SAND2011-2894C

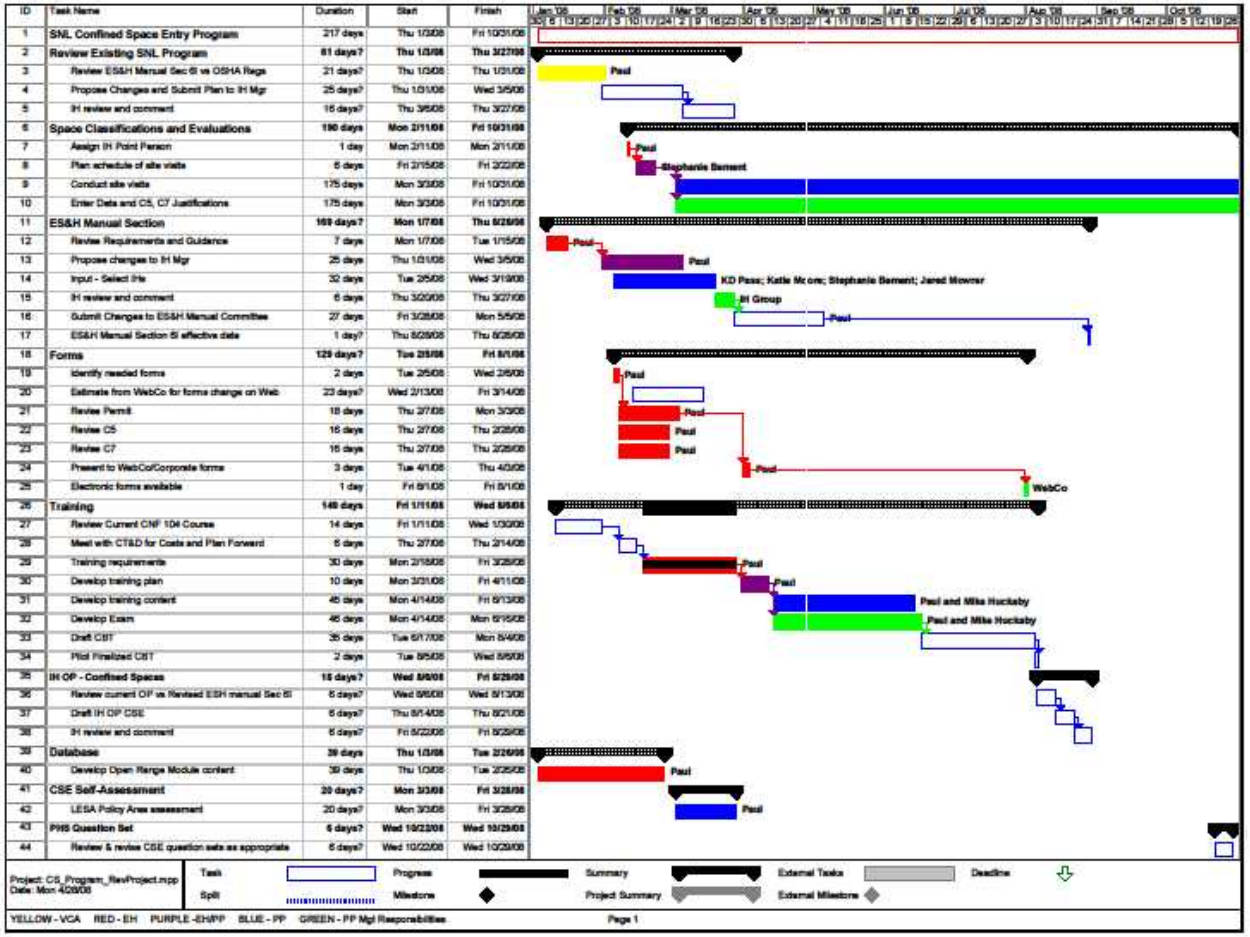
Interpreting the "Regulatory Framework" of OSHA's Confined Space Standard for Development of a Confined Space Program at a DOE Facility

New Mexico Chapter ASSE Professional Development Conference May 2 – 4, 2011

Paul Giering, MS, CIH
Industrial Hygienist
Sandia National Laboratories
Albuquerque, NM

Sandia National Laboratories is a multi-program laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin company, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Where to Begin?!



