Exploration07

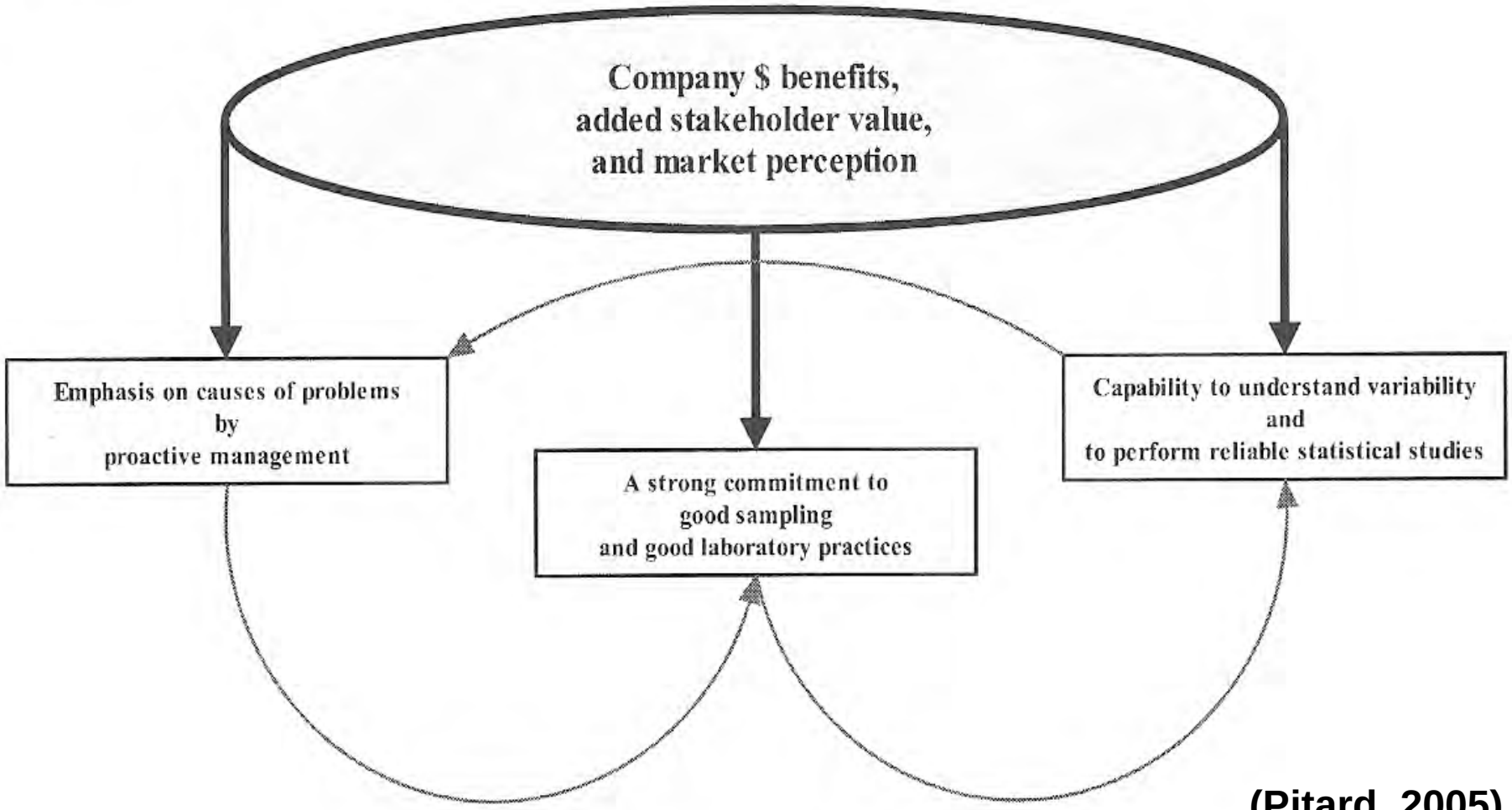
Indicator Mineral Chemistry Quality Control Discussion

Mary Doherty
ALS Chemex

Exploration07

Quality Control Discussion

- Value of Quality
- Define Sources of Error
- Measurement of Error
- Systems to minimize and control error
- NI 43-101, ISO 9001, 17025, reporting requirements



(Pitard, 2005)

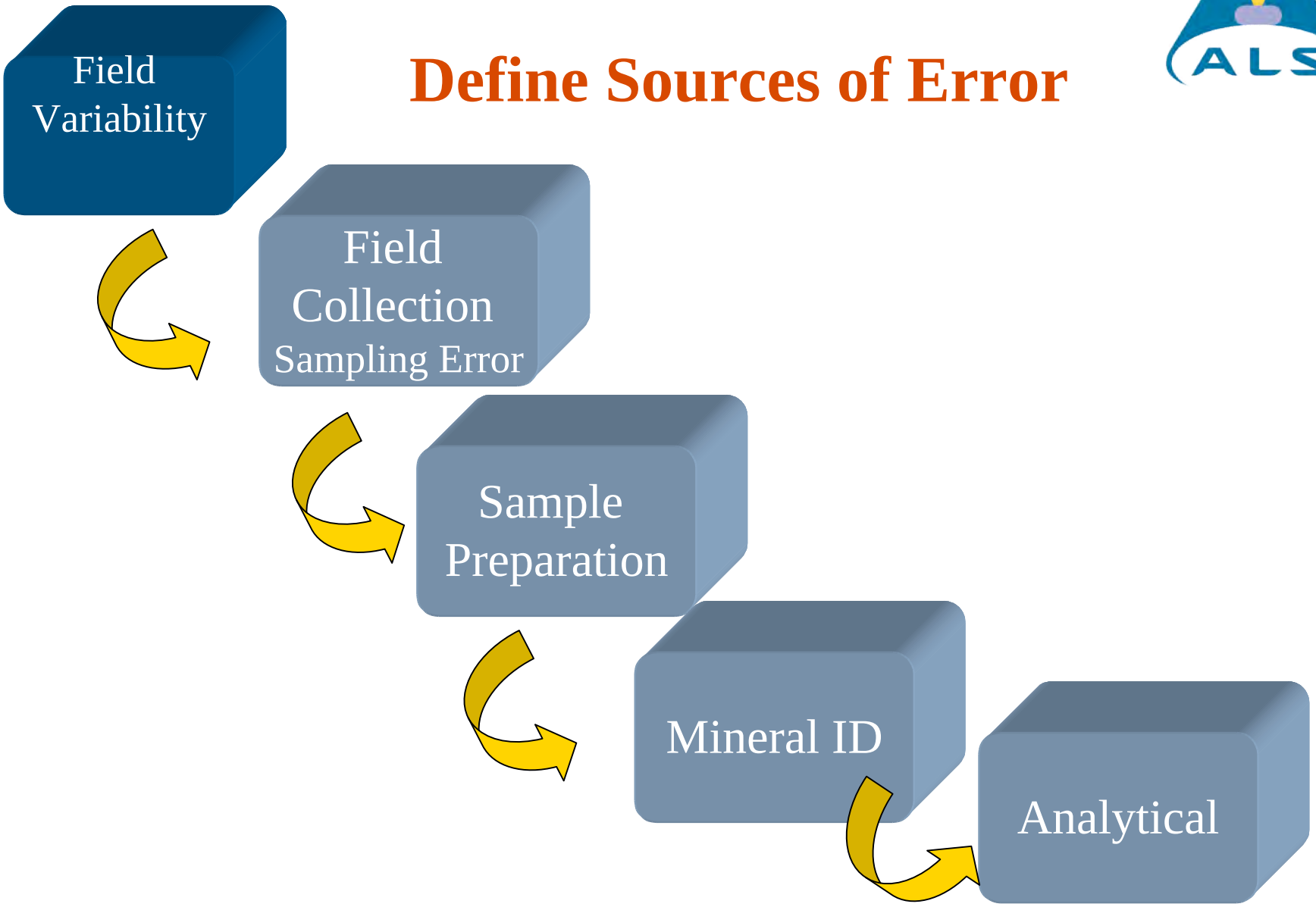
FIG 23 - A management strategy founded on three solid, steady pillars.

