2018 Metal/Nonmetal National Mine Rescue Contest

Team Trainer Competition – Written Test

ANSWER KEY

1.	**A**	pg. 2-21	MSHA Publication 3027
2.	**B**	pg. 2-23	MSHA Publication 3027
3.	**C**	pg. 2-24	MSHA Publication 3027
4.	**B**	pgs. 2-26	MSHA Publication 3027
5.	**B**	pg. 2-6	MSHA Publication 3027
6.	**A**	pg. 3-4	MSHA Publication 3027
7.	**B**	pg. 3-5	MSHA Publication 3027
8.	**A**	pg. 3-5	MSHA Publication 3027
9.	**C**	pg. 3-8	MSHA Publication 3027
10.	**B**	pg. 3-9	MSHA Publication 3027
11.	**D**	pg. 21	2017 - 2018 National MNM Mine Rescue Contest Rules
12.	**B**	pg. 24	2017 - 2018 National MNM Mine Rescue Contest Rules
13.	**B**	pg. 33	2017 - 2018 National MNM Mine Rescue Contest Rules
14.	**B**	pgs. 35, 37, 38 & 39	2017 - 2018 National MNM Mine Rescue Contest Rules
15.	**B**	pg. 113	2017 - 2018 National MNM Mine Rescue Contest Rules
16.	**C**	pg. 259	30 CFR Part 49.2
17.	**B**	pg. 262	30 CFR Part 49.6(a)(5)
18.	**D**	pg. 262	30 CFR Part 49.6(a)(6)
19.	**B**	pg. 263	30 CFR Part 49.8(c)
20.	**B**	pg. 264	30 CFR Part 49.8(g)
21.	**A**	pg. 36	EMR 10th Edition
22.	**C**	pg. 57	EMR 10th Edition
23.	**D**	pg. 564	EMR 10th Edition
24.	**A**	pg. 116	EMR 10th Edition
25.	**D**	pg. 62	EMR 10th Edition
26.	**C**	pg. 5-6	MSHA Publication 3027
27.	**A**	pg. 5-7	MSHA Publication 3027
28.	**B**	pg. 5-9	MSHA Publication 3027
29.	**B**	pg. 5-14	MSHA Publication 3027
30.	**A**	pg. 5-14	MSHA Publication 3027