ID	Task Name	Duration	Start	Finish
1	SNL Confined Space Entry Program	217 days	Thu 1/3/08	Fri 10/31/08
2	Review Existing SNL Program	61 days?	Thu 1/3/08	Thu 3/27/08
3	Review ES&H Manual Sec 6I vs OSHA Regs	21 days?	Thu 1/3/08	Thu 1/31/08
4	Propose Changes and Submit Plan to IH Mgr	25 days?	Thu 1/31/08	Wed 3/5/08
5	IH review and comment	15 days?	Thu 3/6/08	Thu 3/27/08
6	Space Classifications and Evaluations	190 days	Mon 2/11/08	Fri 10/31/08
7	Assign IH Point Person	1 day	Mon 2/11/08	Mon 2/11/08
8	Plan schedule of site visits	5 days	Fri 2/15/08	Fri 3/22/08
9	Conduct site visits	175 days	Mon 3/3/08	Fri 10/31/08
10	Enter Data and C5, C7 Justifications	175 days	Mon 3/3/08	Fri 10/31/08
11	ES&H Manual Section	169 days?	Mon 1/7/08	Thu 8/28/08
12	Review Requirements and Guidance	7 days	Mon 1/7/08	Tue 1/15/08
13	Propose changes to IH Mgr	25 days	Thu 1/31/08	Wed 3/5/08
14	Input - Select IHs	32 days	Tue 2/5/08	Wed 3/19/08
15	IH review and comment	5 days	Thu 3/20/08	Thu 3/27/08
16	Submit Changes to ES&H Manual Committee	27 days	Fri 3/28/08	Mon 5/5/08
17	ES&H Manual Section 6I effective date	1 day?	Thu 8/28/08	Thu 8/28/08
18	Forms	129 days?	Tue 2/5/08	Fri 8/1/08
19	Identify needed forms	2 days	Tue 2/5/08	Wed 2/6/08
20	Estimate from WebCo for forms change on Web	23 days?	Wed 2/13/08	Fri 3/14/08
21	Review Permit	15 days	Thu 2/7/08	Mon 3/3/08
22	Review C5	15 days	Thu 2/7/08	Thu 2/28/08
23	Review C7	15 days	Thu 2/7/08	Thu 2/28/08
24	Present to WebCo/Corporate forms	3 days	Tue 4/1/08	Thu 4/3/08
25	Electronic forms available	1 day	Fri 8/1/08	Fri 8/1/08
26	Training	148 days	Fri 1/11/08	Wed 8/6/08
27	Review Current CNF 104 Course	14 days	Fri 1/11/08	Wed 1/30/08
28	Meet with CT&D for Costs and Plan Forward	5 days	Thu 2/7/08	Thu 2/14/08
29	Training requirements	30 days	Mon 2/18/08	Fri 3/28/08
30	Develop training plan	10 days	Mon 3/31/08	Fri 4/11/08
31	Develop training content	45 days	Mon 4/14/08	Fri 6/13/08
32	Develop Exam	46 days	Mon 4/14/08	Mon 6/16/08
33	Draft CBT	35 days	Tue 6/17/08	Mon 8/4/08
34	Pilot Finalized CBT	2 days	Tue 8/5/08	Wed 8/6/08
35	IH OP - Confined Spaces	15 days?	Wed 8/6/08	Fri 8/29/08
36	Review current OP vs Revised ESH manual Sec 6I	5 days?	Wed 8/6/08	Wed 8/13/08
37	Draft IH OP CSE	5 days?	Thu 8/14/08	Thu 8/21/08
38	IH review and comment	5 days?	Fri 8/22/08	Fri 8/29/08
39	Database	39 days	Thu 1/3/08	Tue 2/26/08
40	Develop Open Range Module content	39 days	Thu 1/3/08	Tue 2/26/08
41	CSE Self-Assessment	20 days?	Mon 3/3/08	Fri 3/28/08
42	LESA Policy Area assessment	20 days?	Mon 3/3/08	Fri 3/28/08
43	PHS Question Set	6 days?	Wed 10/22/08	Wed 10/29/08
44	Review & revise CSE question sets as appropriate	6 days?	Wed 10/22/08	Wed 10/29/08