Corporate Wealth is directly tied to quality

ALS Laboratory Group

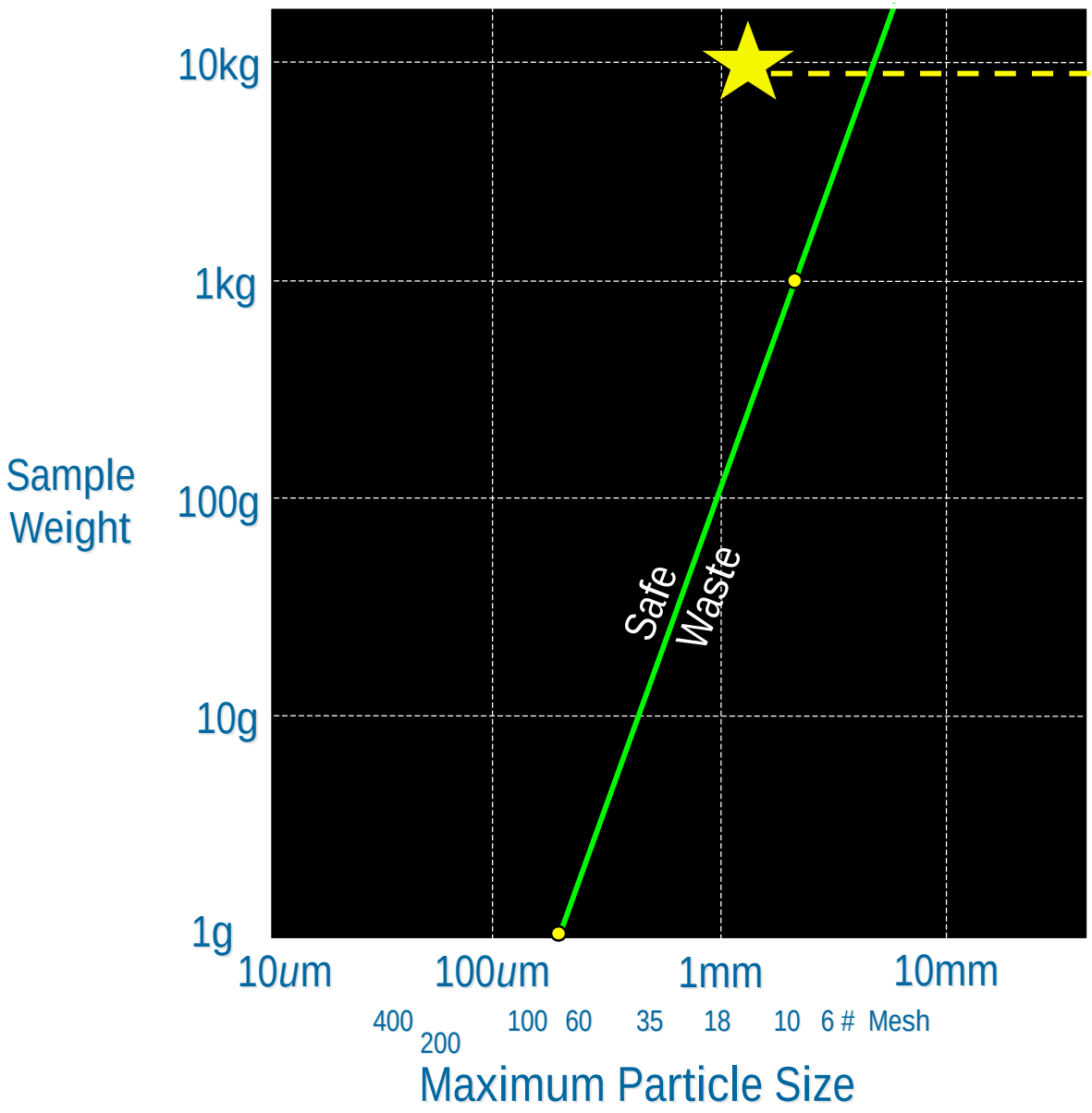
ANALYTICAL CHEMISTRY & TESTING SERVICES

Define Sources of Error



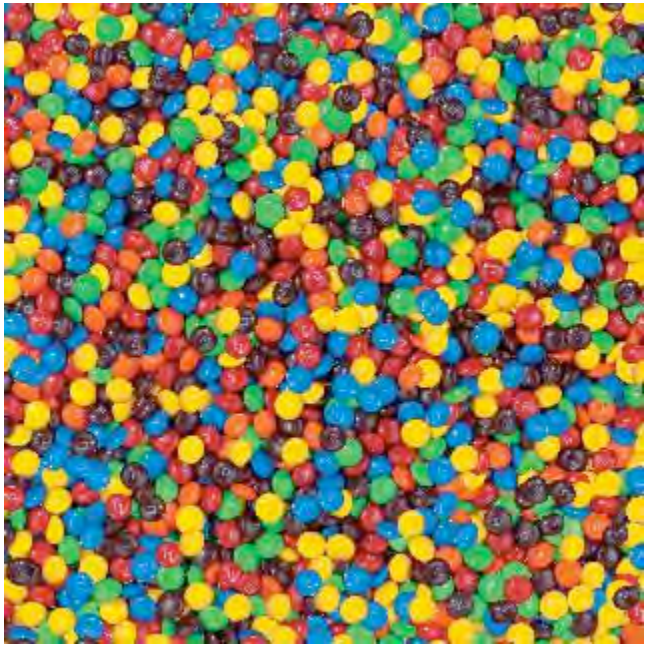
Exploration07

Gy's Safety Curve



Assume:

- **Homogeneous sample**
- **Initial sample size**



Sample Heterogeneity

A. 3,0,1,1,1,0,0,0,1

Answer: <1

B. 9,4,3,2,4,3,3,4,5

Answer : 5

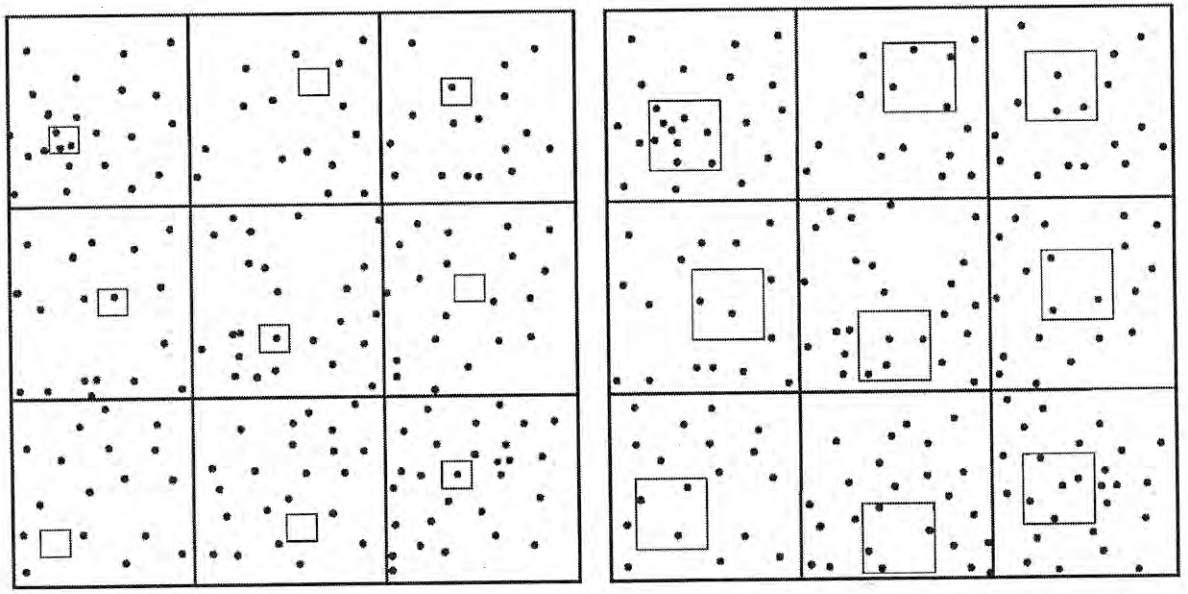


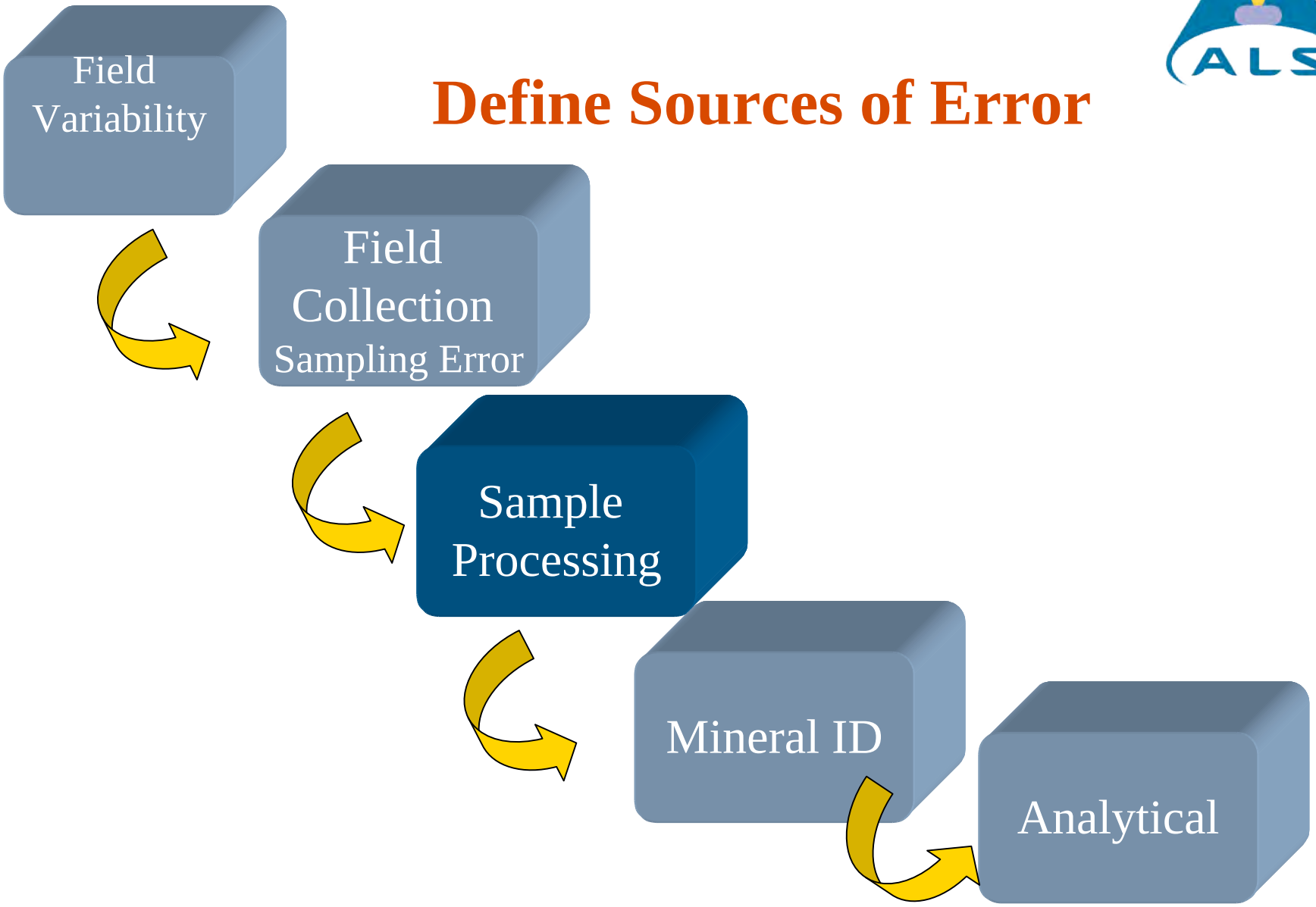
Figure 6. The effect of sample size when there are few analyte particles (black dots) (Pitard, 1993; p. 368).

(Pitard)

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

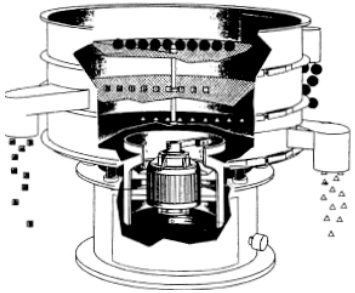
Define Sources of Error



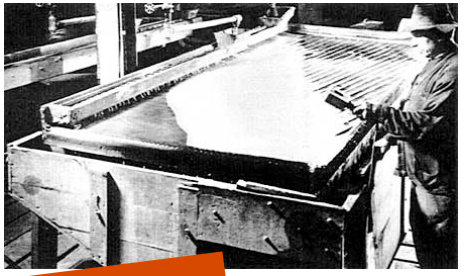
ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Sample Processing



Sieve



Gravity Density Separation

Liquid Density Separation

Magnetic Separation

Mineral Picking

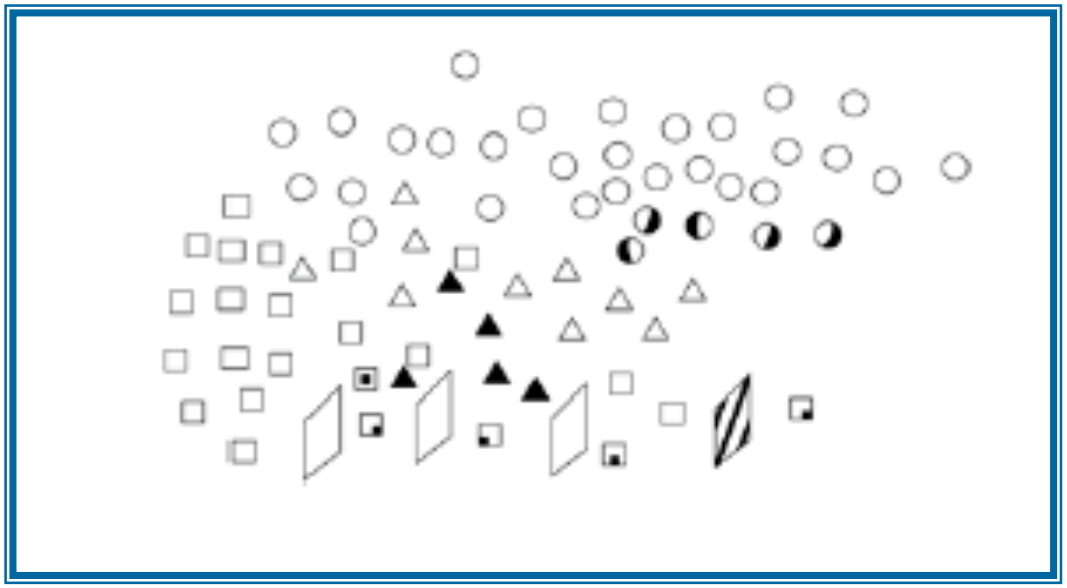
Define Sources of Error, Processing

- Sample processing is complicated by mineral chemistry variations, chemistry varies magnetic susceptibility and density.
- Loss sample
- Sample switches
- Grain losses
- Sample contamination/carry-over
- Splitting error