2018 National Metal and Nonmetal Mine Rescue Contest

JUDGES' PACKET
Field Competition
Day 1

July 24, 2018
Lexington, Kentucky

Table of Contents

Introduction

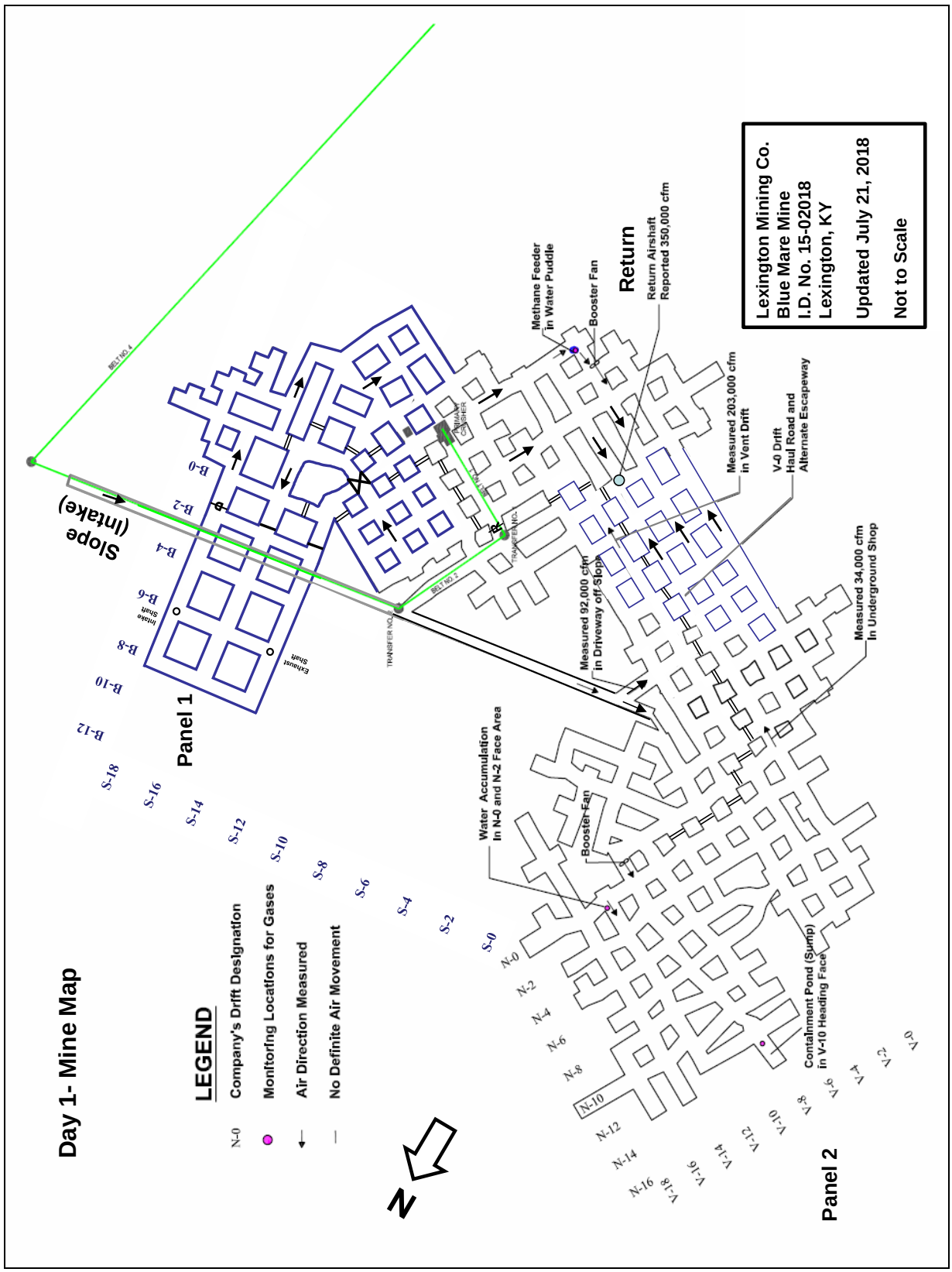
Welcome to the 2018 National Metal and Nonmetal Mine Rescue Contest. Before we begin, we want to commend each of you for the countless hours that you have volunteered, and your selfless dedication and willingness to participate as a mine rescue team member. We would also like to recognize each team for the hard work spent during this past year while training and preparing to help your fellow miners during a mine emergency. In addition, we want to thank each team's company for their support and financial backing for this important training function.

This year all teams will participate in a two-day field competition. We have put together a very challenging problem for each day. Both of which will make you think and exercise all of your mine rescue skills. Hopefully, every team will go away feeling that they are better prepared for an actual emergency based on what they have learned.

Your team's final placement will be based on your combined cumulative discounts for both day's field problems plus your written test discounts. Those teams with the least amount of total discounts will vie for the trophies.

Even though there can only be a handful of contest winners, the real winners are the miners and their families, the communities, and the companies you represent. It is for all of them that we are here today.

Now, let us continue with the briefing for this year's Day 1 mine rescue problem.


Day 1- Mine Map
LEGEND
Company's Drift Designation
Monitoring Locations for Gases
Air Direction Measured
No Definite Air Movement
N-0
Slope (Intake)
Panel 1
Panel 2
Return
Methane Feeder in Water Puddle
Booster Fan
Return Airshaft Reported 350,000 cfm
Measured 203,000 cfm in Vent Drift
V-0 Drift Haul Road and Alternate Escapeway
Measured 92,000 cfm in Driveway off Slope
Measured 34,000 cfm In Underground Shop
Water Accumulation In N-0 and N-2 Face Area
Booster Fan
Containment Pond (Sump) in V-10 Heading Face
Lexington Mining Co.
Blue Mare Mine
I.D. No. 15-02018
Lexington, KY
Updated July 21, 2018
Not to Scale
N