Sandia National Laboratories

Regulatory Drivers

OSHA

- **29 CFR 1910.146 *Permit-required confined space entry* (January 14, 1993)**
- **29 CFR 1910.147 *The control of hazardous energy* (September 1, 1989)**

DOE

- **10 CFR Part 851 – *Worker Safety and Health Program* (February 9, 2006)**

Sandia National Laboratories

Sources for Information – OSHA/NIOSH

- Preamble to the Federal Register – Final Rule
- OSHA Compliance Directives – CPLs
  - CPL 02-00-100 Application of the PRCS Standard (‘95)
  - CPL 02-00-147 The Control of Hazardous Energy – Enforcement Policy and Inspection Procedures (‘08)
- OSHA Letters of Interpretation
- NIOSH “Alerts”, “Criteria Documents”, “Surveillance and Investigative Findings”
- NIOSH Documentation for Immediately Dangerous to Life or Health Concentrations (IDLH)

Sources for Information - DOE

- Preamble to the Federal Register – Final Rule
- IMPLEMENTATION GUIDE for use with 10 CFR PART 851 WORKER SAFETY AND HEALTH PROGRAM
- DOE Lessons Learned Program
- DOE Operating Experience Summaries
- DOE (Confined Space) Guidance Card

Sources for Information – Other

- **ANSI/ASSE Z117.1-2009 *Safety Requirements for Confined Spaces***
- **American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs)**
- **U.S. Chemical Safety Board – Reports and videos**
- **Texts on Confined Spaces:**
  - **"Complete Confined Spaces Handbook" (Rekus)**
  - **"Safety and Health in Confined Spaces" (McManus)**
- **Industry or organizations**

What is a Confined Space?

"Housing officials ask students and their families to remember that they will be occupying confined spaces…"

Student Move-In Day Means Major Activity at University of California, Riverside

Campus Gears Up for Arrival of More Than 3,100 Students to Residence Halls

(Highlander September 13, 2003)

Sandia National Laboratories

Confined Space Definition

- **“confined space” means an enclosure, usually having limited means of access or egress, or both, and poor natural ventilation, which may contain hazardous contaminants or be oxygen deficient, including but not limited to a storage tank, process tank, tank car, boiler, duct, sewer, tunnel, pipeline, pit or tube;**

Sandia National Laboratories

Evaluate the Workplace

Is it a confined space?

- ***"No"*** **does not mean there is a lack of hazards, they must be addressed differently**
- ***"Yes"*** **does not mean there are hazards**

If it is a confined space and there are hazards, are they serious?

Confined Space is…

1. Large enough and so configured that a worker can bodily enter and perform assigned work;

and…

1. Has limited or restricted means for entry or exit;

and…

3. Is not designed (unsuitable) for continuous employee occupancy

1. Can You Bodily Enter and Perform Work?

- **A space that cannot be entered is not a confined space…**

- ***"Small" spaces* do not meet the definition of a "confined space"…**
  - **Nor do they pose hazards comparable to those associated with confined spaces**
  - **Since a worker cannot totally enter such spaces, there should be no difficulty withdrawing from the space**

Sandia National Laboratories

2. Limited Means of Access and Egress?

- Doorways and other portals a worker can walk through are not to be considered limited means for entry or exit
- However, a space containing such a door or portal may still be deemed a confined space if an entrant's ability to escape in an emergency would be hindered
  - High door sill or structural/equipment to step over?
  - Hanging pipes or conduit to duck under?
  - Is it a “Standard” door opening?
  - Ladder or stairs?