Split Error

“Taking a representative split from a large sample is not as simple as many people believe.”

(Rocklabs)



ALS Laboratory Grou

ANALYTICAL CHEMISTRY & TESTING SERVICES

Split Error

- Split all sample
- Even split
- No density separation
- No loss of fines or size segregation
- Error Comparison
  - Cone and Quarter 13.6%
  - Scoop Sample 10.3%
  - Riffle Split 2%
  - Rotary 0.25%

    (Allen and Kahn, 1970)
- Riffle may be as good if operator careful, less likely for larger samples requiring multiple splits.
- Rotary not too fast to segregate fines, more cones preferable.

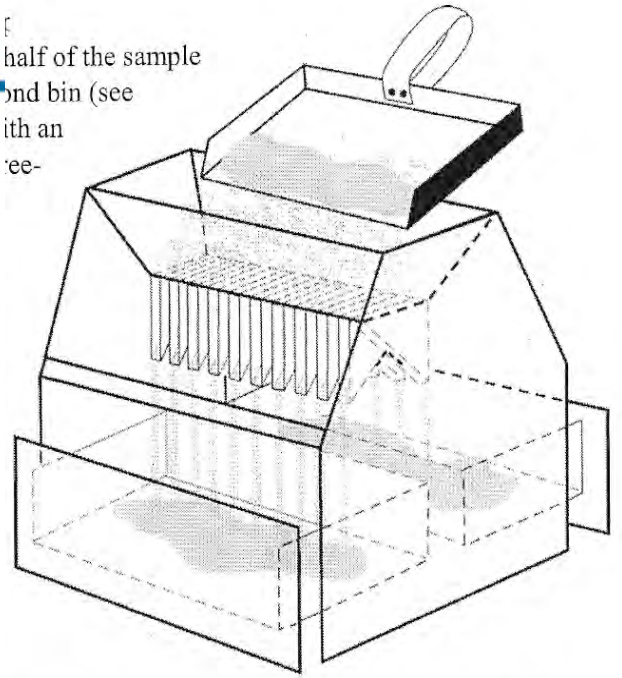
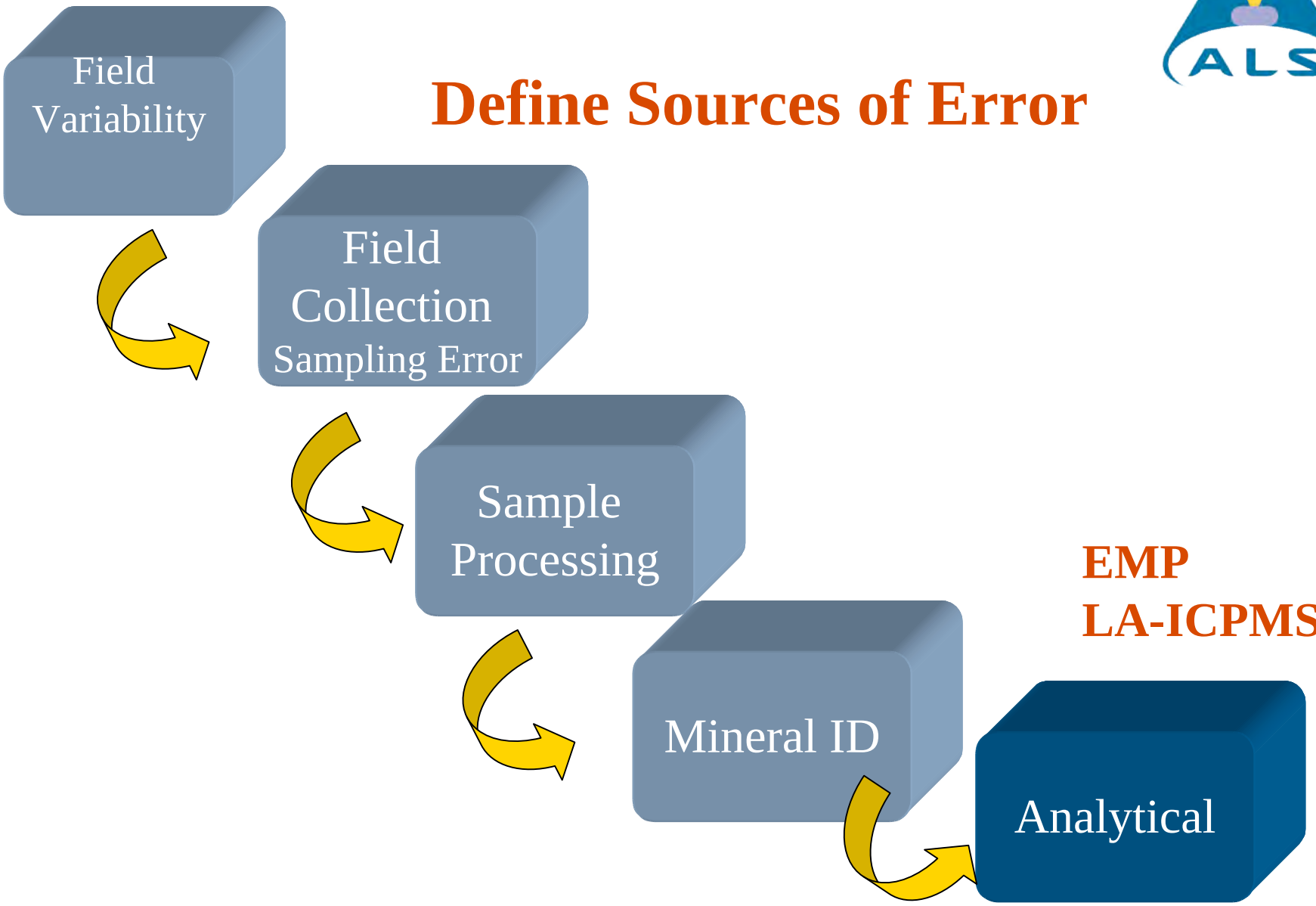


Figure 16. A riffle splitter with 20 chutes and two collection pans.