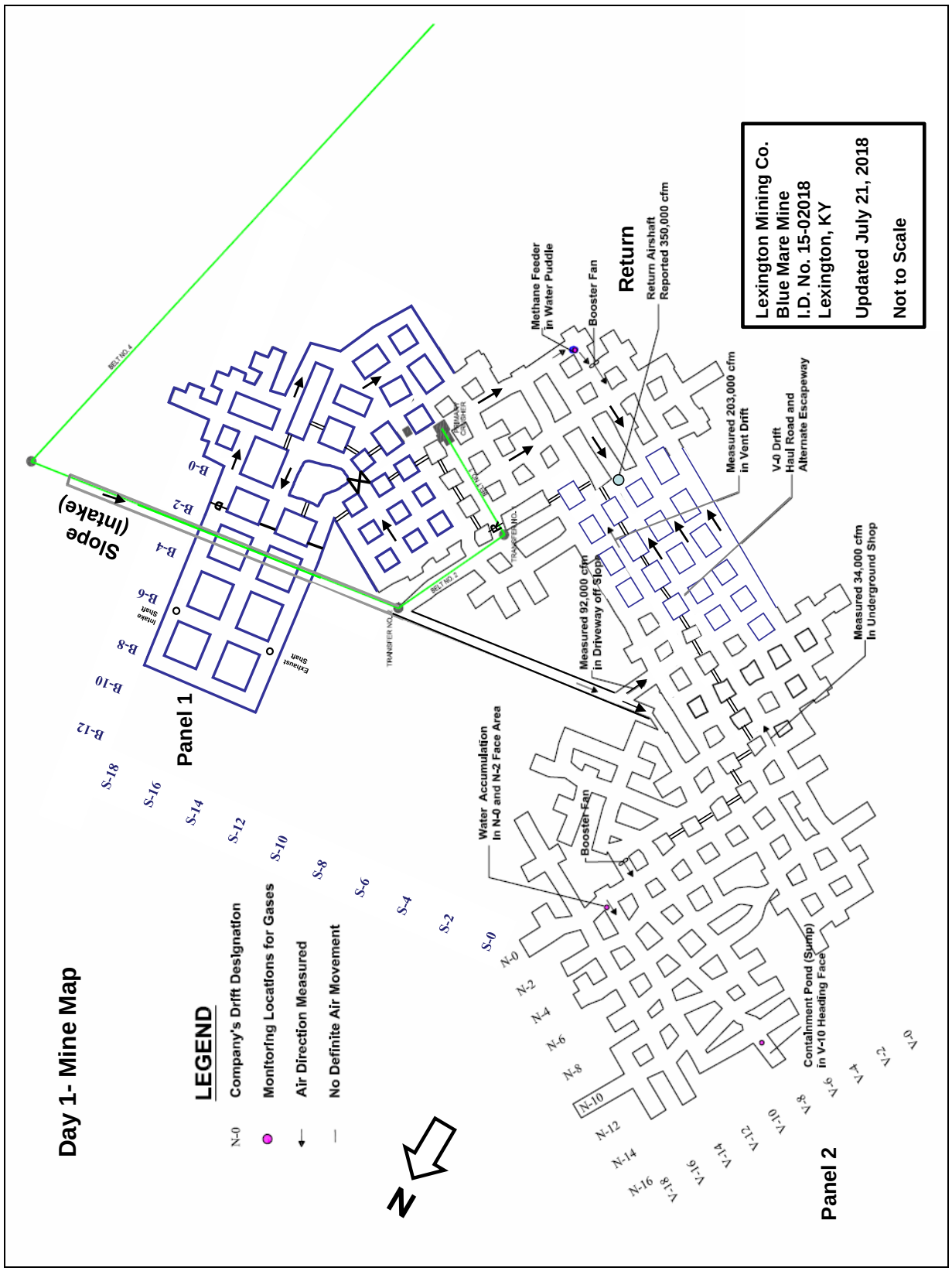
Mine Information Sheet
Lexington Mining Co. – Blue Mare Mine

Mining & Equipment:
The single-level Blue Mare mine uses a conventional room and pillar method to extract ore. At the faces, the broken ore is loaded into rock trucks by front-end loaders and then transported to a feed hopper for the primary crusher. Conveyor belts are used to transport the ore to the surface via the Slope. The entries are initially driven 8 feet high and 10 feet wide. Typical pillar dimensions are 15 feet by 20 feet (W x L). All underground mobile equipment (including the front-end loaders, rock trucks, scaling machines, face drills, roof bolting machines, maintenance vehicles and transport jeeps) is diesel-powered. To date, no recovery work (or second mining) has been performed.

Gas and Oil:
In accordance with Title 30 CFR Part 57.22003, the mine was classified as a Category IV mine, that is, any methane concentrations liberated are not explosive and are not capable of forming explosive mixtures with air, based on the geological area in which the mine is located. Historical gas sampling data from the mine have indicated the presence of methane in trace amounts. Presently, MSHA is reviewing this classification due to several reported methane feeders and two minor ignitions in the face areas. In addition, crude oil is now oozing from the face and side walls in the active workings. Although, to date, it has been only a nuisance, the inflow rate is increasing in Panel 2. The accumulating oil is more of a safety hazard, due to its combustible characteristics, than a health hazard from any associated organic components.

