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Ethical Issues Concerning Confined Spaces

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In March of 2008, the author became the EHS Manager for a large construction project. Due to a number of constraints, the project has a subfloor area, or "Level Zero," which is very large, and has multiple lines, equipment placements, and other obstructions in it. Workers need to work in Level Zero, but there are no provisions for movement there. This paper will explore the ethical implications of EHS in an environment that started out as a construction site, and will end up as a manufacturing plant. The construction code, CFR1926.21-23, has one set of requirements for construction workers who enter these spaces, and the general industry code, CFR1910.146, has quite another. When the two types of workforces meet, and when even the permit-required confined spaces code does not protect workers, then there are ethical issues to deal with. This paper explores these issues and the shortcomings of both the construction code and general industry when addressing confined spaces hazards.

Introduction

In the spring of 2008, the author took a new job as the Manager of Environmental Health and Safety for a construction engineering company, which had contracted with a large overseas fabrication company to convert a computer fab into a solar panel manufacturing facility. He took the job when the safety administrator suffered some health problems, and would be gone for a period (approximately two months). He subsequently returned, and all discussion in this paper was developed jointly with him and the EHS representative of the parent, XXXX company.

During the first week on the job, he became aware of an area of the building known as Level Zero, or the subfab area. The building had originally been built by a Japanese manufacturing company to build computer chips, but just before it was completed, the company announced that they would not occupy it, and were abandoning the project. The company had built this building to the exact specifications as an identical building in Japan, the story goes, and that "copy exact" requirement meant that they built the subfab exactly is it was built in Japan. But in Japan, apparently, they had water table restrictions concerning how deep they could build the subfloor, and so from the top of the main floor to the subfloor was about 7 feet. But all of the structure to support the floor was below this height, and therefore the real height of the Level Zero area for walking purposes varied from about four and a half feet to five feet. When the original floor was made, it was made of removable tile with holes in it for air flow. But to convert the flooring for use as a different manufacturing plant, with much heavier machinery, the flooring was deemed inadequate, and was replaced with a four-inch thick concrete and steel floor, reinforced with rebar.

Early in the project, before the flooring was replaced, Oregon OSHA was brought in for a consultation concerning the Level Zero space. It was declared not to be a confined space, as the floor had air going through it, there were no introduced atmospheric hazards, and the floor tiles were removable throughout the area. Even so, the parent company put together a "Level O Entry Procedure," which declared that while the space was not a confined space, testing of the atmosphere needed to be accomplished prior to entry and air monitors needed to be used during work in the Level Zero area. (We later standardized on "Level Zero" or "Subfab" terminology to describe the space.)

To give a clear view of what this space is like, imagine a space about two football fields in area, end to end. This is the equivalent of what we had there. The parent firm had contracted with another company, both from Germany, to complete the construction. But this company was not familiar with Oregon and USA rules and laws concerning construction, the environment, and occupational safety and health. So they had contracted the author's company to do much of the engineering and the safety and health program for the contract workers who would be on the site.

When the author arrived, he went down to Level Zero, and felt that this was indeed a permit-required confined space. He therefore began looking at the procedure that was being used, and felt that the space could no longer be deemed "not a confined space." Level Zero qualified in several categories:

- It was large enough to enter and perform work;
- It had limited access and egress; and
- It was not designed for continuous occupancy.

In order to be classified as a permit-required confined space, it had to have one or more of the following: engulfment hazard, configuration hazard (for suffocation), atmospheric hazard, or "other recognized hazards." Level Zero did not have an engulfment hazard, nor did it have a configuration hazard. But it did have welding occurring in the space, and it did have other recognized hazards. The other recognized hazards included severe head-butting hazards, mitigated by use of a hard hat; the requirement to climb over structures that had been placed in the area (no provision was made for human locomotion in the Level Zero—there are no walking corridors, for instance). In the near future, there would be chemical lines becoming active in the Level Zero area, which could become hazardous if the chemical leaked. Also, there were inert gas lines in Level Zero, including a 2.5 inch nitrogen line at a pressure of 125 psig, and the possibility of argon lines as well. On the other side of the equation, our engineers had looked at the amount of air in Level Zero; one of the three areas held 40,357 square feet; a second, 47,510 square feet; and the third, 32,980 square feet of area. Combining two of those areas, there were 615,000 cubic feet of air, and, in the other area, 230,800 cubic feet of air. Any contaminant would have to be there in large amounts to have more than a local effect.


