50 COMMON PITFALLS

Hazardous to the credibility of you and your sampling reports

50 COMMON PITFALLS INTRODUCTION

- This document was prepared by SKC Inc. to enhance the credibility of your sampling work. The fifty tips cover a diverse range of common mistakes, any one of which can diminish the value attached to your report.

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EXPECT SCRUTINY

- Every aspect of your sampling project should be planned and executed as if you will defend it in court.
- Leave no doubt about your understanding and professional judgement.

CREDIBILITY

- Is like a chain that depends upon every link for its strength.
- Avoid the common mistakes described in this presentation to prevent weak links.

PITFALL #1

Failure to fully research the details of an unfamiliar task.

Competent project preparation must include research into method protocols covering flow rate, minimum/maximum air volumes, and sample preparation and handling. Consult lab experts for additional help if needed.

PITFALL #2

Failure to obtain data that is relevant to the issue of concern.

Develop a sampling strategy that addresses critical issues such as method sensitivity, appropriate sampling time, and type of sample such as gravimetric analysis for total, inhalable, and respirable dust or chemical analysis for specific metals or other compounds.

PITFALL #3

Failure to consider the physical state(s) of the contaminant.

- Some airborne contaminants can exist simultaneously in both the vapor and the particulate (aerosol) phase.
- Use a sampler that collects all phases of the contaminant of interest.

PITFALL #4

Failure to determine the minimum required sample volume.

- Reliable laboratory quantitation requires a minimum quantity of collected analyte.
- Your sample volume should be sufficient to obtain at least this amount of contaminant.
- Consult the published method or discuss with a lab expert.

MORE ON SAMPLE VOLUME

- Questions may arise when workplace methods designed to measure ppm levels are used to assess contaminant concentrations at much lower levels.
- A higher air volume generally increases method sensitivity, but the reliability of the method might be called into question if sample volume exceeds method specifications.

PITFALL #5

Failure to use a method with documented reliability.

- OSHA does not mandate that employers use government sampling methods.
- Employers, however, must be able to prove the accuracy and precision of alternative methods.

PITFALL #6

Failure to use the sampling media specified in the method.

- Sampling media specified in government methods has been thoroughly tested and evaluated.
- Deviations in media type and published specifications may result in less effective sample collection.

PITFALL #7

Failure to clean cyclones before use.

- To achieve the desired particle size separation, the internal parts of a cyclone must be clean.
- Deposits of particulate matter adhering to the sides of the cyclone can alter the size-selection characteristics of the particulate penetrating the cyclone and collecting on the filter.

PITFALL #8

Use of a pulsating pump for collecting respirable dust samples.

- Size-selective devices such as cyclones are affected by changes in flow rate.
- It is important to maintain a constant and non-pulsating flow rate to ensure correct size selection.

PITFALL #9

Failure to use an RFI/EMI-shielded pump.

Radio frequency interference (RFI) or electro-magnetic interference (EMI) from devices such as walkie-talkies, high-voltage equipment, and electric motors can adversely affect the performance of pumps and other sampling instruments.

PITFALL #10

Use of area samples to assess personal exposures.

The best estimation of a person's exposure to a contaminant is obtained by placing the sampling equipment on the exposed individual. Area samples will be more difficult to defend as a reliable estimate of personal exposure.

PITFALL #11

Failure to use a constant flow pump.

- Constant flow pumps automatically compensate for flow restrictions ensuring the flow rate is held constant.
- Without this feature, users need to constantly monitor and manually adjust the flow rate to accurately measure air volume.

PITFALL #12

Use of a non-validated passive sampler.

Passive samplers with no scientific data to prove their reliability are useful for screening purposes. They do not, however, meet the OSHA requirements for accuracy and precision for compliance sampling.

PITFALL #13

Failure to collect enough samples.

- One or two samples are insufficient to provide a true characterization of typical exposure levels.
- Consult reference books on the subject of exposure assessment or agency standards for designated target compounds for assistance on the proper number of samples.

PITFALL #14

Use of only short-term or grab samples to determine the 8-hour time-weighted average (TWA).

- Grab samples using short-term color detector tubes or other instruments can provide valuable information on peak exposures.
- Their use in estimating 8-hour TWA exposures, however, requires complex statistical analysis.

PITFALL #15

Failure to calibrate a pump properly.

- In air sampling, calibration means to set and verify the flow rate.
- Typically, this is done before and after every sample using a pump flowmeter (calibrator) that has been certified annually to a national standard such as NIST in an ISO 17025 calibration laboratory.
- Secondary calibrators, such as rotameters, that have been regularly calibrated by the user to the certified calibrator can be used as well.

PITFALL #16

Use of a Luer adapter on the inlet of a filter cassette during calibration (with some pumps).