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Define Sources of Error



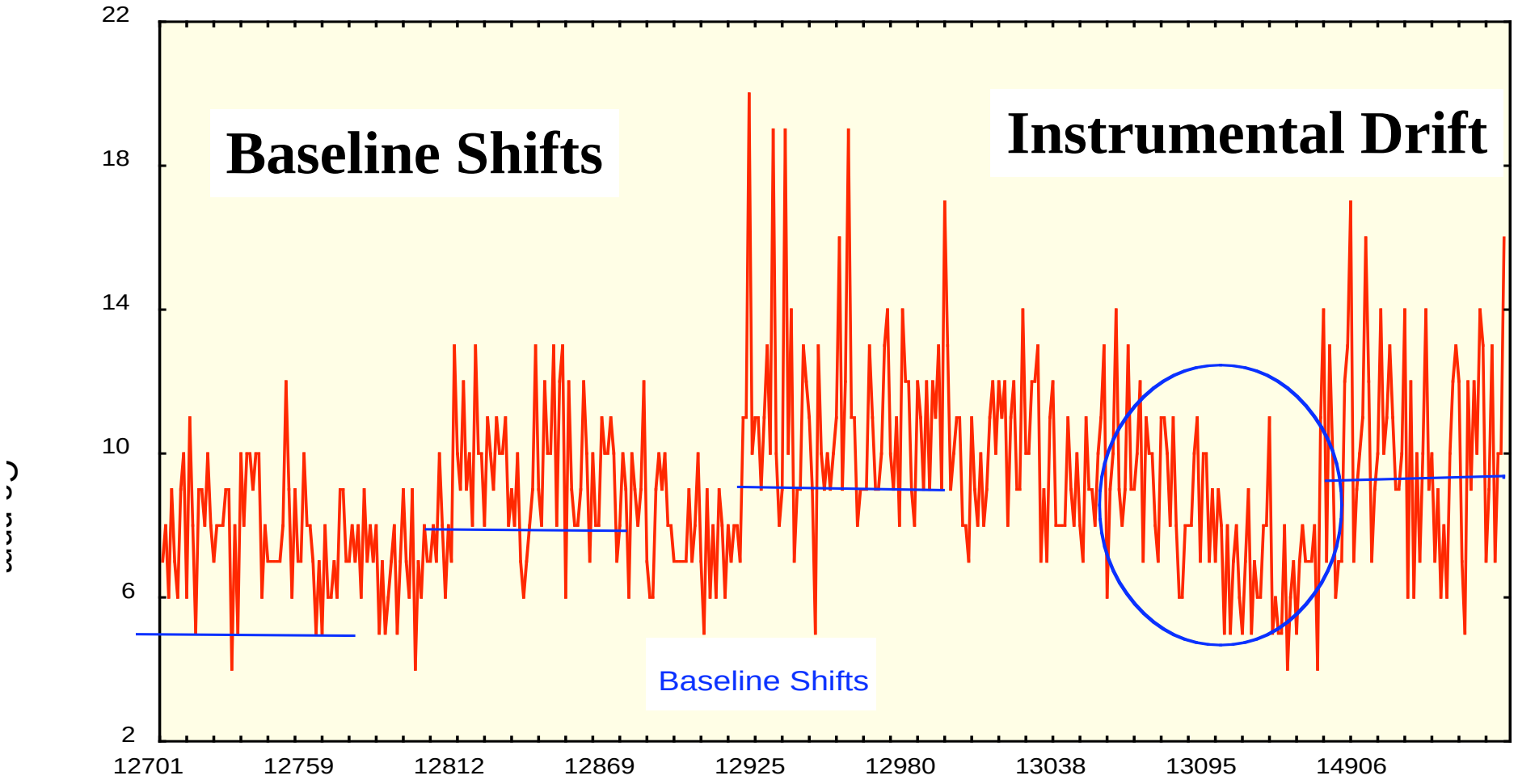
EMP

LA-ICPMS

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Analytical Batch errors



Exploration07

I want a motorcycle

Exploration07

Quality Control Discussion

- Value of Quality
- Define Sources of Error
- Measurement of Error
- Systems to minimize and control error

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Measure and Monitor Quality Control

- Field duplicates
  - Two samples in field
  - Are they useful for indicator mineral sampling?

Probability of field recovery 5%

Probability of lab recovery 92.99%

- Suggest 5%

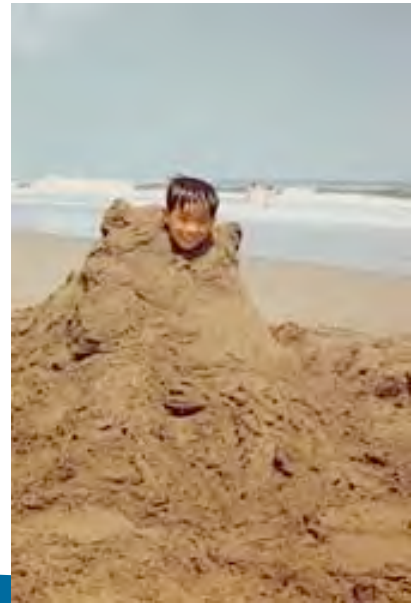
ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Measure and Monitor Quality Control

Blanks:

- Ceramic grade coarse sand
- Detects process sample carry-over or sample switches
- First sample of batch to prevent carry-over from previous work.



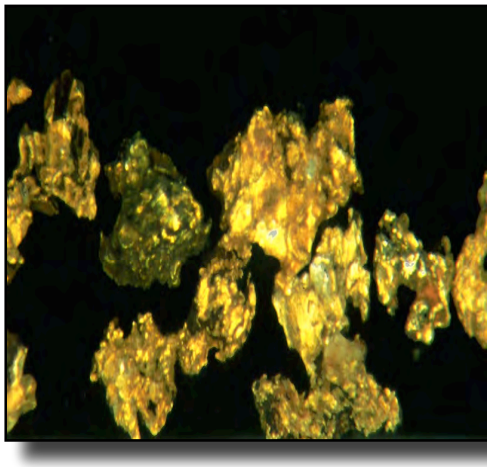
ALS Laboratory Group

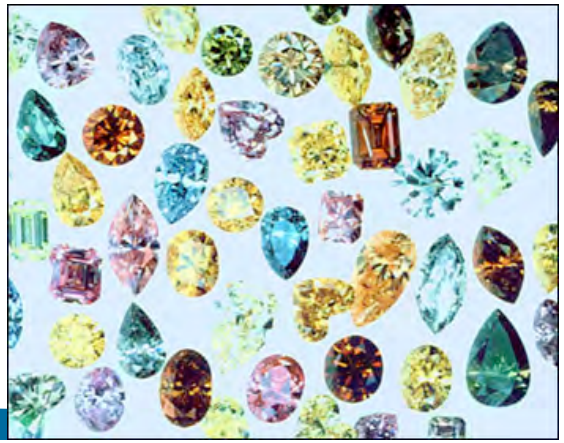
ANALYTICAL CHEMISTRY & TESTING SERVICES

Measure and Monitor Quality Control

Standards:

- **Multiple site duplicates, Site "standards"**
  - **Set of samples taken from a known valuable field site**
- **Spike samples**
  - **Known number of distinct grains**
    - **Unique color diamonds**





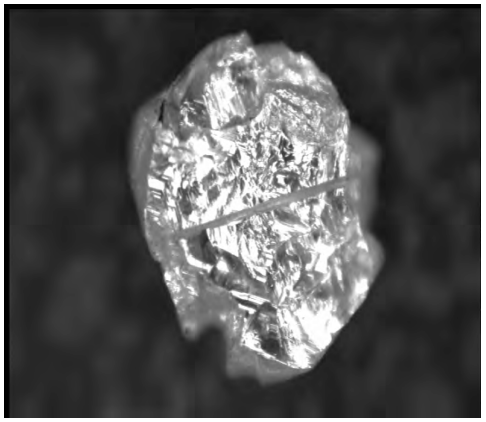
ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Measure and Monitor Quality Control