Photos 1 & 2. Level Zero shown with some work being accomplished there.


Photos 3 and 4. The difficulty moving around is shown, and the large opening to the outside air was provided in two areas on the north side of Level Zero.

Because of the very large volume of air, even with no perceivable air movement, there was a large reservoir of air into which a contaminant could evolve without going over TLV limits, except at the source of the pollution. There was some potential for air flow, through openings to the outside (the floor was no longer porous) on the north side of the building.

Analysis of the Situation

In the author's mind, this was indeed a permit-required confined space. Welding and other processes were introducing hazards into the space, and they needed to be addressed. So he made up a form to formally declassify the space from permit-required to a simple confined space, by having the contractors certify that they would not introduce atmospheric hazards, or if they did, that they would mitigate them. He presented these forms to a "white board" meeting of the contractor representatives, and was promptly told that these conditions were not ones the contractors would abide by. They would not sign off on declassifying the space. They also felt that if we were to classify it a permit-required confined space, they could not operate as they would not be able to use rescue teams, etc. They did not understand the concept of declassifying the space, and the author did not understand the special circumstances that construction workers have concerning confined spaces.

This situation made the author re-look at confined spaces as it pertained to construction workers. From further research, he determined that the permit-required confined spaces code did not apply to construction workers, and a call to Oregon OSHA's Technical Section quickly confirmed this finding. Oregon OSHA did say that the permit-required confined spaces provisions in 1910.146 were "highly recommended" for construction workers though. He needed to regroup, and in the process, wrote the following e-mail to his supervisor:

> Last week we had a contractor's hazardous atmosphere alarm ("oxygen" alarm) go off, and the individuals evacuated from the Level Zero area of XXXXXXXX. Since that time, I have been further defining the issues of confined spaces at XXXXXXXX. I have talked with a number of our people, and with some of the contractors we are using. XXXXX and I have also been into the Level Zero area on Friday, and noted the lack of air movement there.
>
> XXXXXXXXXX has insisted that the Level Zero area is not a confined space. However, it now meets all the Oregon OSHA criteria for a confined space. This is a relatively recent change, due to the changes in the flooring (see below). I am working through the definition, and gave XXXXX a number of materials on it on Friday. There are a number of things that we need to further define, but here are several recent developments which have contributed to the situation:
>
> - The new flooring, of cement and rebar, has replaced the former flooring of clean room style tiles. The older tiles allowed air to move easily from the space above into the Level Zero. Now, that flooring has been replaced by an impenetrable (for air movement) concrete floor.
> - The fans for the Level Zero area are not adequate for moving a lot of air out of the Level Zero area.
> - Outside openings, which could be opened in the north side, are not opened right now.
> - Several of the access points have been replaced by concrete flooring.
> - The trench on the north side has been closed off for fall protection reasons with plywood, again preventing more air movement. We may be opening this up soon, but it is scheduled to be completely covered as the trench is closed up during construction.
> - Underneath, no provisions have been made for personnel movement (walkways, passages, etc.). Therefore, when down people need to crawl over structure to get to work areas. This is causing a lot of access/egress problems, and complicates potential rescue options.
>
> Because of the above, we need to work through to solutions to the confined space issues. There are several things that can be done, and this will be a major focus of my efforts next week. But I wanted you to be aware of this situation in more than just the Incident Log entries.
>
> John

It was at this time that the author perceived an ethical dilemma. The construction workers did not have the same rules to work under the general industry workers, but they were working in the same space. The federal OSHA website even stated that general industry and construction workers operating in the same space would be under different rules.

While there are specific provisions in general industry code for permit-required confined spaces, in construction there was only a very vague training requirement for confined spaces (see Appendix I). Construction workers were very reluctant to declassify a space because they did not know what other construction crews working in the same space would be doing, nor could they control the others.

