



Creating an Effective Plant Operating Plan

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- **National Institute of Environmental Health Sciences**
- **Research Institute of the National Institutes of Health**
- **Mission of the NIEHS is to discover how the environment affects people in order to promote healthier lives.**
- **Conducts basic research on environmental health and environment-related diseases**

NIEHS Central Utility Plant

- **Serves NIEHS campus as well as US EPA Research Facility co-located on the campus**
- **Generate and distribute HTHW for heating, temperature control and process uses**
- **Generate and distribute Chilled Water cooling, dehumidification and process cooling**
- **Distribute electricity to campus**

Fresh Look

- **New Ownership, New Management led to looking at how we can do that which we do so well even better**
- **When reviewing Operations, we felt that we could improve how we organize our approach to SOPs**
- **Management had previous experience managing SOPs for a system covered by OSHA Process Safety Management regulations**

Bhopal India - Catastrophe

- **On Dec. 3, 1984, a leak of 1,000's of pounds of a toxic gas (methyl isocyanate) from a Union Carbide plant in Bhopal India caused:**
 - **The death of up to 10,000 people within 3 days**
 - **The subsequent death of over 15,000 additional victims**
 - **Over 100,000 with chronic disease**



Photo of the Union Carbide Factory Site at Bhopal by Raghu Rai.

Bhopal India - Catastrophe

- **Following the Bhopal disaster Congress directed OSHA to regulate industries that could have chemical related accidents**



OSHA Process Safety Management

- **Regulations that apply to processes that involve Highly Hazardous Chemicals**
- **Intended to prevent uncontrolled emissions, fire, or explosion of highly hazardous chemicals, that presents serious danger to employees in the workplace**
- **Imposes rigorous requirements on the maintenance and operations of these processes**

14 Elements of OSHA Process Safety Management Program (PSM)

- Process Safety Information
- Process Hazard Analysis
- Operating Procedures
- Contractors
- Mechanical Integrity
- Hot Work
- Management of Change
- Incident Investigation
- Compliance Audits
- Trade Secrets
- Employee Participation
- Pre-startup Safety Review
- Emergency Planning and Response
- Training

Elements of PSM Applied to Central Utility Plant Management by NVT

- **Operating Procedures**
- **Employee Participation**
- **Training**

Element 1 – Operating Procedures

- **PSM Defines:**
 - **Which SOPs are required for each process or system**
 - **What information should be included in the SOPs**

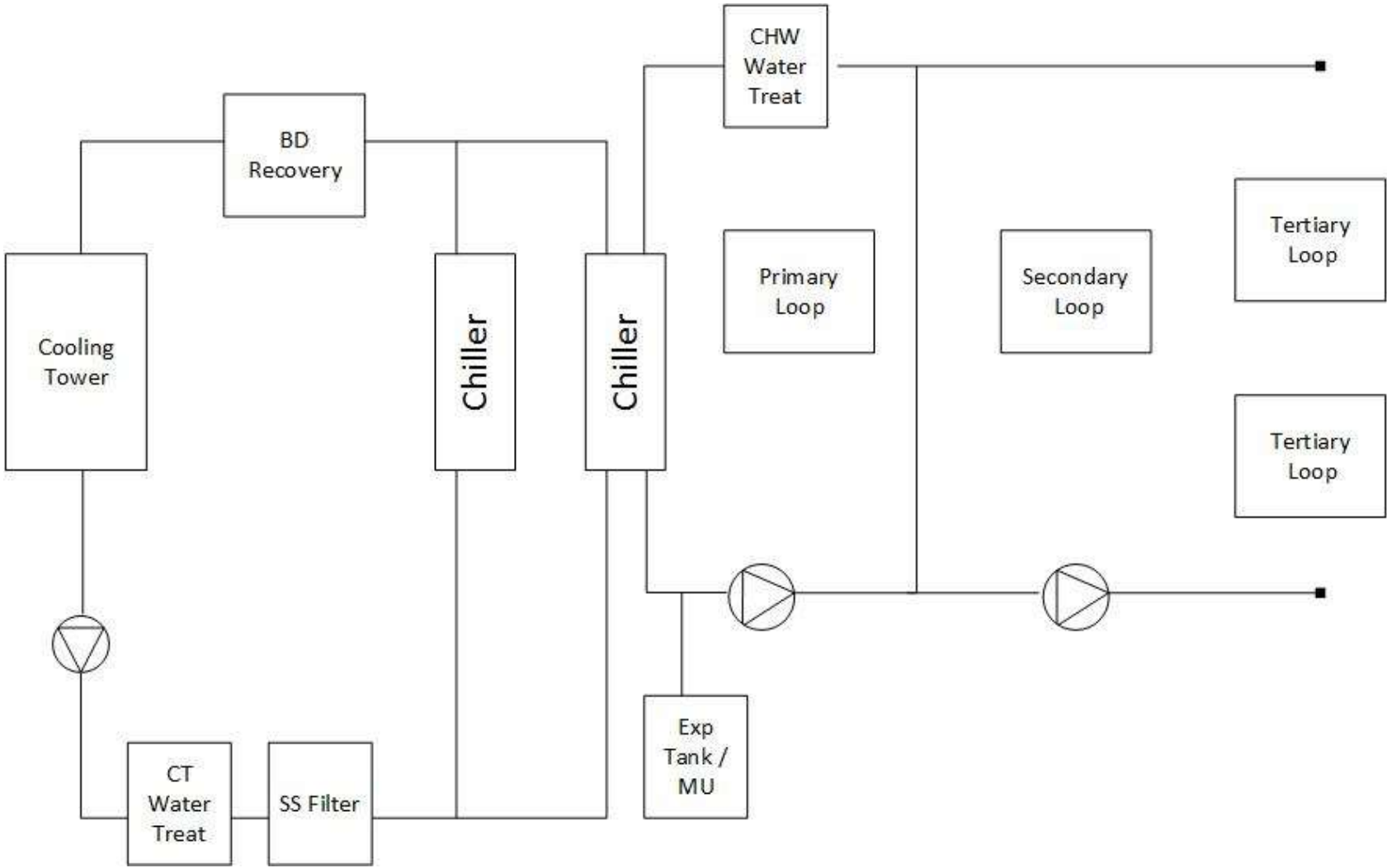
Required Standard Operating Procedure (SOP) Content

