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# 1800 Engineered Safety Work Planning and Controls and HF Delivery System

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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

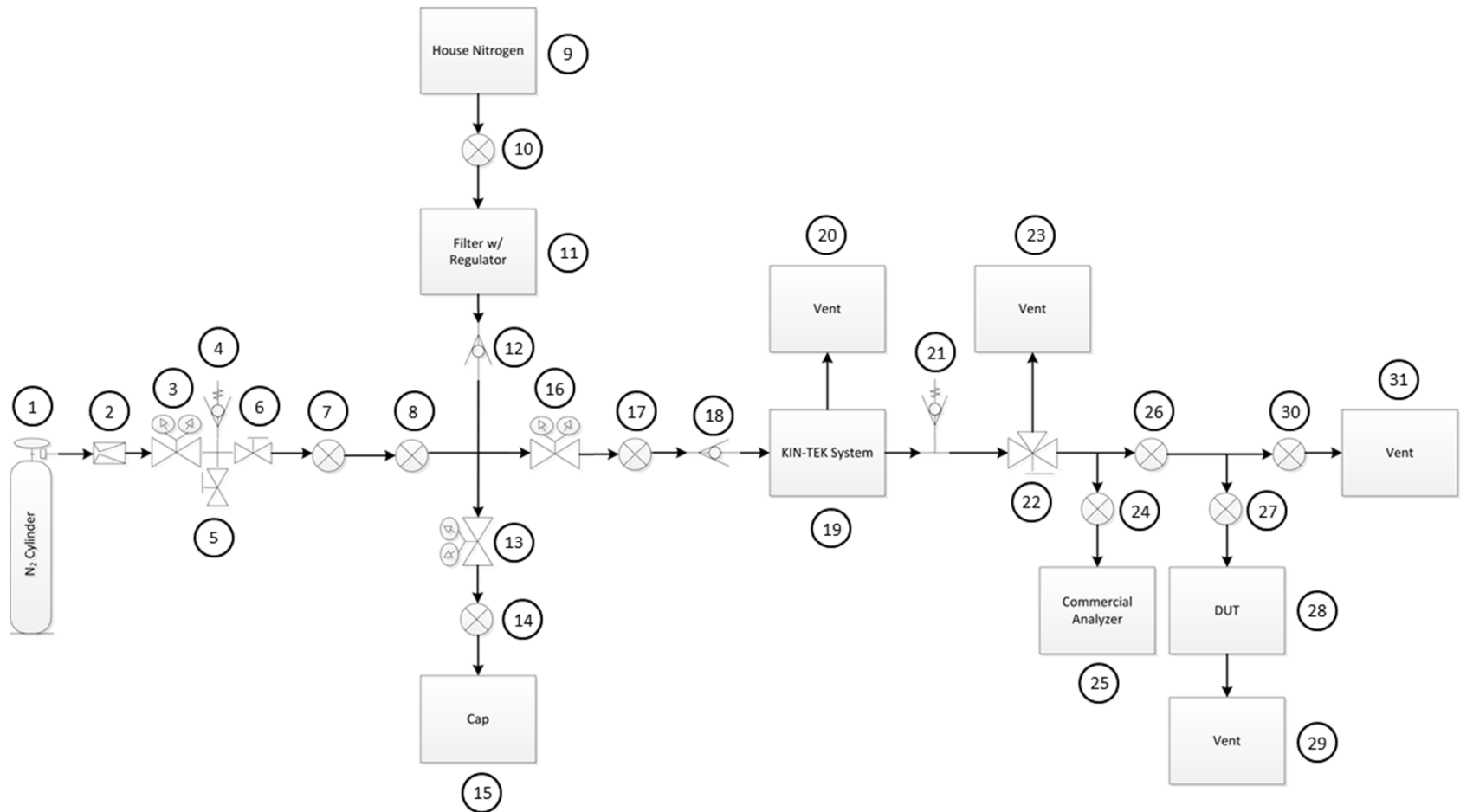
Hazard Category = Industrial Moderate = Director Approval

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

# HF Delivery System Image



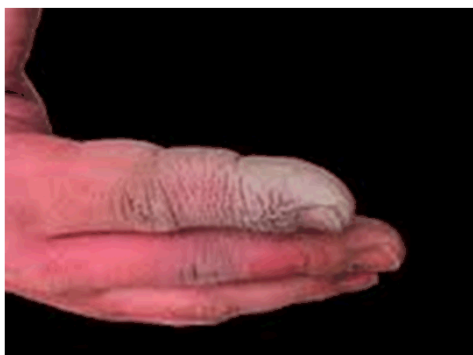
# HF Delivery System Flow Diagram





# 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.

# 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<br>ES&H Coordinator |
| 2           | Define work scope and work environment   | Work Planner<br>ES&H Coordinator |
| 3           | Determine Accident Consequence   | Work Planner<br>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<br>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?