Mine Openings:
The 16-feet wide, arched Slope is 423 feet in length and houses the main line conveyor belt. The slope is also used to transport personnel and supplies and is designated as the primary escape way from the mine. The 480-feet deep, 16-feet diameter Return Shaft is equipped with a 5-man escape hoist and is designated as the secondary escape way from the mine. Two 560-feet deep, 6-feet diameter shafts have been recently raise bored from Panel 1 to the surface. The concrete-lined shafts are used strictly as air shafts for the advancing development. There are no conveyances or ladder ways in the shafts.

Ventilation:
The mine's Main Fan is located on the surface near the Return Airshaft and it is <u>not</u> reversible. The fan produces approximately 350,000 cfm and operates in the stable portion of its performance curve at the lowest available blade setting. The electrical power to the fan is on and the fan is operating. Intake air enters the mine through the Slope and it is directed to the faces using permanent (concrete block) and temporary (brattice cloth) ventilation controls. Exhaust air exits the mine through the Return Airshaft. The normal airflow direction is shown on the mine maps. Ventilation for Panel 1 is now separated from the rest of the mine. A fan installed near the surface of the new Exhaust Shaft, located in Drift S-14, pulls 60,000 cfm from the panel. Fresh air is drawn in through the new Intake Shaft, located in Drift S-18. Additional ventilation controls will be installed to separate the intake and return airways as the panel advances.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Lexington Mining Co.
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Mine Information Sheet (continued)
Lexington Mining Co. – Blue Mare Mine

Water:
The ore body dips toward the West; as result, standing water is typical in Panel 2. However, although a nuisance, the water has never caused any significant production problems. Some water is now seeping into the face areas in Panel 1.

Pumps:
Portable pumps and discharge lines are used to remove water from the working faces to several underground containment ponds. Larger pumping stations have been installed at these locations to keep the water level to a minimum. Permanent discharge lines had been installed to remove the water from the mine via the Slope.

Ground/Rib and Roof Control:
The immediate roof or back is supported by 6-foot long roof bolts, installed on 4-foot centers. Wooden timbers and wooden crib blocks are available for additional support in problem areas.

Mine Map:
The mine map was updated on July 21, 2018 by the onsite Engineering Department.

Other Mines:
There are no known mines, active or abandoned, located within a 5-mile radius of the Blue Mare Mine.