Sandia National Laboratories

3. Unsuitability for Continuous Employee Occupancy?

- **What is the space *designed for*?**
  - **If the space is truly designed for human occupancy, then primary function of space not relevant**
    - **Vented communications vaults**
    - **Sewer lift stations**
- **Some spaces considered confined spaces while being manufactured – classification based upon when worker would enter, not ultimate use of space**
  - **M-1 Tank during fabrication (and cleaning with Freon™) is a confined space [General Dynamics Land Systems Div 15 OSHRC 1275, Sept 11, 1991]**
  - **Manned space capsules –Apollo, Soyuz?**

Sandia National Laboratories

Is the Confined Space Permit-required?

- **Contains or has the potential to contain a *hazardous atmosphere, and/or…***
- **Contains a material that has a potential for *engulfing the entrant, and/or…***
- **Contains *inwardly converging walls or a floor that slopes downward and tapers to a small cross-section* where an entrant could be trapped or asphyxiated, and/or…**
- **Contains any other *recognized serious safety or health hazard***

Sandia National Laboratories

Hazardous Atmosphere

1. Flammable gas, vapor, or mist in excess of 10 percent of the lower flammable limit (LFL),
2. Airborne combustible dust at a concentration > LFL,
3. Atmospheric oxygen concentration that is less than 19.5 percent or greater than 23.5 percent,
4. Atmospheric concentration of any substance that could result in worker exposure above the pertinent dose limit or permissible exposure limit (acute effect only), or
5. Any other atmospheric condition recognized as immediately dangerous to life or health (IDLH):

IDLH Values and Ability to Escape

IDLH Values based on health effects considerations may be above level of:

- **Oxygen deficiency (< 19.5%) – gases**
  - Carbon dioxide (40,000 ppm)
  - Trifluorobromomethane (40,000 ppm)
- **Lower Explosive Limit (> 10%LEL) – flammable gases or vapors**
  - Acetone 2,500 ppm (10%LEL)
  - Ethyl acetate 2,000 ppm (10%LEL)
  - n-pentane 1,500 ppm (10%LEL)
- **Reduced visibility - particulate concentration**?
  - Portland cement (5,000 mg/m^3)
  - Titanium dioxide (5,000 mg/m^3)

Engulfment Hazards

…the *surrounding and effective capture* (gaining control by force) of a worker by a liquid or finely divided (flowable) solid substance that:

- can be aspirated to cause death by filling or plugging the respiratory system or
- that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Sandia National Laboratories

Entrapment Hazards

A worker that falls and becomes *entrapped* due to a small cross sectional area in a permit required confined space could:

- **die due to *'compression asphyxiation'*;**
- **become dehydrated; or**
- **if they suffered a serious cut, they could bleed to death**

Sandia National Laboratories

Recognized Serious Safety or Health Hazards

- Steam, noise, electricity, and moving parts of machinery
- Capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to health effects
- Determination of whether the resulting exposure to a hazard in a confined space will impair the worker's ability to perform self-rescue is the aspect that must be addressed

Non-Permit Confined Space

- ... a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm
- Examples of non-permit confined spaces include:
  - vented vaults,
  - motor control cabinets, and
  - dropped ceilings
- Although they are "confined spaces", these spaces have either natural or permanent mechanical ventilation to prevent the accumulation of a hazardous atmosphere, and they do not present engulfment or other serious hazards

Post Sign or Other "Equally Effective Means"

- ***"Equally effective means"***: **A method, other than signs, that informs workers of the presence of a confined space(s) and may include:**
  - **additional training,**
  - **locked entry cover or panel, or**
  - **an access door that can only be opened with special tools**
- **Alternative methods, *at least as effective as signs*, warning all workers who could reasonably be expected to enter the space knowingly or unknowingly**

SNL Confined Space Signs

Sandia National Laboratories

Entry Options

- **Alternate Procedures – C5**
- **Reclassification – C7**

Sandia National Laboratories

C5 Alternate Procedures

- Absence of non-atmospheric hazards and that the ventilation (continuous forced air ventilation) will keep the air inside the permit space safe for entry
- This should include initial data in the form of:
  - Volume of the space to be entered;
  - Capacity and configuration of the ventilation equipment to be used;
  - Identified atmospheric hazards and potential hazards;
  - Sampling results from routine testing of the space from the time ventilating has begun through final determination of acceptable entry conditions; and
  - Atmospheric hazards created by work in the space

