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Thank You for Attending Today's Webinar:

Tips for Collecting Better IH Data – Anything That Could Go Wrong Will Go Wrong… Unless You are Prepared

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Tips for Collecting Better IH Data - Anything That Can Go Wrong Will Go Wrong… Unless You are Prepared

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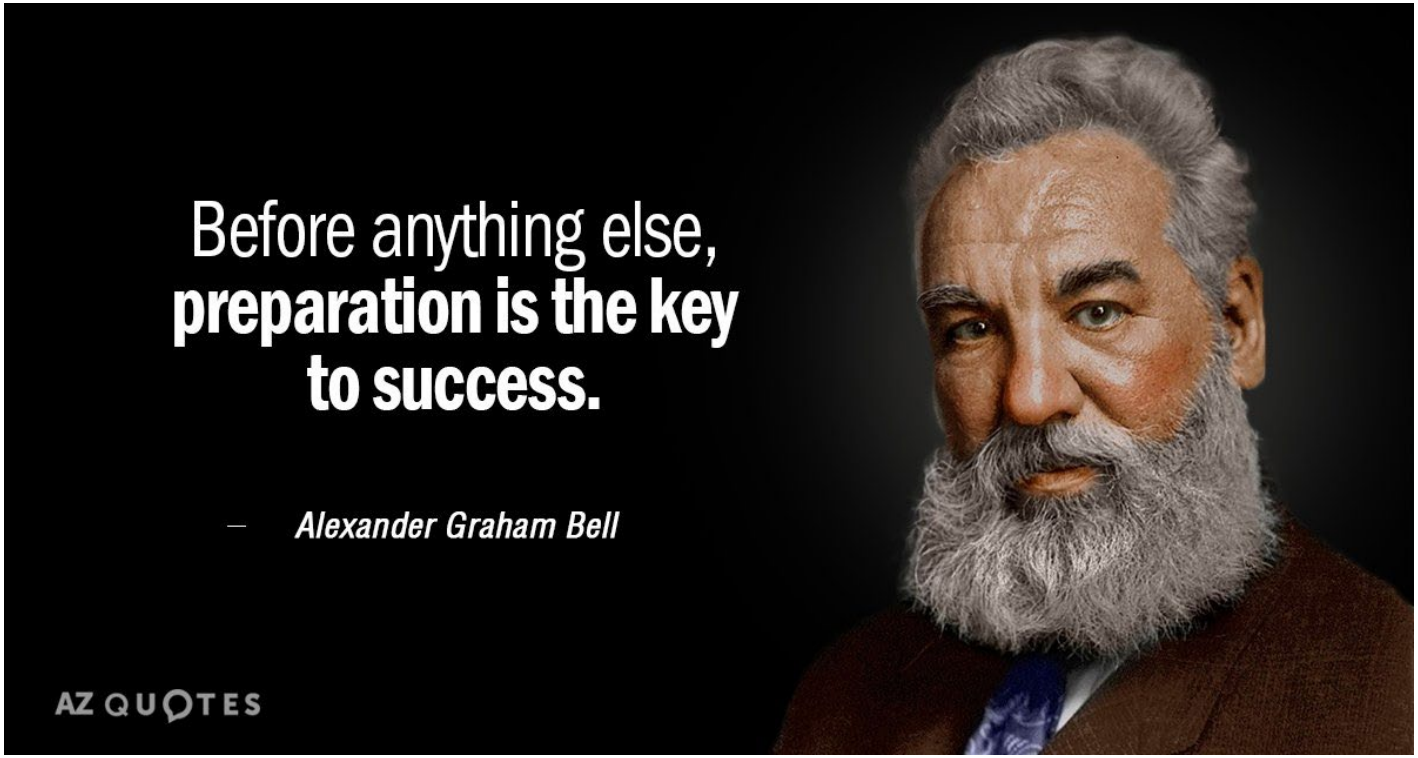
Before anything else,
preparation is the key
to success.
– Alexander Graham Bell
AZ QUOTES

Quality IH Data Requires Good Preparation

- A sound sampling strategy is critical to success
- Know how to use the sampling equipment
- Understand the limitations of the equipment and the data collected
- Allocate time to make observations during the sampling process
- Determine how the results of the sampling will be communicated to management and employees

Developing a Sampling Strategy-Sampling Considerations

- What is the goal of the sampling?
  - Compliance?
  - Evaluation of controls?
  - Identification of sources/exposure drivers?
- What should be sampled?
  - Have agents been well identified?
  - Do methods exists?
  - Are there specific tasks that should be assessed?
  - What criteria will be used for evaluating results?
- When should you sample?
  - Typical?
  - Worst case?
  - Unusual occurrences?
  - Seasonal variations?
- Who gets sampled?
  - Representative?
  - Concerned employees?
  - Cooperative employees?
- Who will do the sampling?
  - Does this person have adequate knowledge and proficiency?