The OSHA Technical Manual discourages the use of Luer adapters in front of the filter. This device may generate significant back pressure for which some pumps cannot compensate, leading to inaccurate results. A good quality constant flow pump, however, should be able to overcome back pressure issues.

PITFALL #17

Misuse of “self-calibrating” pumps.

- Some sample pumps available today have internal flow sensors that measure and display the flow rate.
- These flow indicators are secondary standards that should be verified with an external certified flowmeter.

PITFALL #18

Failure to calibrate with recommended sampling media in line.

OSHA methods require that pumps be calibrated within ±5% of the recommended flow rate with the sampling media in line. This is because various types of sampling media produce different amounts of back pressure (pressure drop) for which the pump must compensate.

PITFALL #19

Failure to correct a rotameter reading for conditions that deviate from those existing during calibration.

- Rotameter readings are affected by both temperature and atmospheric pressure.
- Rotameters should be calibrated under conditions of use or mathematical corrections should be performed if used in conditions different from those during calibration.

PITFALL #20

Inconsistent placement of the rotameter in the sampling train.

If the rotameter was calibrated initially with one end open to the atmosphere, flow readings should be taken with the rotameter in the same position in the sampling train. A significant correction of the readings would be necessary if the rotameter position is changed, such as placing it between the pump and the collection device.

PITFALL #21

Reusing plastic filter cassettes.

- Plastic filter cassettes are designed for one-time use, not for subsequent reloading.
- Opening and closing cassettes can produce cracks and other deformities that can cause leaks.

PITFALL #22

Removing the grit pot from a cyclone during sampling.

- The grit pot on a cyclone must be in place during calibration and sample collection.
- An absent grit pot permits massive leakage and prevents proper collection of the desired size of dust particle onto the filter.

PITFALL #23

Entrusting a sampling project to unqualified persons.

- Proper exposure monitoring and data interpretation requires expertise and careful thought.
- Even if done correctly, data can be challenged if the person's resume shows little evidence of training.

PITFALL #24

Failure to account for the presence of interfering compounds.

- Sampling methods often specify compounds that can interfere with sampling or analysis.
- The use of a pre-filter or other scrubbing device may be required. Discuss with a lab expert.

PITFALL #25

Failure to place a sorbent tube in a vertical position during sampling.

- Airborne contaminants take the path of least resistance when pulled through the collection media.
- If the sorbent tube is placed in a horizontal position, the sorbent material may fall away from the wall of the tube creating a small channel through which the air will flow and reduce adsorption.

PITFALL #26

Failure to maintain proper orientation of some size-selective particulate samplers.

- The performance of some particulate samplers, such as 10-mm nylon cyclones, are affected by orientation.
- Significant bias can be introduced if the devices are inclined during sampling.

PITFALL #27

Failure to use the flow rates and air volumes listed in published methods.

Air volume and flow rate requirements of published methods have been researched and tested; deviations are not recommended.

PITFALL #28

Failure to sample at the specified flow rate when using a respirable dust sampler.

- Each type of respirable dust sampler (including cyclones and the SKC Parallel Particle Impactor or PPI) has a specific design flow rate that achieves the 50% cut-point specified in the agency standard.
- Using a different flow rate will alter the collection efficiency curve, including the 50% cut-point.

PITFALL #29

Failure to make notes on work operations during the sampling interval.

Competent exposure monitoring requires frequent observation of conditions and operations that could affect sampling results.

PITFALL #30

Failure to inspect the filter during the sampling period.

- It is important to check the filter during sampling for signs of excessive loading.
- Filters can become plugged by heavy particulate loading or by the accumulation of oil mists if present in the air.

PITFALL #31

Reuse of sample bags.

A published study indicates that bags should not be reused because it is impossible to fully remove all the collected chemical from the bag material. *Reference are available upon request.*

PITFALL #32

Failure to make an accurate measurement of sampling time.

An accurate measurement of sampling time is just as important as flow rate because the product of the two provides sampled air volume.

PITFALL #33

Use of passive samplers under stagnant air conditions.

- A minimum air movement of 25 ft/min across the face of a passive sampler is necessary for adequate collection.
- When air is stagnant, “starvation” occurs because there are no fresh contaminant molecules to drive diffusion. This condition produces erroneously low results.

PITFALL #34

Storing, assembling, or processing collection devices in areas containing chemicals.

Before and after sampling, there are opportunities to invalidate the sample by exposing collection devices to contaminants during assembly, disassembly, storage, and shipping.

PITFALL #35

Failure to document chain of custody.

- Unreliable evidence can be challenged by the courts.
- A professional chain of custody form shows who handled the sample and demonstrates that you are serious about the integrity of your work.

PITFALL #36

Failure to store samples properly after collection.