Standards:

- **Spike samples**
  - **Known number of distinct grains**
    - **Laser Etching**

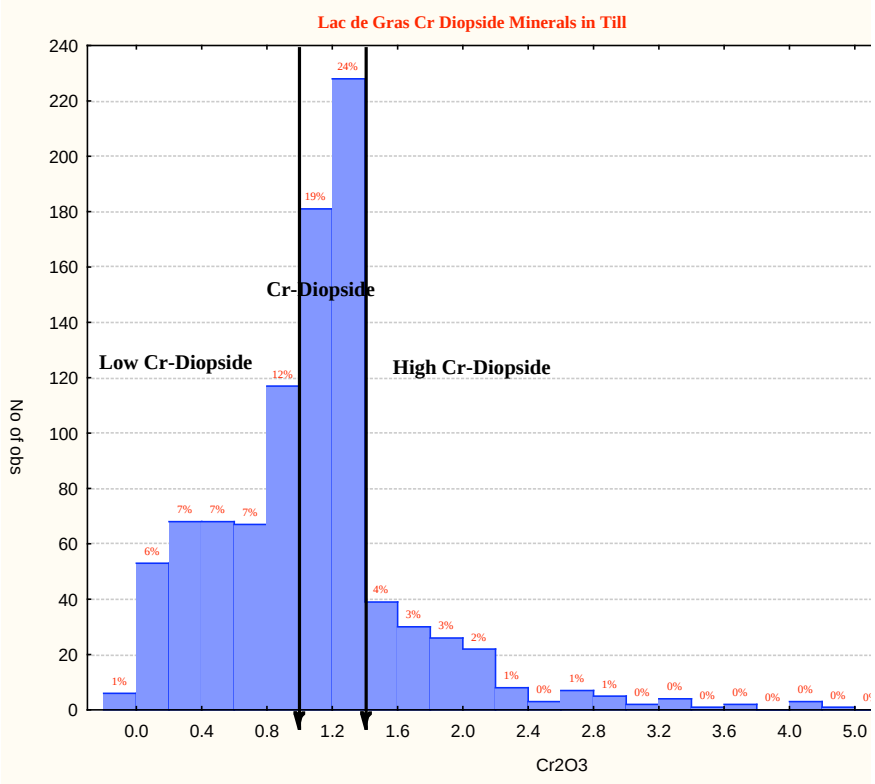


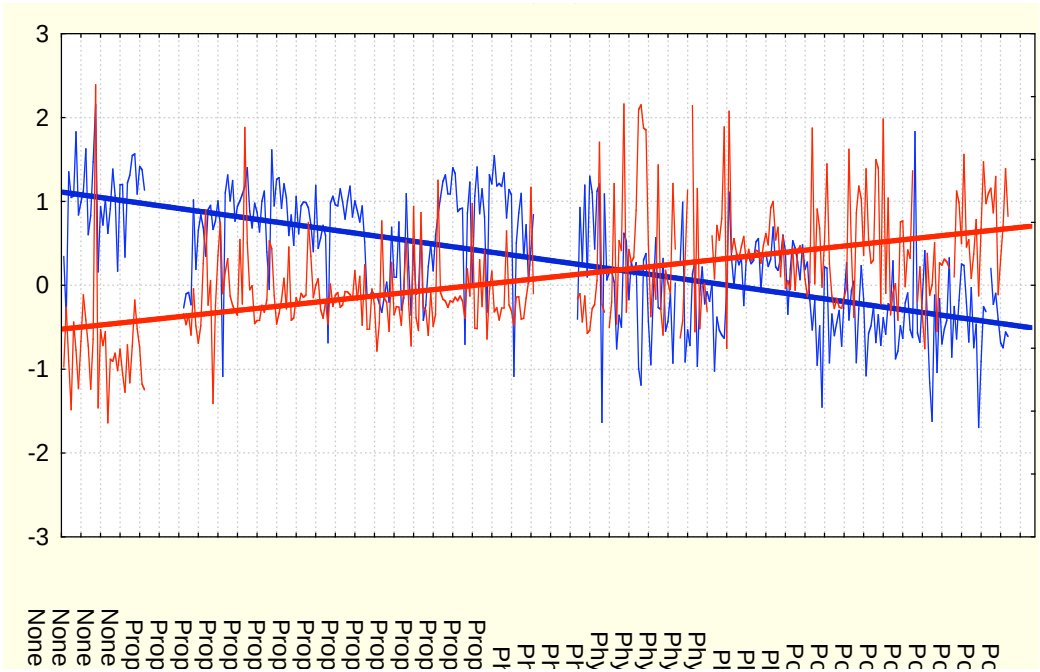
(photos from Whiteford)

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Quality Control for Grain Analysis