What Criterion Will Be Used?

- There are many different Occupational Exposure Limits (OELs) to use for comparison
  - They are NOT all the same
  - Sampling methods or set-up of the sampling equipment may vary depending on the OEL used
  - Identify which OEL is appropriate for the exposures
- If taking compliance samples, read the applicable OSHA Standard(s)
  - Some expanded health standards specify the sampling methods, length of samples & selection of jobs to be sampled
  - Be aware that some State OSHA plans have PELs that are different than Federal OSHA PELs
- OELs apply to personal ***breathing zone*** samples
- OELs are for noise are especially confusing- there are 3 types

OEL Variations

- Regulatory vs. recommended
  - OSHA PELs are the regulatory limits
  - All others (NIOSH RELS, ACGIH TLVs, OARS WEELs, manufacturer's limits or other countries limits) are *recommended* limits in the US
- Time period the OEL applies to
  - TWA (Time Weighted Average)
  - STEL (Short Term Exposure Limit)
  - C (Ceiling)
  - These are NOT interchangeable numbers
- Chemical or physical form
  - Fume or dust
  - Particle size: "Total", respirable (R), inhalable (I) or thoracic (T)
  - Oxides
  - Solubility
  - Compounds
  - Valence state for metals

Step 1- Identify Substances

- Obtain *recent* SDSs to ID substances
  - Check Sections 3 & 8 for ingredients
  - Verify actual use of product when on-site
- Determine if there an OEL & sampling method for the substance(s)
  - Use the CAS# to ensure you get the right match
- If you are using a direct reading instrument, ID sensor interferences and check to see if they may be present in the workplace

What Can Go Wrong

- Find out that the
  - SDS doesn't match what is actually used
  - The substance is no longer used
  - The formulation has changed
  - End result= You may have the wrong sample media, pumps or sensor
- May overlook the presence of trace ingredients that have significant toxicity
- Misunderstanding of chemical names
- Increased costs due to
  - More/different analytes requiring analysis
  - Second visit to get it right

Step 2- Understand the Processes

- ID production/product variations that may impact exposures (if not familiar with the operations, check out the company website to see what is made)
- Determine how the substance becomes airborne
- What processes are used to make the product?
- Are byproduct(s) formed?
- Are there steps in process that may create short, but high, exposures?
- How often is the employee exposed to the substance, how long do the "episodes" last and when do the exposure occur?
- ID if there is confined or restricted space usage
- What cleaning methods are used during production and for housekeeping?
- How is the product packaged?
- Are there days or times of the month to avoid sampling?

Focus Points That May Impact Exposures

- Abrasive processes that create dust ⇧
- Aerosolization of liquids ⇧
- Dilutions ⇩
- Degree of automation ⇧ or ⇩
- Dry handling of solid materials ⇧
  - Container (especially bag) opening
  - Weighing
  - Scooping
  - Dumping/transfers
- Dry sweeping or brushing ⇧
- Heating of materials ⇧
- Indoor sources of combustion ⇧
- Manual mixing/blending/filling ⇧
- Use of compressed air ⇧

Common Examples of Where the Details Really Matter

Painting/Coating/Gluing Operations

- Multiple products are often used (primers, topcoats, catalysts/hardeners, gun flushes, wipe down solvents, thinners/reducers)
- Job shops and custom work often have more variations in substances used
- "Water" based and "low" VOC don't mean much from an IH standpoint
- Lab offered solvent scans may not include all of the solvents present in the products used
- High volatility solvents may necessitate lower sample volumes to prevent breakthrough or use of higher capacity sorbent tubes
- Method of application matters-passive samplers can get clogged up during spraying
- Use of respirators with hoods/helmets makes placement of sampling device complicated

Welding & Thermal Cutting

- The source of most welding fume is the wire or stick used-get the SDS for it
- The welding or cutting method can greatly impact the emissions generated
- Hexavalent chromium samples have to be collected separately from other metals
- Surface coatings can release additional hazardous chemicals

Step 2-What Can Go Wrong?