Continuous Forced Air Ventilation

- Delivery system or device that provides positive pressure for the space where entrants are working
- Conditions that must be met:
  1. No employee may enter the permit space until the forced air ventilation has eliminated any hazardous atmosphere found within the space
  2. Ventilation must be directed to ventilate the immediate areas where an entrant is or will be present within the space and must continue until all entrants have left the space
  3. Air supply for ventilation must be from a clean source and must not increase hazards in the space

C7 Reclassification

- **Permit space reclassified as a non-permit confined space if there are no actual or potential atmospheric hazards and if all other hazards within the space are *eliminated without entry into the space***
- **The reclassification would be valid as long as the non-atmospheric hazards remain eliminated**

Sandia National Laboratories

OSHA CPL 02-00-147

- **The Control of Hazardous Energy – Enforcement Policy and Inspection Procedures (2/11/08)**

  Chapter 3 Inspection Guidance, C. 2. Relationship between the *Control of hazardous energy (LOTO) standard* and the *Permit-required confined spaces (PRCS), 29 CFR §1910.146, standard (pg 3-10)*

- **When other standards require LOTO procedural and training provisions [1910.147(a)(3)(i)]**

Sandia National Laboratories

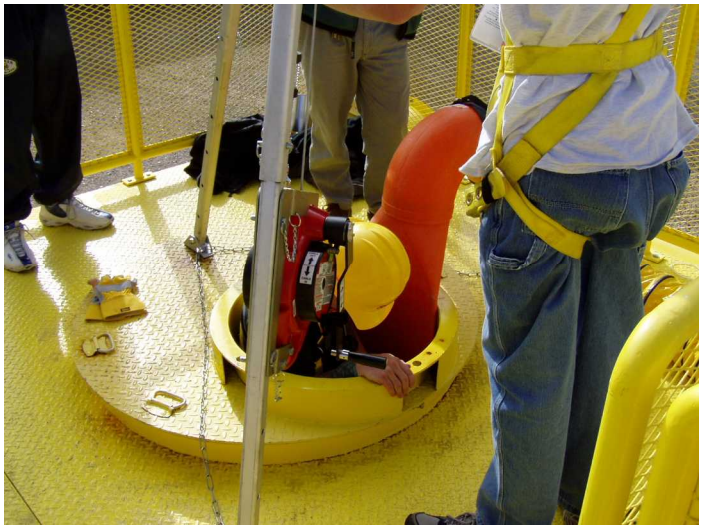
Hazard Control vs. Hazard Isolation

"Isolation": permit space removed from service and completely protected against release of energy and material into the space by such means as:

- ***Electromechanical hazards*** – isolated by LOTO, or guarded
  - **Lockout /tagout of all sources of energy;** and/or
  - **Blocking or disconnecting all mechanical linkages**
- ***Flowable material hazards*** steam, flammable gases, flammable and combustible liquids effectively isolated only by:
  - **blanking or blinding;** or
  - **misaligning or removing sections of lines, pipes, or ducts;** or
  - **a double block and bleed system** utilizes closure of two valves, opening of a bleeder valve, and application of LOTO devices

Training

- Understanding, knowledge, and skills necessary for safe performance
- “Refresher” or “Follow-up” training



Sandia National Laboratories

Rescue

- "Rescue Service"
- Employer's evaluation
  - Initial
  - Performance
- Annual rescue practice
- Non-entry rescue vs. Rescue