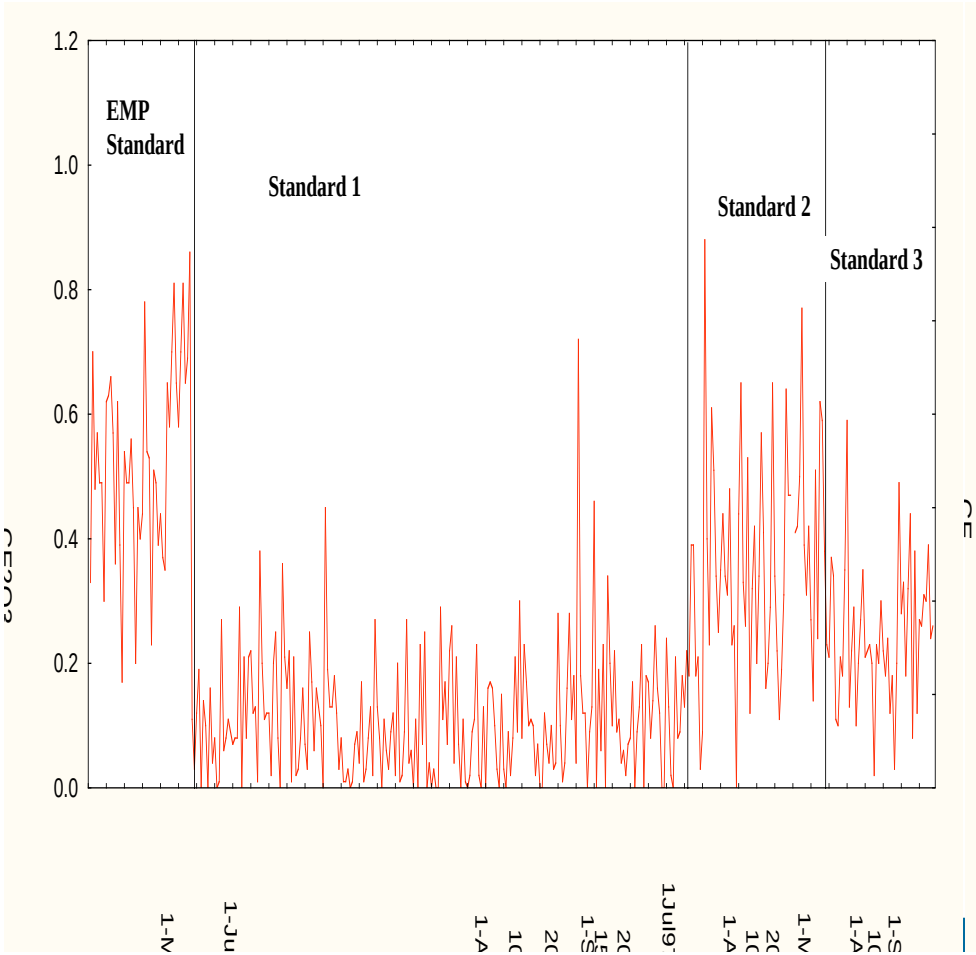


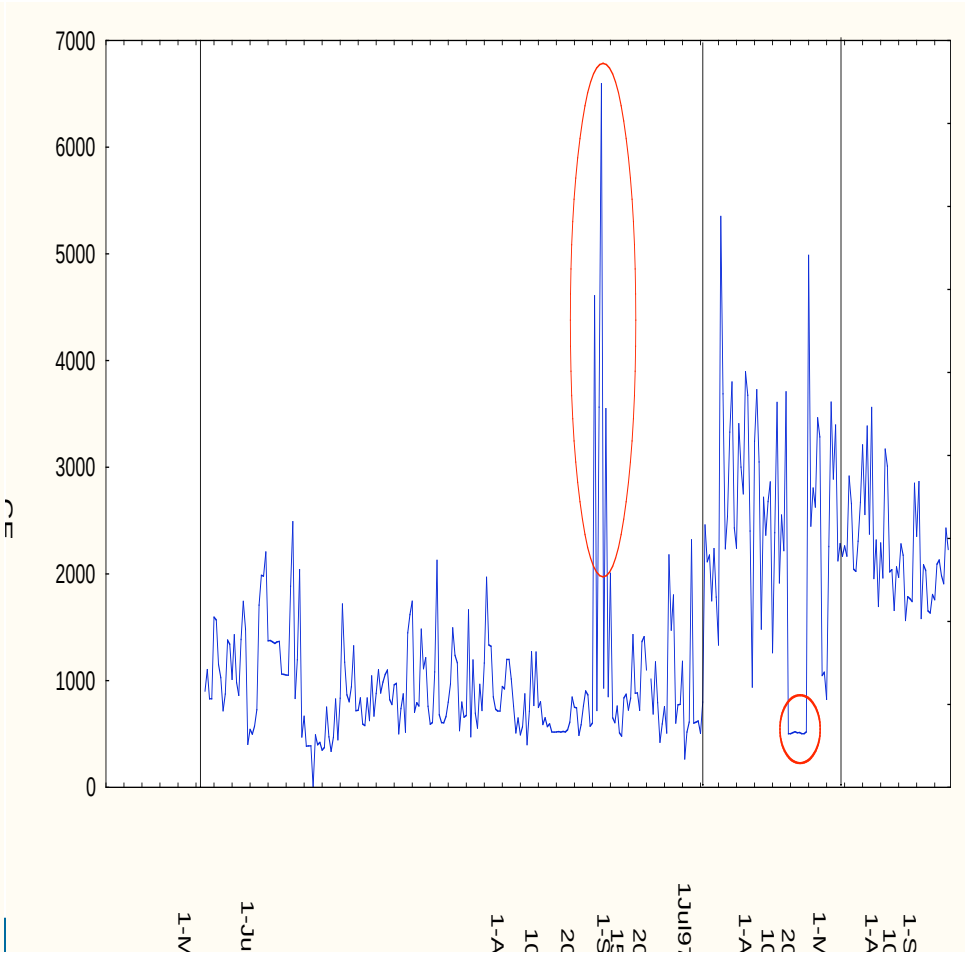
Quantitative QC especially in research development

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Comparison of Replicates for Ce
EMP vs. Laser Determinations



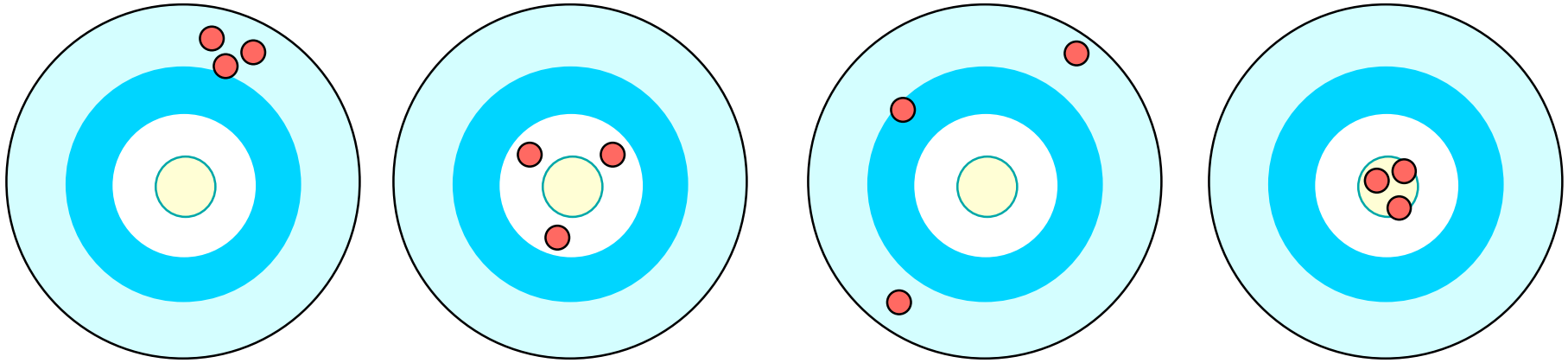


ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Precision - **Replication of a value with no regard to it‘s reflection of absolute “truth”**

Accuracy - **Comparison of a value to absolute “truth”.**



Precise, Not Accurate

Not Precise, Accurate

Not Precise, Not Accurate

Precise, Accurate

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Measure and Monitor Quality Control

- Grain Analysis, EMP and LA-ICPMS
  - Known grains
  - Randomize
  - Duplicate grains
  - Batch repeats
  - Duplicate samples to second lab

Exploration07

Quality Control Discussion

- Value of Quality
- Define Sources of Error
- Measurement of Error
- Systems to minimize and control error
- NI 43-101, ISO 9001, 17025, reporting requirements

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

NI 43-101

- **Canadian regulation governing disclosure of technical information by exploration/mining companies listed on stock exchanges**
- **Widely adopted as a general guideline for best practices by international companies**
- **Delegates responsibility for technical information to a "Qualified Person"**
- **Requires regular reporting according to industry-standard guidelines**
- **A response to the scandal to re-instill confidence in Canadian traded companies**

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Implications of NI 43-101

- **Requires Disclosure of all Relevant Technical Information**
- **Defines the Role of "Qualified Person"**
- **Requires the *Qualified Person* to Verify all Technical Information Reported**
- **Requires the Qualified Person to Set Up and Maintain a *Quality Control Program* on Projects**
- **Recommends the Use of *Accredited Laboratories* and Industry Standard Practices**

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

What is ISO 9001:2000?

ISO 9001:2000 is a term for a set of international quality standards developed by the International Organization of Standards in Geneva, Switzerland.

This organization has a membership of standards groups representing 110 countries. The American National Standards Institute (ANSI) is the United States representative.

Over 140 countries recognize the standard.