Further, there could be no monitor above and line into Level Zero, as there was no way to move someone who had collapsed out of Level Zero without causing a lot of harm, and potentially death, to that person using a lifeline system envisioned in the permit-required rules. Level Zero was more like an "industrial cavern" than a permit-required confined space like a tank. Pulling someone out of that would be pulling him/her out through tubes and around piping that would literally tear him or her apart.

How does a health and safety professional function in this environment? First, further define the problem. What really are the main issues? How can hazards be remedied? A complete inventory of hazards was made for Level Zero, and other hazards for the rest of the building also. A joint safety walkthrough with the safety representatives of all the contractors was conducted, and several Level Zero hazards were uncovered. Here are the two results that led to changes:

Date	Event	I x	U =	S	Status	Issues	Recommendations
6-10-08	Level Zero confined spaces issues.	4	2	8	~~Open~~ Closed	Nitrogen and argon has been hooked up, and is available in ¾ inch pipes in the subfab Level Zero areas. Contractors were informed and this was discussed with contractors and XXXX.	XXXX XXXXX has said that these are locked out. Need to confirm. Jcr 6-16-08 I checked, talked with XXXX, and the line is not locked out at the tank or outside. 'Called XXXX, and he said he walked it yesterday, and it is locked out inside the building. We will discuss it later this afternoon. Jcr 6-18-08
6-18-08	XXX workers in Level Zero without O2 monitor or signing in.	4	2	8	~~Open~~ Closed	By not signing in, we will not know whether they are out in an emergency. Also, by not wearing an oxygen monitor, they will not know if the atmosphere changes and they need to get out.	I talked with _____ , and gave him our monitor several days ago. Today, his people did not have it in one area, so _____ took it to them. I also printed off and gave _____ the Level Zero procedure and 21copies of the sign-in sheets to use. XXX no longer in Level Zero, and are now XXXX contractors.

Table 1. Safety Survey with Prioritization Using the ANSI/AIHA Z10-2005 Risk Assessment Matrix (see Appendix II)**.**

The two above incidents were assigned a Risk Assessment Matrix number of "8," or "Serious, High Priority Remedial Action" required. That meant that we needed to take measures immediately to remedy the situations. For the nitrogen and argon line issues, the author walked these lines with the EHS person for the firm, traced where they entered the building, and where they went. The argon line did not go into the Level Zero area, but stayed outside. The nitrogen line was another story, though. It went into Level Zero a number of feet, but was a solid stainless steel pipe with a welded-on cap. It extended about twenty feet into the Level Zero area, but not in an area with much activity. After walking the line, the author was satisfied that this was not a significant hazard to Level Zero.

There were weekly meetings with the safety representatives of the contractors. In the meeting from 3-25-08, the following items were brought up:

Item	Topic	Initiator
1	Confined spaces—XXX indicated that the recent incident was caused by a faulty reading on their sensor. The monitor had drift. But, the area is sometimes hazy, with a definite odor. The central area has XXXX painting in the future.	JCR
2	Level Zero floor—no fire watch when there is welding above. XXXX stated that there needed to be fire watch, blankets, etc. This was addressed in the 2:00 PM White Board meeting.	XXXX
3	No air flow in the Level Zero—need to get more flow	XXXX

Table 2. Document the content of the meeting (as necessary beyond the scope of the agenda), decisions made, etc.

The last item was of great concern, as there were some hazards being introduced. The Level Zero policy (see Appendix III) was re-written to state specifically that the space was considered a confined space, and that all the precautions were necessary during this period when construction was on-going. With these measures, we were confident that these hazards could be mitigated. The faulty air monitor caused concern initially, but then was sent to the manufacturer and determined to be malfunctioning.

The ethical question concerned why there was this double standard, and how to deal with a situation that did not match either the intent of the construction code (training, with some particular rules concerning welding, for confined spaces) or the extremely intrusive problem of implementing permit-required confined spaces policy in the area. The EHS person for XXXX Company was prepared to go to a permit-required confined space situation when a chemical was introduced. But what needed to be done in the meantime? The main issues of the N_2 and argon lines turned out not to be a significant risk. But at one point, the author actually considered resigning rather than presiding over a workplace headed for what appeared to be a potential tragedy. Rescue in the area would be complicated, and while the author asked to bring the fire department into the area for a look-see, the EHS person decided he would wait until his own Emergency Response Team (ERT) was established. But even then, the ERT would not do confined space rescues, as that was not in their training. In order to sort this out, the author

consulted the ASSE and AIHA/ABIH Codes of Professional Conduct.[i] The AIHA/ABIH Member Ethical Issues document has the following statement:

> C. In order to satisfy organizational policies and legal requirements concerning public health and safety, members should:
>
> Follow appropriate health and safety procedures in the course of performing professional work to protect clients, employers, employees, and the public from conditions where injury and damage are reasonably foreseeable.
>
> ***Inform appropriate management representatives and/or governmental bodies of violations of legal and regulatory requirements when obligated or otherwise clearly appropriate.***
>
> ***Make reasonable efforts to ensure that the results of industrial hygiene assessments are communicated to exposed populations.***[ii]

(Emphasis added by the author.)

The Board of the Certified Safety Professional (BCSP) had a statement which was very useful in making these determinations:

> This code sets forth the code of ethics and professional standards to be observed by holders of documents of certification conferred by the Board of Certified Safety Professionals. Certificants shall, in their professional safety activities, sustain and advance the integrity, honor, and prestige of the safety profession by adherence to these standards.

Standards

> ***Hold paramount the safety and health of people, the protection of the environment and protection of property in the performance of professional duties and exercise their obligation to advise employers, clients, employees, the public, and appropriate authorities of danger and unacceptable risks to people, the environment, or property.***
>
> 2. Be honest, fair, and impartial; act with responsibility and integrity. Adhere to high standards of ethical conduct with balanced care for the interests of the public, employers, clients, employees, colleagues and the profession. Avoid all conduct or practice that is likely to discredit the profession or deceive the public.
>
> Issue public statements only in an objective and truthful manner and only when founded upon knowledge of the facts and competence in the subject matter…[iii]

(Emphasis added by the author.)

The author looked at these statements, and satisfied himself that the team had done all they could to inform the managements of the three companies of the problems, inform the employees, train the employees in the contractor orientations, and mitigated as thoroughly as possible the hazards of the Level Zero space.

At this point, all parties were working hard to provide a safe and healthful environment under very trying circumstances for all of the workforce at the facility, including contractors, tool vendors (who were hooking up tools), and employees of the three companies. There was no reason to take these issues to other authorities such as OSHA, although, at one point, it was a

consideration, before we came to some agreement about how we needed to proceed. This must be in the back of the mind of any occupational health and safety professional when dealing with situations which, in his or her professional judgment, must be mitigated but there are roadblocks thrown up by management. Such was not, thankfully, the case here.

In the author's mind, resolving these issues concerning Level Zero was important, as he would be gone for a week to Tulane University in New Orleans, LA, for a week-long Air Sampling and Analysis Laboratory class. At one point, he nearly did not go to these classes when, a week prior to departure, these issues still remained unresolved.

Upon returning from his Tulane University class, the author noted that the conditions in Level Zero, and throughout the fab, were changing for the better almost daily. The tools were being installed; floor coatings completed (which had been a concern, as they were epoxies, and turned out to be water-based instead of solvent-based so the breathing hazard was much reduced); the trenches became air ducts for balancing the clean room environments; and production started in the fab. The reason this helped immensely is that, with the balancing of the air handlers for the clean room, air was being diverted down what used to be "trenches" and were now air ducts into the Level Zero area. Level Zero went from virtual dead-air space to a vital part of the building air re-circulating system, just as it was designed to do. The author asked his company's engineers to provide air flow design parameters for Level Zero, and they produced the following table:

Space	**Area (SF)**	**Volume (Cubic feet)***	**Air Flow (CFM)****	**Recirculated Air Changes per Hour**
Area 1	23,920	239,200	56,200	14.1
Area 2	26,460	264,600	15,000	3.4
Area 3	13,290	132,900	11,772	5.3
Area 4	56,570	565,700	191,740	20.3
Area 5	16,830	168,300	259,200	92.4
*Volume assumes Level 0 height of ten feet.				
**These values are from air flow diagrams and the ventilation schedule. The values are air circulation rates, and not fresh air rates.				