Sandia National Laboratories

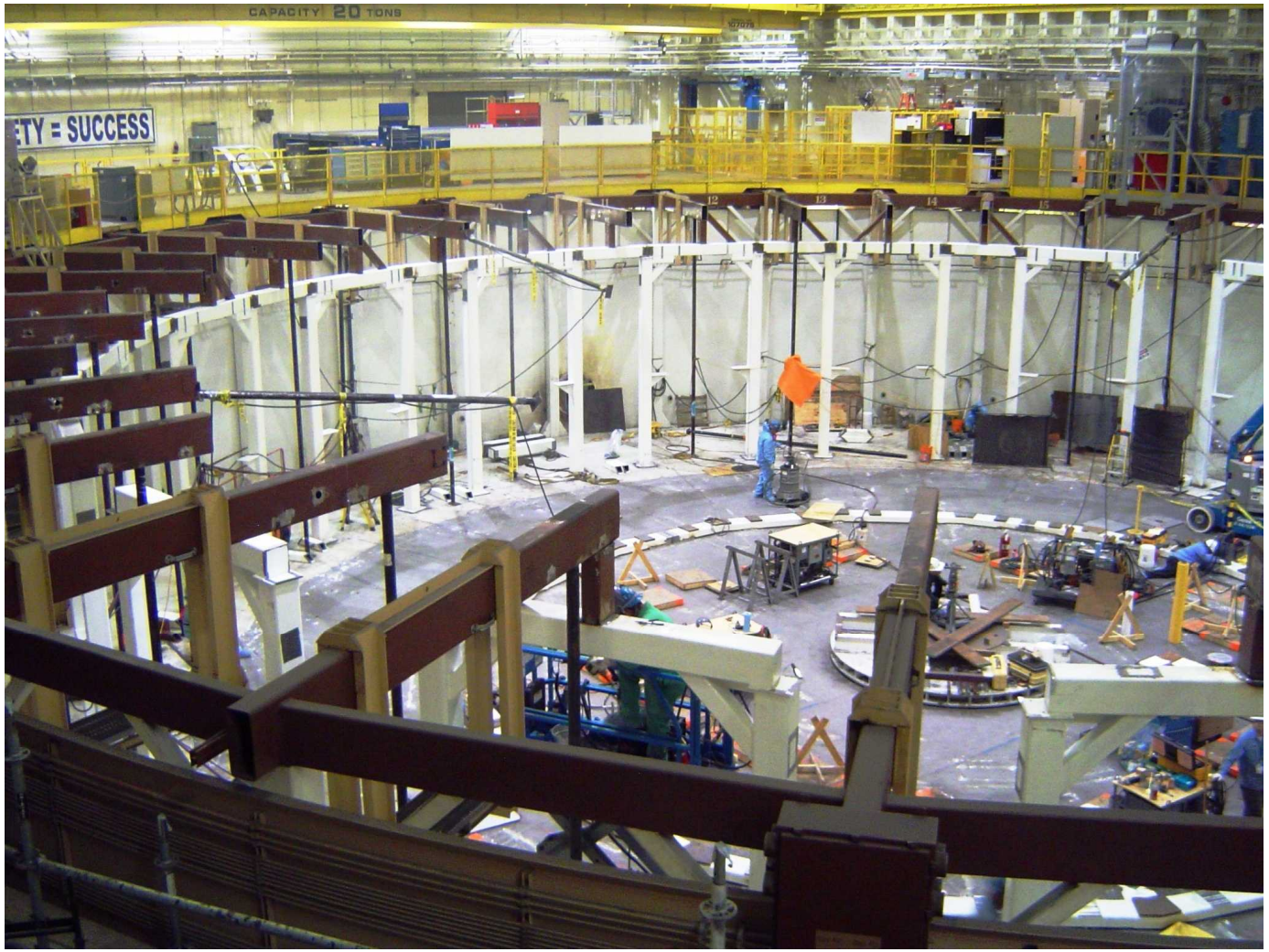
Recordkeeping

- Written permit space program
- Cancelled permits
- Written certifications
  - C5 Alternate procedures?
  - C7 Reclassification?
- Training certifications
  - Authorizing supervisor, Attendant, Entrant
  - Rescuers

SNL LNG Burn Test

Sandia National Laboratories

Z Machine Refurbishment



Sandia National Laboratories

Severe Accident Phenomena/Analysis (Surtsey)

Sandia National Laboratories