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1800 Engineered Safety Work Planning and Controls and HF Delivery System

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Organic Material Science

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What I will discuss today

- What is Engineered Safety & Work planning and controls?
- Our ES WP&C process in center 1800 at SNL
- The Kintek Hydrofluoric Acid vapor delivery system
 - What is it?
 - What are the primary hazards associated with an HF vapor delivery system
 - Engineered Safety
- How we have documented the ES WP&C
- Questions

What Is ES WP&C?

- Purpose of ES WP&C is to provide the safest conditions and environment to perform hazardous activity level work (ALW)
- Critical thinking about safety and unacceptable outcomes is embedded in our process.
- Optimizing our process while incorporating the new features key to Engineered Safety requirements and Culture Change:
 - Work Planner Safety Theme (Why is this work safe)
 - Hazard Category (no longer Rigor level)
 - Decision Maker Narrative (Why does management accept the risk of performing this work)
 - Bundling like types of hazardous activities, **When appropriate**

The ES WP&C Process

- Work Planner Safety Theme - work planners get in a room together and have a thoughtful discussion around safety and risks associated with the ALW.
- Bundling of like hazardous activity, **when appropriate**, does the following:
 - 1) more efficient process, 250 ALW docs → 110 docs
 - 2) raises awareness within the Center regarding capabilities and collaboration opportunities
 - 3) Eliminates redundant overlap

These two items alone are the beginning of the “Culture Change” we are aiming for in 1800.

Things that we think about.....

- 1800 MOWs are independent entities doing lots of similar *and* dissimilar work.
- We have many students
- Trouble shooting can easily become off-normal ALW events
- Fire Safety, IH, etc., offer advice, Management is the decision maker
- Using equipment for purposes for which it was not designed
- By being “safer”, are we introducing new hazards?
- Our general lab Center OPs cover a lot
- Cynicism and its impact on safety and safety culture
- Rabbit hole mentality and safety – e.g. Sandia is in a flight path, how do we mitigate this failure mode?

Group Critical Thinking is KEY to success.

HF Vapor Delivery System

- What makes this ALW unique?
 - System uses 1 mL of anhydrous HF, delivers up to 50 ppm of HF
 - HF vapor used to expose samples using mixture of commercial and home built equipment
 - unattended operation
 - continuous operation

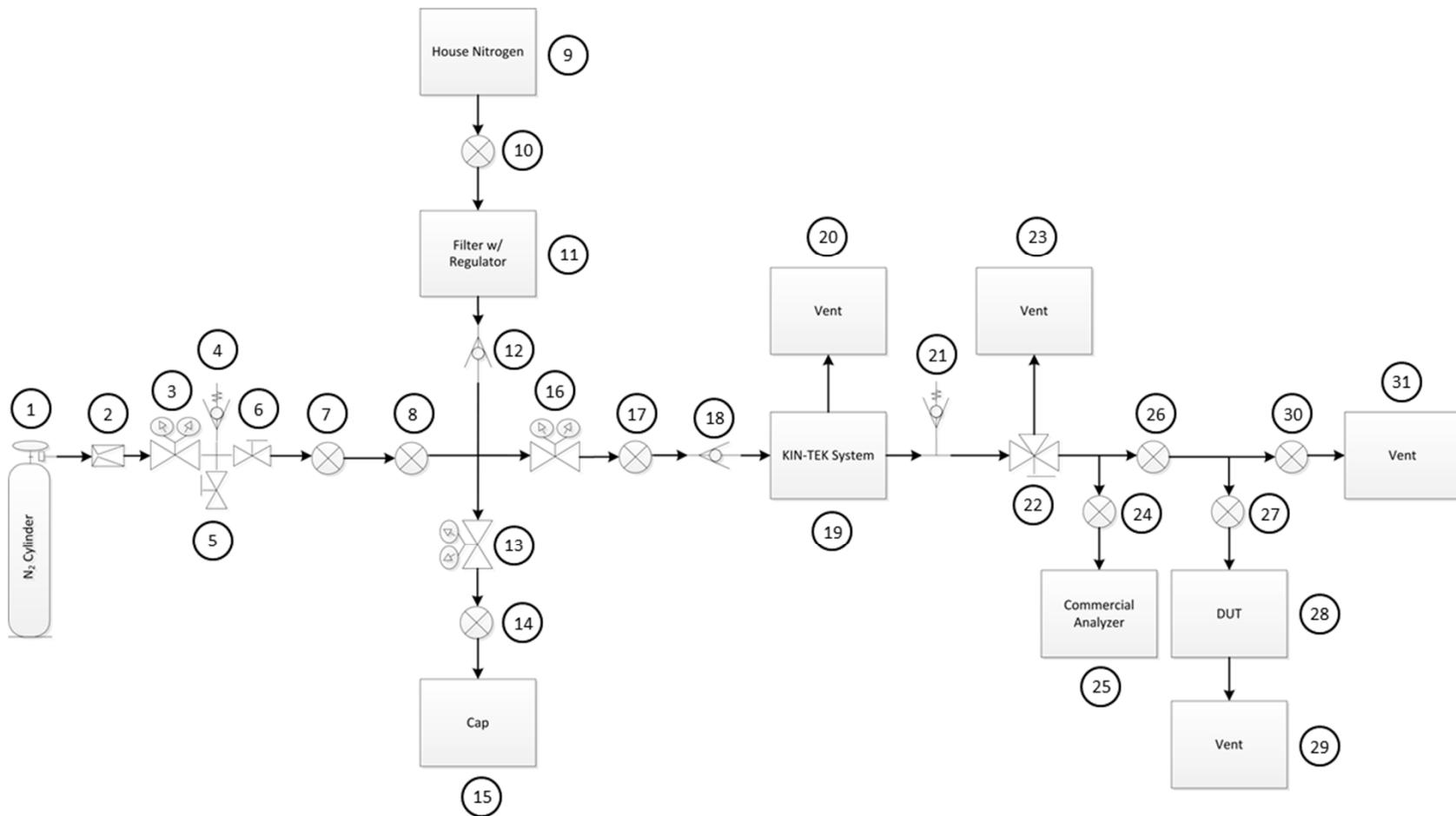
Hazard Category = Industrial Moderate = Director Approval