Table 3. Air Changes for Level O

There was actually a safety factor built in, as the height of Level Zero was not ten feet, but at most seven feet. This would change the number of air changes to a greater number, as the cubic feet in the area would be smaller. For example, Area 2 would have 4.9 air changes per hour instead of 3.4 (264,600 × 0.70 = 185,220; 15000 cfm × 60 m/hr = 900,000 cf/hour; 900,000 / 185,220 = 4.9).

Because of these changes, and the fact that vendors were now doing tool installs and not construction work (the major construction activities were winding down), the parent company's EHS person decided it was time to declare these spaces permit-required confined spaces, and go through a declassification process like the one the author had tried to initiate several months prior. In the construction meeting we had to announce these changes, we got the same rhetoric, with the

construction workers saying that they could not function in this manner. But this time, rather than simply give in, we listened to them, and were persistent in saying that the change was occurring. We had rolled out the declassification form, but several of the questions were a problem to the contractors. So we met with them, and changed the questions to ones that they could live with.

This new policy and procedure is being implemented as this paper is being written. The contractors have decided not to fight it, because it simply does make sense. We have decided not to require the air monitors on their person anymore, but an initial test is still required. We have wrapped the security personnel into the new Level Zero procedure (which we can now do, as they are now here 24/7 instead of 6 AM to 6 PM), and they will be monitoring the numbers and locations of these people in Level Zero. If they don't get a confirmation that the people our out at the designated time, they will call the responsible person to ensure that the people are out (see Appendix V for the specifics of the procedure and policy).

This shows that, with patience, planning, good communications, and a bit of luck, changes in the workplace can be successfully completed. But it also takes a lot of hard work to document the hazards, work through to achieve true mitigation of those hazards, and keep the cooperation of all parties involved.

This also raises questions about confined spaces as they currently stand in the U.S. under OSHA. Construction does not come under the permit-required rules, partly because of the unique types of activities that occur under construction, but also in part because no one has decided to work through these problems. The author's understanding is that there is a movement nationally in OSHA, and in some state plans such as Oregon's, to include construction workers into the confined spaces rules. But that did not help this particular situation, and it must be assumed that nothing will happen in this regard for at least a year while the elections are occurring.

Finally, this whole sequence of events shows the value of understanding the ethical constraints under which health and safety personnel should operate. The documents provided by AIHA and the BCSP are valuable for providing guidance in these situations, but the health and safety professionals need to be familiar with them, and use them.

Appendix I General Safety and Health Provisions C

§1926.21 Safety Training and Education.
General requirements. The Secretary shall, pursuant to section 107(f) of the Act, establish and supervise programs for the education and training of employers and employees in the recognition, avoidance and prevention of unsafe conditions in employments covered by the act.

Employer responsibility.
The employer should avail himself of the safety and health training programs the Secretary provides.

The employer shall instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury.
Oregon Administrative Rules
Oregon Occupational Safety
and Health Division

1926.21(b)(3) C-3 1926.23
Employees required to handle or use poisons, caustics, and other harmful substances shall be instructed regarding the safe handling and use, and be made aware of the potential hazards, personal hygiene, and personal protective measures required.

In job site areas where harmful plants or animals are present, employees who may be exposed shall be instructed regarding the potential hazards, and how to avoid injury, and the first aid procedures to be used in the event of injury.

Employees required to handle or use flammable liquids, gases, or toxic materials shall be instructed in the safe handling and use of these materials and made aware of the specific requirements contained in Subparts D, F, and other applicable subparts of this part.

(6) ***All employees required to enter into confined or enclosed spaces shall be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of protective and emergency equipment required. The employer shall comply with any specific regulations that apply to work in dangerous or potentially dangerous areas.***

For purposes of paragraph (b)(6)(i) of this section, "confined or enclosed space" means any space having a limited means of egress, which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere.

Confined or enclosed spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces more than 4 feet in depth such as pits, tubs, vaults, and vessels.

Stat. Auth.: ORS 654.025(2) and 656.726(3).
Hist: APD Admin. Order 4-1989, f. 3/31/89, ef. 5/1/89 (temp).