- You may have the wrong sample media, pumps or sensor for the way the substance is applied/used
- May not get a representative sample
- Production variations are a **major** reason exposures vary
  - You have to observe and understand the variations and determine if they impact the interpretation of results
- Significant exposures may be missed
  - Off-shift work is often ignored or misunderstood
- The sample time may not encompass high exposure tasks
  - Can easily happen with shifts longer than 8 hours
  - If doing short term samples, it is easy to miss the highest exposures unless you know **when** they occur

Step 3- Selecting People

- ID number of employees performing the task and potential variations in their tasks/procedures/controls
- Determine when exposures occur
- ID shift start & end times for each employee sampled
- Where do they work?
- Is PPE worn that may affect sampling procedures?

What Can Go Wrong

- The wrong employee is sampled
- Not enough employees are sampled
- Equipment may not handle cold weather if employees work outside in the winter
- Significant amount of sample time is missed because of shift start/end time "confusion"
  - Sample time is almost always lost at the beginning & end of the shift
  - If employees work remotely, in different buildings or are scattered across large areas, sample time can be lost (and time for observations may be reduced)
  - Opportunities to maximize sample time can be missed with staggered shifts
- PPE may interfere with placement of sampling equipment

Step 4- Selecting the Sampling Method(s)

- Consult lab/lab guides for the appropriate sampling method
- Obtain correct media and accessories
- Determine analyte compatibility if multiple analytes will be collected on a single collection device
- If using filters, determine if they are used open or closed faced or if size selective devices are needed
- If using passive samplers, determine if aerosolized material could clog up membrane-if so use an active sampling method
- Obtain correct sorbent tube holder
- Determine if the media creates a back pressure that exceeds the capability of the pump
- Determine if media has special storage requirements
- Obtain pumps and calibrators that fit the flow rate range(s) used
- Obtain correct diameter tubing to connect media/tube holder to the pump inlet
- Order **more media** than you need for errors, field blanks, multiple samples and surprises
- Obtain battery chargers or proper batteries

ANALYTE	SAMPLING MEDIA	REFERENCE METHOD	MIN VOLUME	MAX VOLUME	FLOW RATE	COMMENTS	COMPAT	CAS#
Acetic acid	6	OSHA ID-186SG IC	10	240	.2-.5	Ship on ice		64-19-7
Acetic anhydride	111	OSHA 102(GC)	3	7.5	0.05	Sample open faced, 1 month shelf life, ship on ice		108-24-7
Acetone	45	OSHA 69(GC)	1	3	0.05		A	67-64-1
Acetone	128	GC FID In-house					A	67-64-1
Acetonitrile	2	NIOSH 1500/1501(GC)	1	12	0.2	Submit as separate sample		75-05-8
Acetonitrile	128	GC FID In-house				Submit as separate sample		75-05-8
Acetophenone	8	OSHA PV 2003(GC)	1.5	12	0.1			98-86-2
Acid Mist Scan	6	OSHA ID-165SG(IC)	3	100	0.5	See Scan list in back of guide		
Acids(mineral)	6	NIOSH 7903(IC)	3	100	0.5			
Acrolein	10	OSHA 52(GC)	3	48	0.1	Sample for 24 L if also for formaldehyde. Ship on Ice.		107-02-8
Acrylamide	116	OSHA PV 2004(GC)	15	120	1			79-06-1
Acrylate Scan	112	OSHA 89(GC)	1.5	12	0.2	See Acrylate Scan list at back of guide.		
Acrylic acid	121	OSHA PV2005 (LC)	12	24	0.1	2 tubes in series		79-10-7
Acrylonitrile	1	OSHA 37/NIOSH 1604(GC)	7.5	20	0.2	Submit as separate sample		107-13-1
Adipic acid	4	HPLC In-house	10	100	0.2			124-04-9
Alcohol Scan	174	OSHA 100 (GC)	0.75	6	0.05	See Alcohol Scan list at back of guide.		
Aldehydes scan	138	EPA TO11A(HPLC)	15	500	0.5-1.5	Ship on ice. See Aldehyde scan list in back of guide		
Aldrin	4	OSHA 67(GC)	60	480	1		E1	309-00-2
Alkaline dust		Call lab for details		960		Call lab for details		
Allyl isothiocyanate	1	NIOSH 1500/1501(GC)	1	12	0.2	Submit as a separate sample		57-06-7
Aluminum	14	NIOSH 7303(ICP)	100	960	2			7429-90-5
Amine Scan						See Various Amine lists at back of guide.		

Step 4-What Can Go Wrong?