Over 8,500 companies are certified in the United States

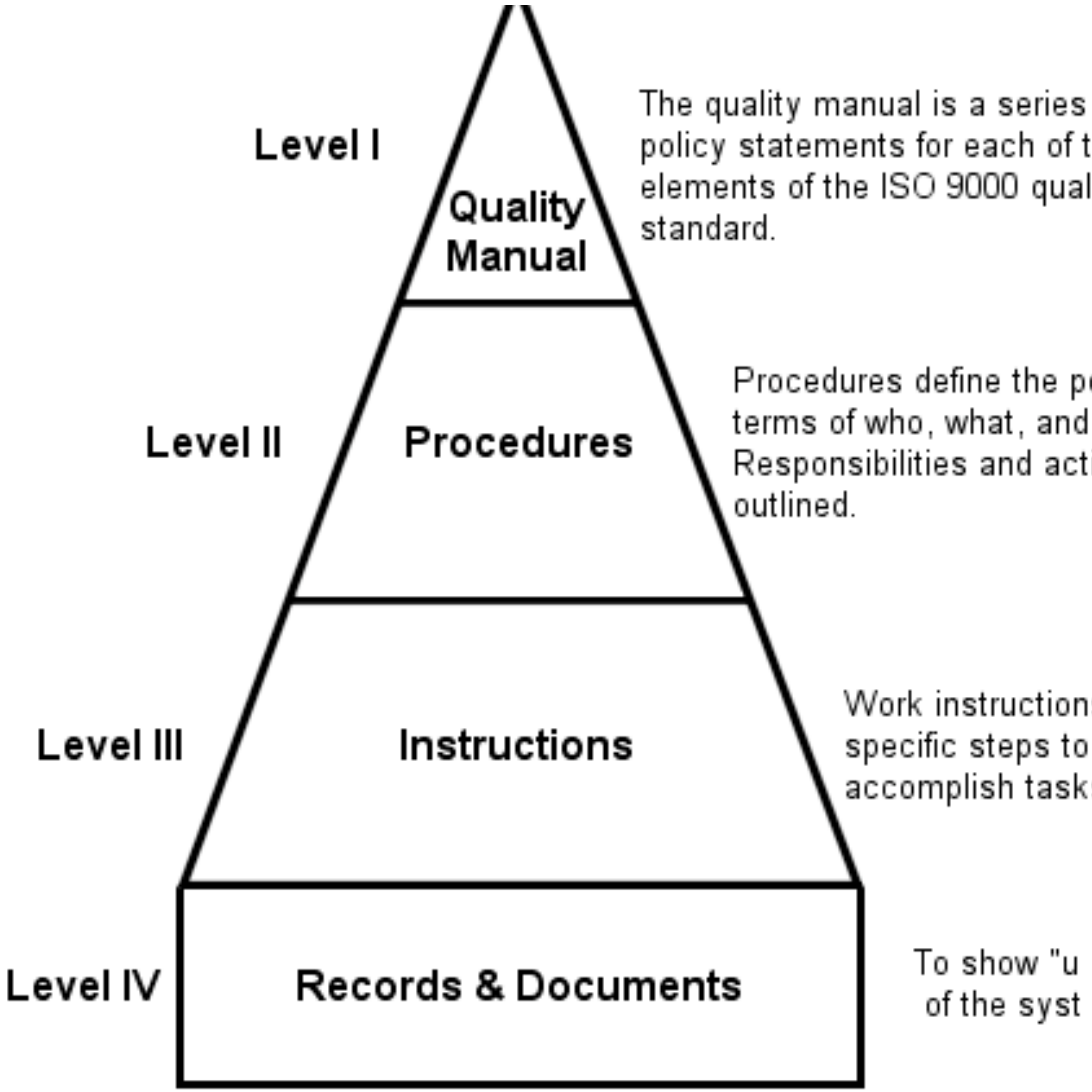
ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Certification - ISO 9001:2000

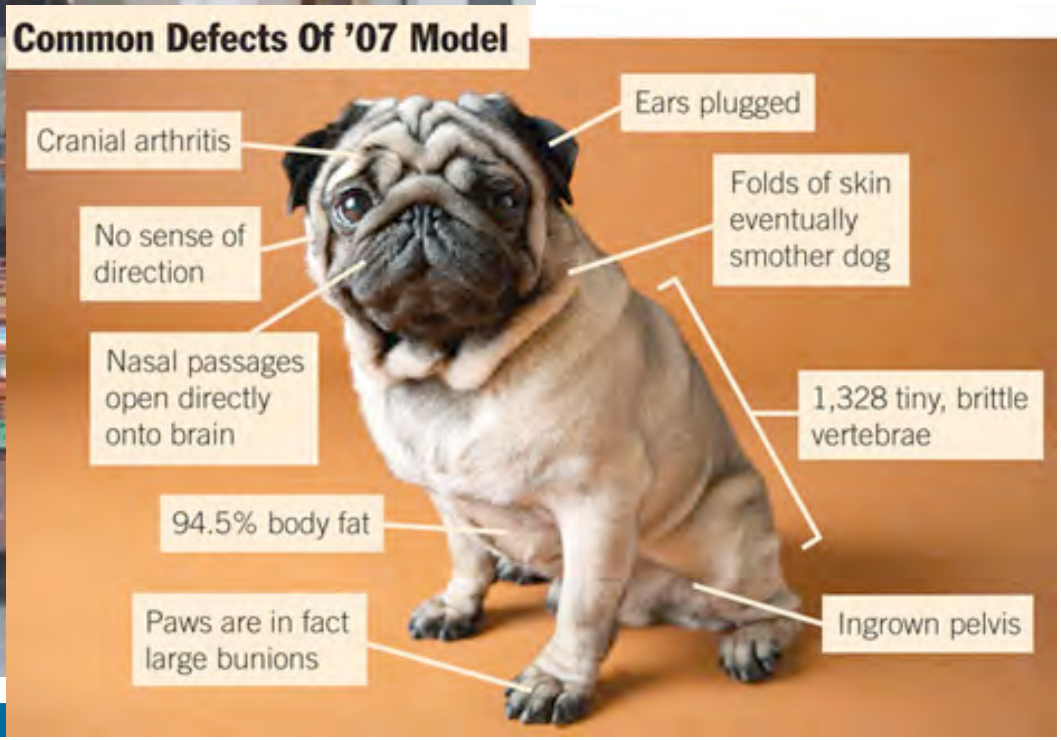
- **Requires evidence of a quality management system covering all aspects of an organisation.**
- **Reviews what the organization does to fulfill:**
  - ✓ **the customer's quality requirements and applicable regulatory requirements,**
  - ✓ **achieve continual improvement of its performance in pursuit of these objectives.**
- **Registration requires an audit by an external agency accredited by ISO**
- **Requires annual renewal**

ISO 9001:2000 is a model/standard that lists requirements for a system to manage quality assurance; not a strict set of rules but a series of common sense guidelines



Key: Say what you do; Do what you say.
A common sense standard.

- **Initial registration**
- **Annual renewal**



Quality Control Recommendations

- Visit the lab and review the project.
- Define potential sources of error.
- Find out what the lab is doing to control quality

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Quality Control Recommendations

- **Insert 10% quality control samples in both processing and grain analytical batches.**
  - **Field Duplicates – Site Variability: 1 in 20-30**
  - **Blanks – carry-over contamination: 1 in 20**
  - **Analytical Control Samples – Accuracy: 1 in 20**
  - **Lab Replicates – Precision: 1 in 20**
- **Confirm Data with Follow-up Sampling (5%)**
- **Check with a second lab (10%)**

ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

Hit the mark, with a well designed system which will recognize error, measure the error, minimize error.

The wealth of your Corporation is dependent upon the quality of the exploration and reserve data.