APD Admin. Order 8-1989, f. 7/7/89, ef. 7/7/89 (perm)

Appendix II Risk Assessment Matrix

(*From:* ANSI Z10-2005 (5-16-08))

Assessment and Prioritization

OHSMS system issues are assessed to determine their impact on health and safety. Hazards are assessed by determining the level of risk associated with each hazard. OHSMS issues are then prioritized by considering the level of risk, potential for system improvements, compliance with standards and regulations, feasibility, and business consequences. Finally, it is necessary to identify the underline causes and other contributing factors related to OHSMS issues. Objectives are then developed from the listing of prioritized issues.

Assessing the Level of Risk

This appendix provides an overview of the concepts and process of risk management. An effective OHSMS incorporates the concepts of hazard recognition with risk assessment. This standard pertains to hazards that lead to risks for people. The following definitions apply:
Hazard--A condition or inherent property that can cause injury, illness, or death.
Exposure--Contact with or proximity to a hazard, taken into account duration and intensity.
Risk--An estimate of the combination of the likelihood of an occurrence of a hazardous event or exposure, and the severity of injury or illness caused by the exposure.
Risk Assessment--The identification and analysis, either qualitative or quantitative of the liklihood for injury/illness to occur.

Hazard Analysis and Risk Assessment Guide

A general guide on how to perform a hazard analysis and risk assessment. The following thought and action process is applicable to a hazard-risk evaluation. Select a manageable task, system, or process to be analyzed. What actions of workers present potential for harm? Define possible failure modes that result in exposure to hazards. How could an undesirable event happen for a task and each associated hazard? Estimate the frequency and duration of hazard.

Assess the severity of injury/illness. Make an estimate of the injury consequence. Determine the likelihood of an accident/injury. The likelihood of occurrence is normally related to an interval of time (daily, weekly, monthly, yearly.) Use the risk assessment matrix, risk ranking, and scoring system to define the level of risk. The level of risk is determined by plotting the likelihood of an occurrence or exposure and the potential of injury. Hazard risks can be listed and ranked. Risks, system deficiencies, and opportunities for system improvement make up the OHSMS issues and develop documented objectives and implementation plans. The organization prioritizes OHSMS issues and develops documented objectives and implementation plans.

Residual Risk

Risk can never be eliminated entirely. Residual risk is defined as the remaining risk after control has been implemented. You must then determine if the residual risk is acceptable left over is acceptable. If it is not then more controls will need to be put in place.

Risk Assessment Matrices

A risk matrix id used to prioritize risk reduction measures, while using incident probability and the severity of the of injury illness that could occur. A risk matrix provides a method to represent risk in a manner that can be visualized. The elements to be considered are:

- Likelihood of the occurrence of a hazardous event or exposure, and
- Severity of injury and illness.

For illustrative purposes the following matrix one application of basic terms. The example matrix can be used an aid to determine priorities and remedial actions as illustrated by the matrix.

Often, a risk matrix is used to help prioritize risk reduction measures, giving consideration to incident probability and the severity of injury or illness that could result. Risk matrix presents a reasonably quick method to represent in a manner that can be visualized. The elements to be considered in applying a risk assessment matrix are:

- Likelihood of the occurrence of a hazardous event or exposure; and
- Severity of injury or illness that can result.

Countless probability, severity, and frequency of exposure exhibits and risk assessment matrices r appear in literature. The meanings of the terms they use have wide variations. For illustrative purposes only, the following matrix shows one application oof basic terms. As a tool, the example matrix can be used as an aid to determine priorities and remedial actions as illustrated in the matrix. Others may choose different priorities or actions.

To use the matrix, determine the potential severity and frequency of the incident. From this, determine the number for the frequency and the severity, and multiply the two. This will be used to prioritize separate incidents for hazard reduction activities. When using this matrix, you can format the report as follows, then prioritize the survey.

To prioritize, enter the information, the frequency and severity into the tables, using the number for each. Multiply those two numbers to get the “M,” or multiplier, and enter that figure in column 5, the “M” column. Then, when all the incidents have been entered from the survey, you will want to sort the table. Highlight the entire table, then use the “Sort” function under the “Table” menu in Word. Sort it “descending” using column 5.