Potential for significant on-site impacts to co-located workers or the environment

HF Delivery System Image



HF Delivery System Flow Diagram



Primary Hazards

- HF spill, HF contact, or HF inhalation hazard which can result in death if not treated.
- Over pressurization of system



HF rapidly penetrates skin, interrupts nerve function, and can cause cardiac arrest. Pain may only be noticeable hours later after exposure.

Engineered Safety of HF System

- Cypher lock combination required to access lab.
- Work conducted in fume hood, training required, OPs, proper signage, and PPE.
- If fume hood ventilation fails, alarm system triggers EOD to call 4 MOWs and management – positively tested.
- If power outage in Bldg. 701, back-up generator provides power to ventilation after approximately 20 seconds.
- Two independent ventilation fans in Bldg. 701, if one fails, system operates at approximately 60% flow.
- System uses 1 mL of anhydrous HF in plastic permeation tube – nominally not breakable.
- Maximum of 50 ppm HF vapor delivery, controlled by Kintek system, over-temperature control, 2 redundant flow regulators.
- Calcium gluconate immediately available if HF contact occurs. 10

Engineered Safety of HF System

- 2 person rule implemented when handling HF permeation tube.
- Leak checks of system (without HF) before operation and during scheduled maintenance intervals.
- Storage of HF permeation tubes in secondary plastic containment and in corrosive cabinets.
- Any unreacted or excess HF vapor is trapped in magnesium sulfate traps – verified HF escapes of <1ppm.
- Magnesium sulfate present if spill occurs.
- PSDP for system and overpressure controls.
- All waste disposed of as HF hazardous waste in plastic containers with secondary containment.

How is this all documented?

Activity Title:	HF Vapor Delivery System - KIN-TEK
Work Planner/Org:	Patrick Finnegan/1835
Work site (Bldg./Rm):	701/3329

Roles and Responsibilities

TASK NUMBER	TASK DESCRIPTION	ASSIGNED TO:
1	Prepare Safety Theme	Work Planner ES&H Coordinator
2	Define work scope and work environment	Work Planner ES&H Coordinator
3	Determine Accident Consequence	Work Planner ES&H Coordinator
4	Define Operating Envelope	Work Planner
5	Review Lessons Learned	Work Planner
6	1st Decision Point- <i>Accept Work</i> ; review work scope and operating envelope documentation	Decision Maker
7	Prepare Job Safety Analysis	Work Planner ES&H Coordinator
8	Document areas of additional consideration	ES&H Coordinator
9	Document additional unallowable outcomes (if any)	Decision Maker
10	2nd Decision Point- <i>Approve work</i> ; narrator on addressing the criteria for the system design	Decision Maker
11	3rd Decision Point- <i>Authorize Work</i> ; perform necessary verification activities on the final system design	Decision Maker
12	Document new Lessons Learned	Work Planner
13	Provide WP&C forms to matrixed worker's line management (if applicable)	Work Planner

Questions?