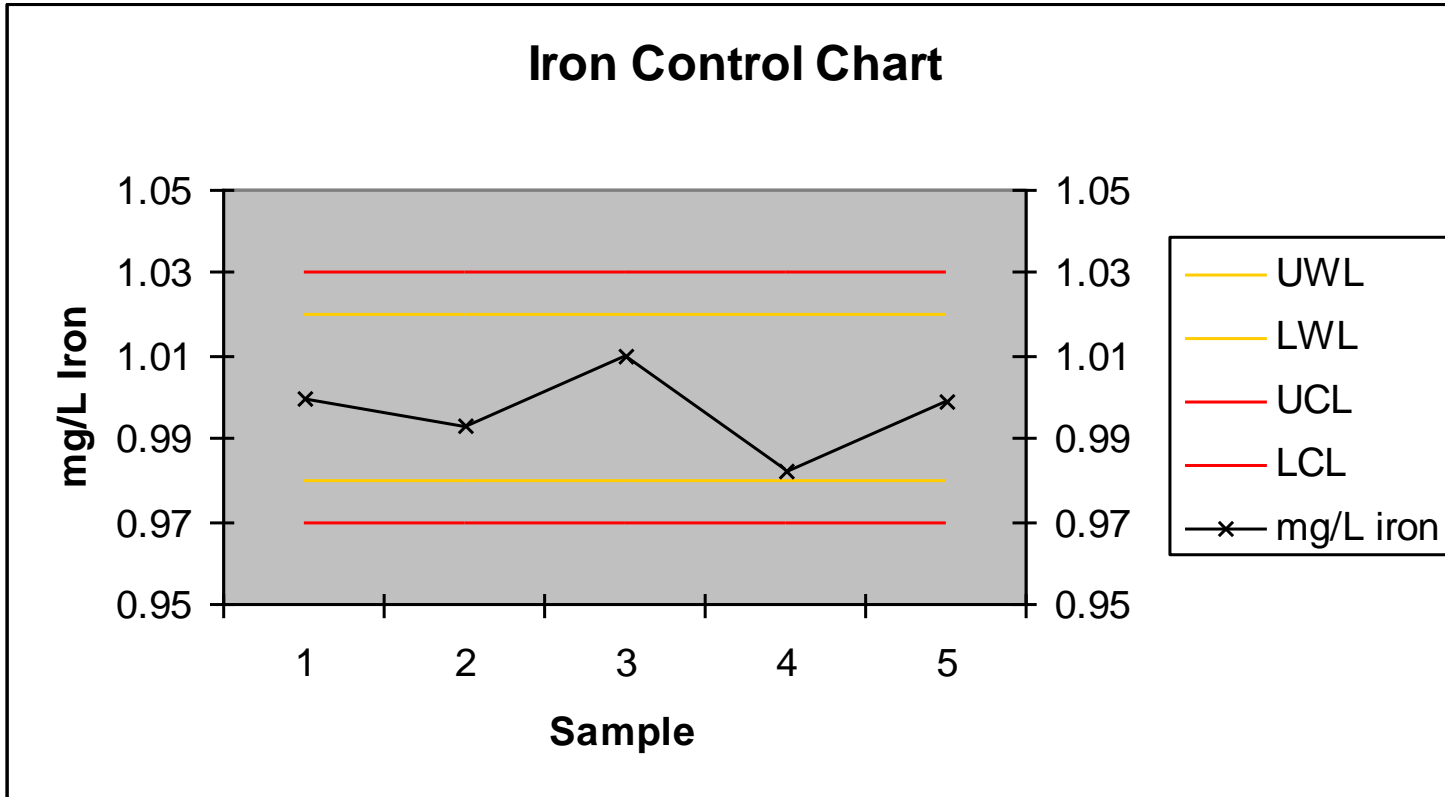
Calculate:

- ▶ Mean **1.000**
- ▶ Standard Deviation ($\pm 1s$) **± 0.010 (0.990-1.010)**
- ▶ $\pm 2s$ **± 0.020 (0.980-1.020)**
- ▶ $\pm 3s$ **± 0.030 (0.970-1.030)**

QA/QC Control Charts



QA/QC Control Charts

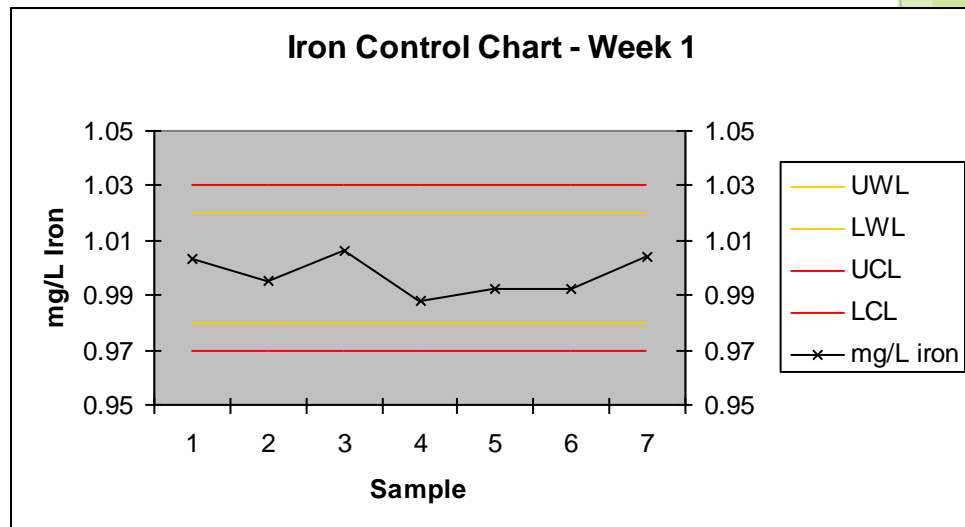


QA/QC Control Charts

Control Analysis Results - Week 1

Sample	mg/L Iron	Thurs	0.988
Mon	1.003	Fri	0.992
Tues	0.995	Sat	0.992
Wed	1.006	Sun	1.004