Modified ANSI Z10-2005 Risk Assessment Matrix

	Severity of Injury or Illness Consequence and Remedial Actions			
Likelihood of OCCURRENCE or EXPOSURE For selected Unit of Time or Activity	**CATASTROPHIC** Death or permanent total disability **4**	**CRITICAL** Disability in excess of 3 months **3**	**MARGINAL** Minor injury, lost workday accident **2**	**NEGLIGIBLE** First Aid or Minor Medical Treatment **1**
Frequent Likely to Occur Repeatedly **5**	**High** Operation not permissible **20**	**High** Operation not permissible **15**	**SERIOUS** High Priority Remedial Action **10**	**Medium** Take Remedial action at appropriate time **5**
PROBABLE Likely to occur several times **4**	**High** Operation not permissible **16**	**High** Operation not permissible **12**	**SERIOUS** High Priority Remedial Action **8**	**Medium** Take Remedial action at appropriate time **4**
OCCASIONAL Likely to occur sometime **3**	**High** Operation not permissible **12**	**SERIOUS** High Priority Remedial Action **9**	**Medium** Take Remedial action at appropriate time **6**	**Low** Risk Acceptable: Remedial Action Discretionary **3**
REMOTE Not likely to occur **2**	**SERIOUS** High Priority Remedial Action **8**	**Medium** Take Remedial action at appropriate time **6**	**Medium** Take Remedial action at appropriate time **4**	**Low** Risk Acceptable: Remedial Action Discretionary **2**
IMPROBABLE Very unlikely—may assume exposure will not happen **1**	**Medium** Take Remedial action at appropriate time 4	**Low** Risk Acceptable: Remedial Action Discretionary 3	**Low** Risk Acceptable: Remedial Action Discretionary 2	**Low** Risk Acceptable: Remedial Action Discretionary 1

Modified Z10-2005 Risk Assessment Matrix (modified by putting numbers & colors to the cells)

Appendix III—Level Zero Entry Procedure 4-11-08

Appendix 9.4

XXXXXX Company

PW SUB FAB LEVEL ZERO
ENTRY AND EXIT PROCEDURES:

The Level Zero is considered a "confined or enclosed space" under the Oregon OSHA Construction Code definition 1926.23(6)(i). Since no chemical exposure or other hazards are currently in the area, the spaces can be entered with the procedures that have been set up below. These are not considered "permit-required confined spaces," as the construction code applies during the construction phase of these projects. However, persons performing Level Zero work are recommended to have Confined Space Training. They MUST also be aware of Level Zero entry requirements and the conditions ahead of time, with the requisite training and equipment, and be monitored during planned Level Zero working times.

Any planned Level Zero work which potentially creates either physical or health hazards to Level Zero occupants will require a "safety job walk" and SIPP pre-planning for any required **PSP** (Phased Safety Plans) or **NIP** (No Impact Plans). **Examples**…fiberglass work, welding, painting, or major chemical use. Work like this must be scheduled 1 to 2 weeks in advance. All work in Level Zero must either mitigate the hazards to others working in these spaces, or exclude the other contractors from those areas until the hazard no longer exists. **Call XXXXX EHS for questions about work plan hazards/Level Zero conditions.**

All Level Zero entrants must "SIGN-IN" at the Level Zero Entrance Board located at each entrance. On the company sign-in sheet, enter the entrant's name, date, work area in the Level Zero, description of work, check-in time, and check-out time. If leaving but returning same day to complete work, check-in and check-out is again required. Use a new sign-in sheet for each day.

A "Buddy" is required at all times for entry into Level Zero. If the buddy stays out of Level Zero, (s)he must stay within cell phone or radio contact range at all times, with a recommended check-in via the radio/phone every 15 minutes. The buddy can continue with other work, as long as contact can be maintained. If entrance is required without a buddy from your company, arrange with XXXXX to have one of the on-site personnel available to act as your "Buddy".

OXYGEN-LEL-CO Meter(s) must be used for any Level Zero entry and kept within 20' of the working group. The Meter must be lowered into Level Zero and checked prior to using stairs/ladders for entry. If alarm(s) occur while in Level Zero, LEAVE LEVEL ZERO IMMEDIATELY and report the event to XXXXX. Any alarm is an incident, and an incident report needs also to be filled out.