- You don't have the correct media or media processing items
- You can't connect the sample media or sorbent tube holder to the pump or calibrator
- You can't field calibrate if the device doesn't cover the flow range(s) needed
- Things will happen and if you don't have enough replacement media, then this opportunity to sample is gone
- If open faced samples are collected closed faced, actual exposures may be underestimated
- Membrane of passives samplers gets covered up
- The sample results cannot be compared to an exposure limit because the wrong sampling device is used
  - This is especially an issue with size selective sampling
  - Also an issue with noise sampling

Step 5- Select Appropriate Flow Rate & Sample Time

- Determine the flow rate needed
  - Lab guides/staff/published methods can provide the recommended flow rate and sample volume for the analytical method
  - Flow rate choice directly impacts sample volume & sample time
  - Some methods have flow rate ranges
  - **Size selective devices use a specific flow rate and should not be altered**
- Determine the sample volume needed
  - Flow rate (lpm) X sample time (minutes) = sample volume (liters)
  - The **minimum** sample volume is critical to get reasonable detection limits
  - The **maximum** sample volume is critical to prevent media overloading, bypass or inadequate derivatization
  - Volumes are based on exposures around the OEL so there is wiggle room within published flow rates & sample volumes but you *need to know* what you are doing to vary them

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Step 5-What Can Go Wrong?

- You don't have enough media to cover the shift
- The detection limit is above the OEL or Action Level making exposure judgments dicey
- Too much breakthrough on the sorbent tube or filter invalidating the sample
- Underestimate exposures when using treated media because chemical is not completely derivative
- Wasted time and money by having to do too many samples to cover a shift
- Using the wrong flow rate for size selective devices, invalidating the sample

Step 6- Tools & Calibration

- Useful tools to have tools on hand
  - Duct tape, painter's tape
  - Screwdriver/other tools to open, adjust or fix equipment
  - Timer/clock (adjust clock on equipment if coming from another time zone)
  - Alligator clips for tubing (holds tubing in place on employee)
  - Belts or vest
- Method of recording data (paper or electronic forms)
- Play with the equipment if you are not familiar with it
- Inspect equipment and media
- Prepare batteries
- Calibrate each piece of equipment before sampling
  - For pumps/media sampling, calibrate **with the media in line**
  - Some media require an adaptor to calibrate
  - Inspect equipment and tubing
  - Record calibration data
  - Plan for the time to do this

- Zero or clear stored data if necessary before sampling
- For noise dosimeters, make sure setting are correct

What Can Go Wrong

- Incomplete battery charging - shortened sample times
- Damaged media -leaks
- Unacceptable data because of calibration deficiencies
- Lack of electronic or paper documentation can come back to haunt you
- Exceeding memory capacity of instrument can lead to data truncation or to pump shut-off
- Problems on-site because you don't have good way for the employee to wear the equipment
- Shortened sample time trying to calibrate or fix problems if you wait until the last minute

Step 7- On-Site Equipment Placement

- Have the jobs (people) pre-identified but always ***be prepared*** to adjust-have a back-up plan if employee refuses to wear equipment or is absent
- Be prepared to show up at the shift start
- Explain to the employee what you are doing-keep it simple
- Collection device placement
  - In the breathing or hearing zone (use two tubing contact points)
  - OUTSIDE a respirator helmet or hood, preferably out of the air outflow
  - Under the welding helmet for welding fume samples
  - On the outermost layer of clothing (may change during shift)
  - Place area samples in safe, stable places
- Pump and tubing placement
  - Usually placed on waistband or in a vest pocket
  - Watch out for common reasons tubing kinks at pump inlet
    - Sit-down jobs (chairs or seats)
    - Air line/PAPR belts, fall protection
    - Weight

Pros of central location at shift start

- Likely quieter
- Can hook up a lot of people quickly
- Can explain process once to group

Pros of job –site location at shift start

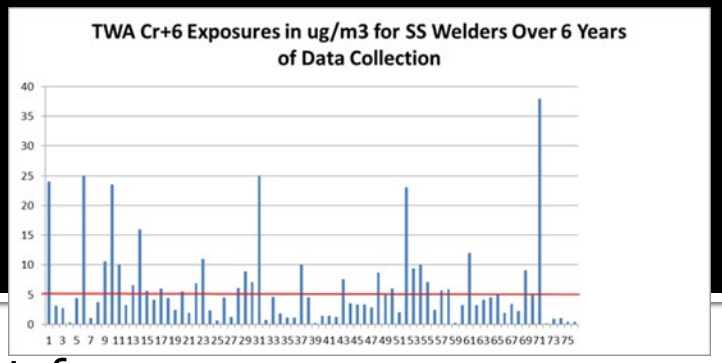
- Can see what PPE is used & work around/with it
- Can verify it's the correct job/person to sample

Step 7-What Can Go Wrong?