- Air sampling methods stipulate storage conditions, including maximum storage times.
- Some samples will require special conditions, such as freezer storage or analysis within a few days.

PITFALL #37

Inverting a cyclone during or after sampling.

The cyclone separator permits collection of smaller particles on the filter and removal of larger particles into the grit pot. Inversion of the cyclone causes larger particles to fall from the grit pot onto the filter material making the results erroneously high.

PITFALL #38

Improper shipping of bag samples.

- Bag samples should not be shipped in an unpressurized airplane cabin, as the resulting expansion can result in sample loss.
- Similarly, high temperatures outside of those specified by suppliers, such as SKC, should be avoided.

PITFALL #39

Failure to supply blank samples to the analytical lab.

Blank samples are analyzed to ensure the sampling media is clean and free of background contamination. This reduces errors in identification and quantification of contaminants.

MORE ON BLANK SAMPLES

MEDIA BLANKS

- Unopened new samples of the media used in the field
- Minimize errors resulting from background contamination of the sample media.

FIELD BLANKS

- Exact replicas of the field samples, but no air is drawn through them.
- Minimize errors resulting from contamination during sample handling.

PITFALL #40

Use of a non-accredited analytical laboratory.

- AIHA-accredited laboratories have demonstrated a high proficiency in analyzing industrial hygiene samples.
- Failure to use an accredited laboratory can raise doubt about data integrity.

PITFALL #41

Failure to correct the flow rate for changes in temperature or atmospheric pressure.

Environmental conditions at the sampling site should be similar to those at the calibration site. If the pump electronics do not automatically correct the flow rate for changes in temperature and atmospheric pressure, the user should do a mathematical correction to ensure the proper air volume is determined.

PITFALL #42

Failure to document and report pertinent technical information.

All critical sampling parameters, such as sample time, temperature, and atmospheric pressure, along with sample identification should be recorded and kept on file with analysis results.

PITFALL #43

Failure to document and report pertinent non-technical information.

Competent environmental monitoring requires meticulous collection of information identifying location, conditions, work activities, etc. The reader of your report should not have to guess at the details.

PITFALL #44

Failure to document and report both field and lab sample identifiers.

- It is common to re-label samples for lab analysis to ensure the lab identifier is unique; therefore, field notes might refer to samples by different numbers.
- Identifying the sample by both numbers in the report shows attention to detail.

PITFALL #45

Failure to correctly interpret the analyte quantified.

In some cases, the value reported by the laboratory must be scaled upward for the report of your findings, because the laboratory actually detected and quantified only part of the contaminant.

EXAMPLE:
SAMPLING METALLIC COMPOUNDS

- The laboratory often reports the results as just the metal (e.g., inorganic manganese compounds *as Mn*).
- If the relevant exposure limit is for the metal, there is no problem.
- However, if the exposure limit is for the metal oxide fume, then an adjustment is required.

PITFALL #46

Failure to explain analytical nuances in the report.

- Some sampling projects involve more subtleties than others and the reader of your report should feel confident you have comprehended these.
- Example: Fluoride is measured as a *surrogate* for the many components of PTFE thermal decomposition products.

PITFALL #47

Failure to explain assumptions inherent in data manipulations.

- It is perfectly legitimate to make assumptions about an unsampled period of time.
- One might assume zero exposure after work concluded or that the average concentration did not vary between the sampled and unsampled periods.

BUT ASSUMPTIONS MUST BE CLEAR

- The reader should be given actual sampling times and actual average concentrations during the sampling periods along with your assumptions.
- Otherwise, there is a suggestion of possible dishonesty and reason for doubt about the credibility of the data.

PITFALL #48

Failure to present data and related information in a neat, organized format.

Competent reporting of study findings takes time. Each report requires its own individual assessment of the proper presentation format.

BE ORGANIZED

- The most competent study can look incompetent if it is presented in a thoughtless fashion.
- Use tabulated data with all assumptions and adjustments explained.

PITFALL #49

Failure to gain familiarity with related work by others.

- In a deposition or a trial, an IH might be discredited if they are ignorant of work done by others that is related to the subject of the testimony.
- This is also important for the corporate IH who may rely on consultants.

PITFALL #50

Failure to gain familiarity with the employer's safety practices.

- In legal proceedings, the sampling report is only one aspect of a larger issue—the state of workplace health and safety.
- Data on contaminant concentrations must be placed in this context.

CREDIBILITY

- Is like a chain that depends upon every link for its strength.
- Is enhanced by avoiding the common mistakes listed in this presentation.
- Contact SKC at www.skcinc.com for information on sampling protocols and sampling media that have stood the test of time and court challenge.

THANK YOU FOR YOUR COMMITMENT TO GOOD SCIENCE!