OSHA PSM / NVT Standards	Examples
Quantify Operating Limits	<i>"Fill until the level indicator reaches 5/8 or 300 gallons....."</i>
Include Safety and health considerations	<i>"Personnel performing chemical fill must wear appropriate PPE(polyvinyl chloride (PVC) gloves, tyvek coveralls, goggles and face shield) and"</i>
Safety systems and their functions	<i>"Ensure fill personnel are aware that Tank has high level switch with horn and strobe that activate on overflow."</i>

Required Standard Operating Procedures

OSHA PSM	NVT Standards
initial startup	initial startup
normal operations	normal operations
normal shutdown	normal shutdown
emergency shutdown	others as required
emergency operations	(standard applied to each system and sub system)
startup after a emergency shutdown	

Chilled Water System Overview



Chilled Water System – Subsystems

- **Cooling Tower (CT)**
- **CT Water Treatment**
- **CT Pumps**
- **Side Stream Filtration**
- **Blowdown Recovery**
- **Chillers**
- **Primary CHW Loop**
- **Secondary CHW Loop**
- **Expansion Tank**
- **CHW Water Treatment**

CHW System SOPs (Part 1)

1	Chilled Water System – Start Up	8	CT Water Conductivity Test
2	Chilled Water System – Shutdown	9	CT Water pH Test
3	Chilled Water System – Normal Operation	10	CT Water Corrosion Inhibitor Test
4	Cooling Tower – Start Up	11	CT Water Legionella Sample
5	Cooling Tower – Shutdown	12	CT Water Biological Test
6	Cooling Tower – Normal Operation	13	CT Pumps – Start Up
7	CT Water Treatment - Normal Operation	14	CT Pumps – Shutdown

CHW System SOPs (Part 2)

15	CT Pumps – Normal Operation	22	Chiller 1 – Start Up
16	Side Stream Filtration – Start Up	23	Chiller 1 – Shutdown
17	Side Stream Filtration – Shutdown	24	Chiller 1 – Normal Operation
18	Side Stream Filtration – Normal Operation	25	Chiller 2 – Start Up
19	Blowdown Recovery System – Start Up	26	Chiller 2 – Shutdown
20	Blowdown Recovery System – Shutdown	27	Chiller 2 – Normal Operation
21	Blowdown Recovery System – Normal Operation	28	Primary CHW Loop – Start Up

CHW System SOPs (Part 3)

29	Primary CHW Loop – Shutdown	35	Expansion Tank – Shutdown
30	Primary CHW Loop – Normal Operation	36	Expansion Tank – Normal Operation
31	Secondary CHW Loop – Start Up	37	CHW Water Treatment - Normal Operation
32	Secondary CHW Loop – Shutdown	38	CHW Water Conductivity Test
33	Secondary CHW Loop – Normal Operation	39	CHW Water pH Test
34	Expansion Tank – Start Up		

So at this point we have.....

- **Written 39 SOP's that describe how to operate each System and major Subsystem**
- **Ensured that each SOP defines Operating Limits, Safety Hazards and Safety Systems for the system**

Element 2 – Employee Involvement

- **PSM Specifies:**
 - **Employees have a lot of knowledge about the processes they work on and they play key roles in making sure that process operation is conducted safely.**
 - **Employers must have a written plan of action for employee participation in process safety management.**

NVT Employee Participation

- **NVT relies on participation from our Operators to:**
 - **Identify the “other” SOPs that need to be included in our Operating Plan**
 - **Write SOPs using the format we have adopted**
 - **Validate that our SOPs are correct, easy to understand and accessible**

Training

- **Initial training on SOP's at hire. Training and demonstration by supervisor or senior Operator.**
- **After 90 days of hire, employee must demonstrate proficiency in each SOP**
- **Each operator will review each SOP annually and certify that they agree SOP is correct and they understand how to perform.**
- **Supervisor will randomly choose at least 5 SOPs to have each Operator demonstrate their proficiency annually.**

Annual Updates to SOP

- **Feedback from Operators regarding potential changes to specific SOPs will be reviewed by Supervisor and management.**
- **Changes that are confirmed to be technically correct will be made to the SOPs.**
- **Operators will review all new and modified SOPs.**

Current Status

- **NVT is in process of applying these elements to our SOPs for the Chilled Water Systems**
- **Implementation will then extend to our operation of the:**
 - **High Temperature Hot Water Systems**
 - **Waste Incineration Systems**
 - **Electrical Distribution System**

Conclusion

- **A systematic approach to creating and managing Standard Operating Procedures will ensure we have accurate procedures with which to operate the plant in a safe, reliable and efficient manner**
- **Employee Participation the process will result in more accurate procedures**
- **On going SOP training and reviews will keep our Operators skills sharp**

For more information

- www.nvttech.com
- www.niehs.nih.gov
- www.emgcorp.com