- **GPS or Bluetooth equipment capability is no substitute for doing observations**
- You miss sample time and perhaps important exposure because you don't want to get up early
- Employee thinks device is spying on them and takes it off or alters his/her behavior
- Collection device or microphone placement issues
  - Gets covered up by clothing, vests, PPE (e.g. protective suits, coats & jackets)
  - Tubing gets dislodged
  - Placement gets changed at breaks
- Pump flow faults when tubing gets kinked
  - Leads to loss of sampling time
  - Salvagability of sample depends on what is known about the flow faults
- Uncooperative employees may disrupt the sampling
- Employee gets annoyed by the equipment or tubing and takes it off
- Equipment /media falls off employee
- Area sample equipment gets damaged

Oops- this is what happens to a pump that falls off an employee and ends up in a foundry shakeout system!

Step 8- Observations



- Why?
  - Numbers without context are pretty useless
  - How can variability, sample representativeness and sample quality be explained without observational info/data?
- Plan to spend time observing
  - Each employee's tasks & work practices
  - Sampling equipment
  - PPE usage
  - Controls & environmental conditions
  - Process disruptions/unusual happenings
  - What happens to equipment at breaks
- Processes info
  - Parts made
  - Substances actually used
  - Frequency and length of use
  - Tools and equipment used
  - Production numbers/output
- Be prepared to deal with issues
  - Employee leaves for the day
    - Switch to another employee doing same job?
  - Sample device problems
    - Pump stoppages-some fixable, others not
    - Collection device covered up or moved
    - Tubing disconnects from pump
    - Media becomes overloaded and stops pump
    - Damaged tubing
    - Damaged sample media (sparks from high energy hot processed & abrasive blasting can be wreck filters)
    - Filter gets put on backwards after falling off

Step 9- Post Sampling

- Inspect media and equipment
- If applicable, download data from noise dosimeters or direct reading instruments
  - Use significant digits and/or accuracy range of instrument
- Post calibrate sample pumps and media
- Prepare a field blank & submit with samples
- Calculate sample volumes based on sample length and average flow rate
  - Use significant digits
- Complete chain of custody/ lab submission forms
  - Be sure to designate the chemical and physical form of the analyte (see slide 4)-its not the lab's job to figure this out
- Ship samples observing any special handling requirements

Step 10- Interpreting Results

- Review lab reports to determine if there are any laboratory notes about the samples
- If applicable, calculate TWAs
  - Use significant digits
- Compare results to the applicable OELs
  - Match the OEL to the substance sampled and time frame of the sample
- Before making exposure judgments……
  - Review observational data to determine what the results actually represent and if there were events that may have impacted the sample results
  - Identify data limitations and whether they impact the results
- Communicate results to management and if applicable, to employees

Step 10-What Can Go Wrong?

- Calculating TWAs incorrectly
  - For samples less than 480 minutes, zero exposure is assumed for the non-sampled time.
  - This can significantly underestimate the actual exposures and should ONLY be done if you know that there was a high chance the exposure really was "zero"
- **Comparing the results to the wrong OELs** (see slide 4 for areas of pitfalls)
- Wrong comparisons for noise data
  - OSHA Hearing Conservation (Action Level) comparisons: 5 dB exchange rate, 80 dB threshold, 90 dBA criterion level
  - OSHA PEL comparisons: 5 dB exchange rate, 90 dBA threshold, 90 dBA criterion level
  - ACGIH/NIOSH REL comparisons: 3 dB exchange rate, 80 dBA threshold, 85 dBA criterion level
  - All use slow setting of instrument
- Not acknowledging the limitations of the data
- Relying on one set of data to make broad judgments about the exposures

Summary

- Set aside adequate time for prep work, set-up, observations, take-down, sample prep and interpretation of results
- Prepare a good sampling strategy that will give you quality, representative data
- Verify information provided to you
- Become very familiar with how to do the sampling so you look like an "expert"
- Always calibrate the equipment
- MAKE OBSERVATIONS, MAKE OBSERVATIONS, MAKE OBSERVATIONS
- Document sampling info & process/employee info
- Identify the limitations of the data
- Don't overinterpret the numbers
- Expect variations in exposure data
- Be respectful of the employees and make the process as comfortable for them as you can

Thank You!

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