Results display normal, random variation between the UWL and LWL.



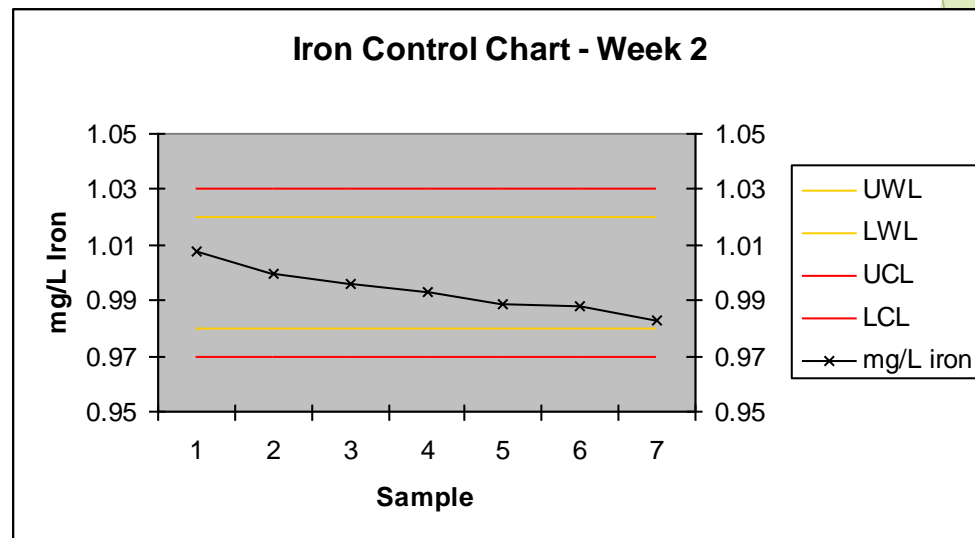
QA/QC Control Charts

Control Analysis Results - Week 2

Sample	mg/L Iron
Mon	1.008
Tues	1.000
Wed	0.996

Thurs	0.993
Fri	0.989
Sat	0.988
Sun	0.983

Three or more points in one direction indicates a possible bias in analytical results. Need to investigate.



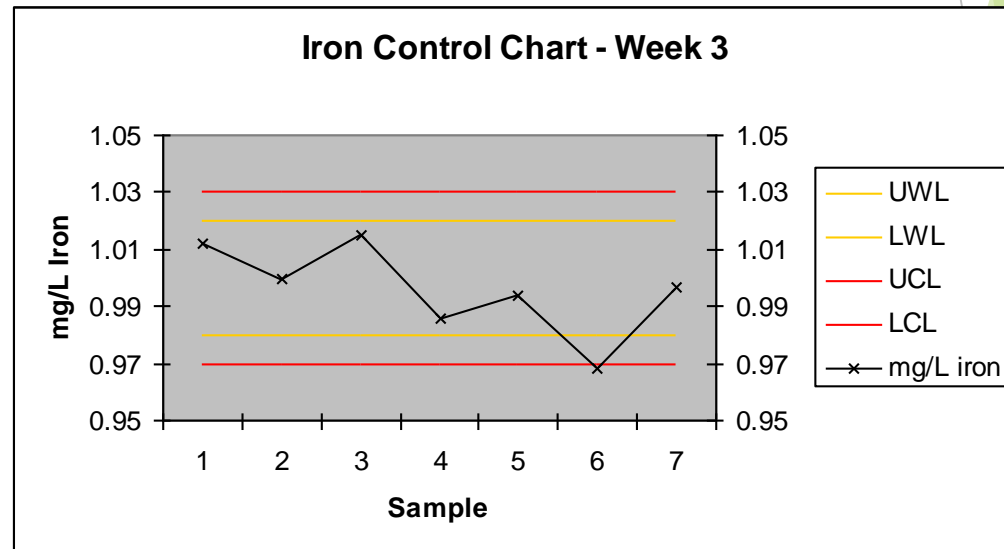
QA/QC Control Charts

Control Analysis Results - Week 3

Sample	mg/L Iron
Mon	1.012
Tues	1.000
Wed	1.015

Thurs	0.986
Fri	0.994
Sat	0.968
Sun	0.997

Data has a high degree of scatter to the LCL. Need to investigate.



Assignment

- ▶ Sign-up for Presentation and Paper
- ▶ Continue work log (due the end of the semester)
- ▶ Homework 8
- ▶ Assignment: Homework 9
- ▶ Read:
 - 1) QA/QC topic Ch. 1-9 of Prichard
 - 2) QA/QC topic Ch. 8 Bayne