If noxious odors, leaks, or other potential health and/or safety conditions are observed in the Level Zero, leave the Level Zero immediately and report the event to XXXXX.

If a potentially "Life Threatening" event such as fire, smoke, major chemical spill, Oxygen deficiency, or major flooding is observed, leave the Level Zero immediately and report the event to XXXXX.

Appendix IV—New Level Zero Policy and Procedure

SUB FAB LEVEL ZEROENTRY AND EXIT PROCEDURES:

- The Level Zero is now considered a "permit-required confined space" under 1910.146,and not a "confined or enclosed space" under the Oregon OSHA Construction Code definition 1926.23(6)(i), as conditions in Level Zero have changed, and construction activities have declined. There is now a potential chemical exposure and or other hazards currently in the area. The potential for actual exposure to these chemicals is low, as they are double-contained inside plastic tubing. Other hazards are also present including head bumping hazards, and walking in a stooped manner due to the low overhead. These latter hazards are the main reason that this space becomes a "permit-required confined space." These hazards are mitigated by use of PPE (hard hats), and cautious walking or seated, wheeled stools.

- Any planned Level Zero work which potentially creates either physical or health hazards to Level Zero occupants will require a Level Zero Reclassification Form to be filled out and filed with XXXX security. Mitigation of the hazard may require a pretask plan (contractors). Examples: fiberglass work, welding, painting, or major chemical use. Work like this must be scheduled 1 to 2 weeks in advance. All work in Level Zero must either mitigate the hazards to others working in these spaces, or exclude the other workers, vendors or contractors from those areas until the hazard no longer exists. If new hazards are being introduced, it is the contractor/vendor/XXXX employee's responsibility to mitigate these hazards prior to entry. Failure to do so means entry requires a confined spaces entry permit, and removal of all other affected personnel. Call XXXX HSE for questions about work plan hazards/Level Zero conditions.

- All Level Zero entrants must "SIGN-IN" at the Level Zero Entrance Board located at each entrance. On the company sign-in sheet, enter the entrant's name, date, work area in the Level Zero, description of work, check-in time, and check-out time. If leaving but returning same day to complete work, check-in and check-out is again required. Use a new sign-in sheet for each day.

- Because of phone/radio lack of coverage, a "Phone Buddy" is not now required at all times for entry into Level Zero. A buddy system under the floor is now required. If phone contact can be established, then a buddy can stay out of Level Zero, (s)he must stay within cell phone or radio contact range at all times, with a recommended check-in via the radio/phone every 15 minutes. The buddy can continue with other work, as long as contact can be maintained.

- A new Reclassification Form must be filled out prior to Level Zero entry. This form allows the space to be declassified from a permit-required confined space to a non-permit-required confined space.

- OXYGEN-LEL-CO Meter(s) are now used to declassify the space by sensing prior to entry. Their use must continue only if introduced atmospheric hazards cannot be mitigated with controls (smoke eaters for welding operations, for instance) in Level Zero and kept within 20' of the working group. The Meter must be lowered into Level Zero and checked prior to using stairs/ladders prior to entry. If alarm(s) occur while in Level Zero, LEAVE LEVEL ZERO

IMMEDIATELY and report the event to XXXX. Any alarm is an incident, and an incident report needs also to be filled out. This is XXXX policy precaution, and is not OSHA-required for entry under this reclassification procedure.

- If noxious odors, leaks, or other potential health and/or safety conditions are observed in the Level Zero, leave the Level Zero immediately and report the event to XXXX. **If a potentially "Life threatening" event such as fire, smoke, major chemical spill, Oxygen deficiency, or major flooding** is observed, leave the Level Zero immediately and report the event to XXXX. **The reclassification is rescinded** if any life-threatening hazards are observed or sensed (including the air monitor going off).

QUESTIONS OR CONCERNS:

ENDNOTES

[i] AIHA/ABIH Codes of Professional Ethics.

[ii] See the following websites to review and/or download the documents:
http://www.philaaiha.com/Ethics.htm
http://www.abih.org/members/documents.html#ethicscode

[iii] See the following website for this statement by the Board of Certified Safety Professionals:
http://www.bcsp.org/bcsp/media/ethics.pdf