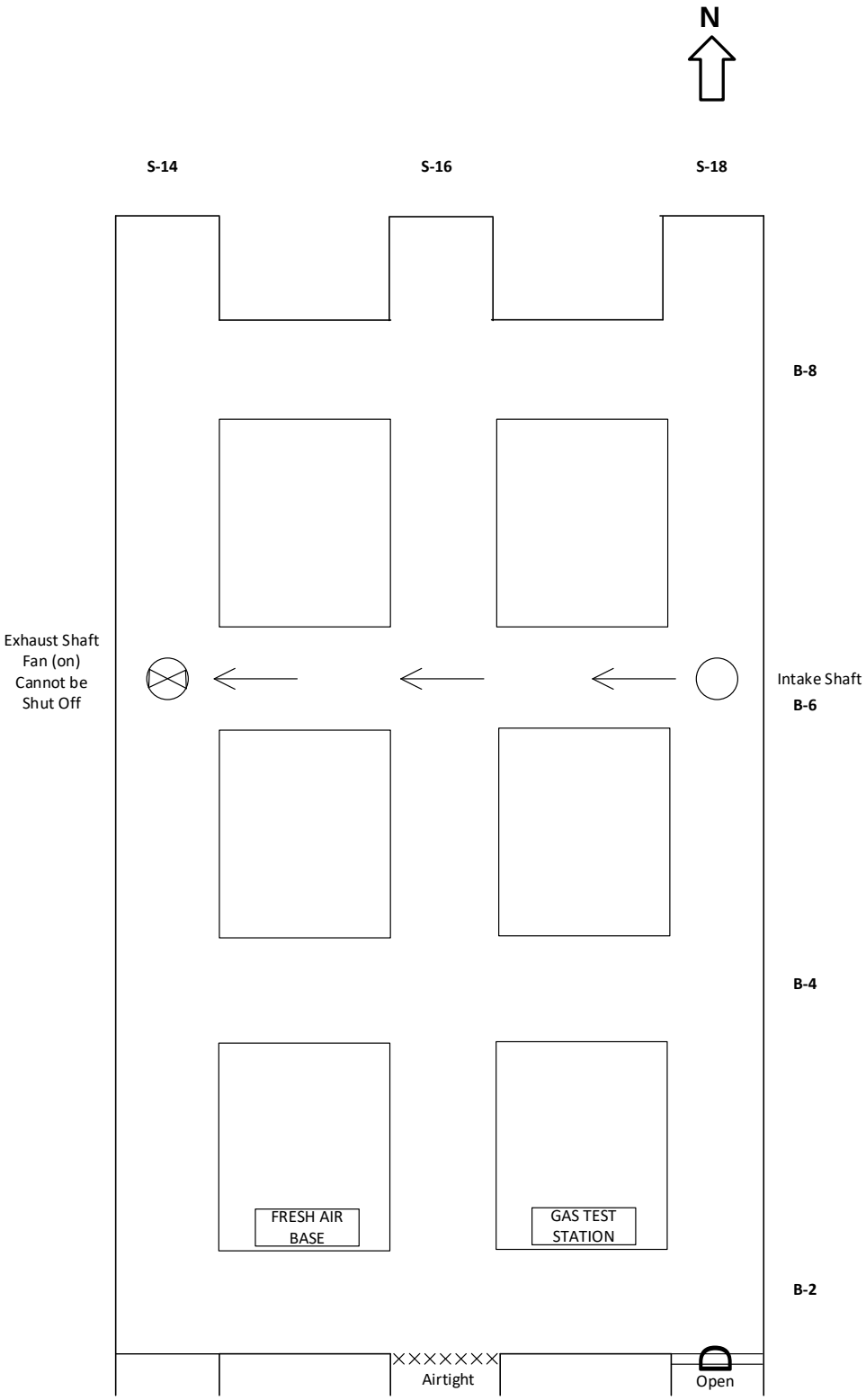
Explosives:
Explosives are available and stored on the surface. They are used during the mining cycle and blasting is conducted at the end of each shift while all persons are out of the mine. Only enough explosives for a day's use are stored in day boxes on the blaster's jeep.

Materials:
Most available equipment and materials to work the problem are located in the mine and are identified with placards. If there is something else deemed necessary by the team, upon request, it can be delivered in a reasonable amount of time. **Note: The team will only be allowed to carry two sets of brattice material and frames at any given time. "Wing" curtains will not count toward this maximum.**

Communications:
Pager phones are available in the mine and normally have contact with the surface. The current phone locations are marked on the mine map. At this time, we do not know the status of the communication system, because there has been no contact with the missing miners.

Team Working Order # _____

Team Map (Panel 1)



Team Briefing Statement

The Lexington Mining Co.'s Blue Mare Mine is a single-level underground mine opened by a slope and one shaft. The Slope houses the main line conveyor belt and is also used to transport personnel and supplies. Intake air enters the mine through the Slope, so it is designated as the primary escape way from the mine. The mine is ventilated by a surface-mounted exhausting fan operating at the Return Airshaft. This shaft is equipped with a 5-man escape hoist and is designated as the secondary escape way from the mine. Ventilation for Panel 1 is now separated from the rest of the mine. A fan installed near the surface of the Exhaust Shaft, located in Drift S-14, pulls about 60,000 cfm from the panel. This fan cannot be reversed. Fresh air is drawn in through the Intake Shaft, located in Drift S-18. These 6-foot diameter, concrete-lined shafts are used strictly as air shafts for the advancing development. There are no conveyances or ladder ways in the shafts. Additional ventilation controls will be installed to separate the intake and return airways as the panel advances.

Ore is mined by the traditional room and pillar method. The entries are initially driven 8 feet high and 10 feet wide. Pillar dimensions in the newest developments are typically 15 feet by 20 feet (W x L). The immediate roof, or back, is supported by six-foot rock bolts. The back is fairly competent, but problem areas are supported by wooden timbers or stacked crib blocks. The ore body dips toward the West; therefore, standing water is typical in Panel 2. However, although a nuisance, the water has never caused any significant production problems.

In accordance with Title 30 CFR Part 57.22003, the mine is classified as a Category IV mine, that is, any methane concentrations liberated are not explosive and are not capable of forming explosive mixtures with air, based on the geological area in which the mine is located. Presently, MSHA is reviewing this classification due to several reported methane feeders and two minor ignitions in the face areas. In addition, crude oil is now oozing from the face and side walls in the active workings.

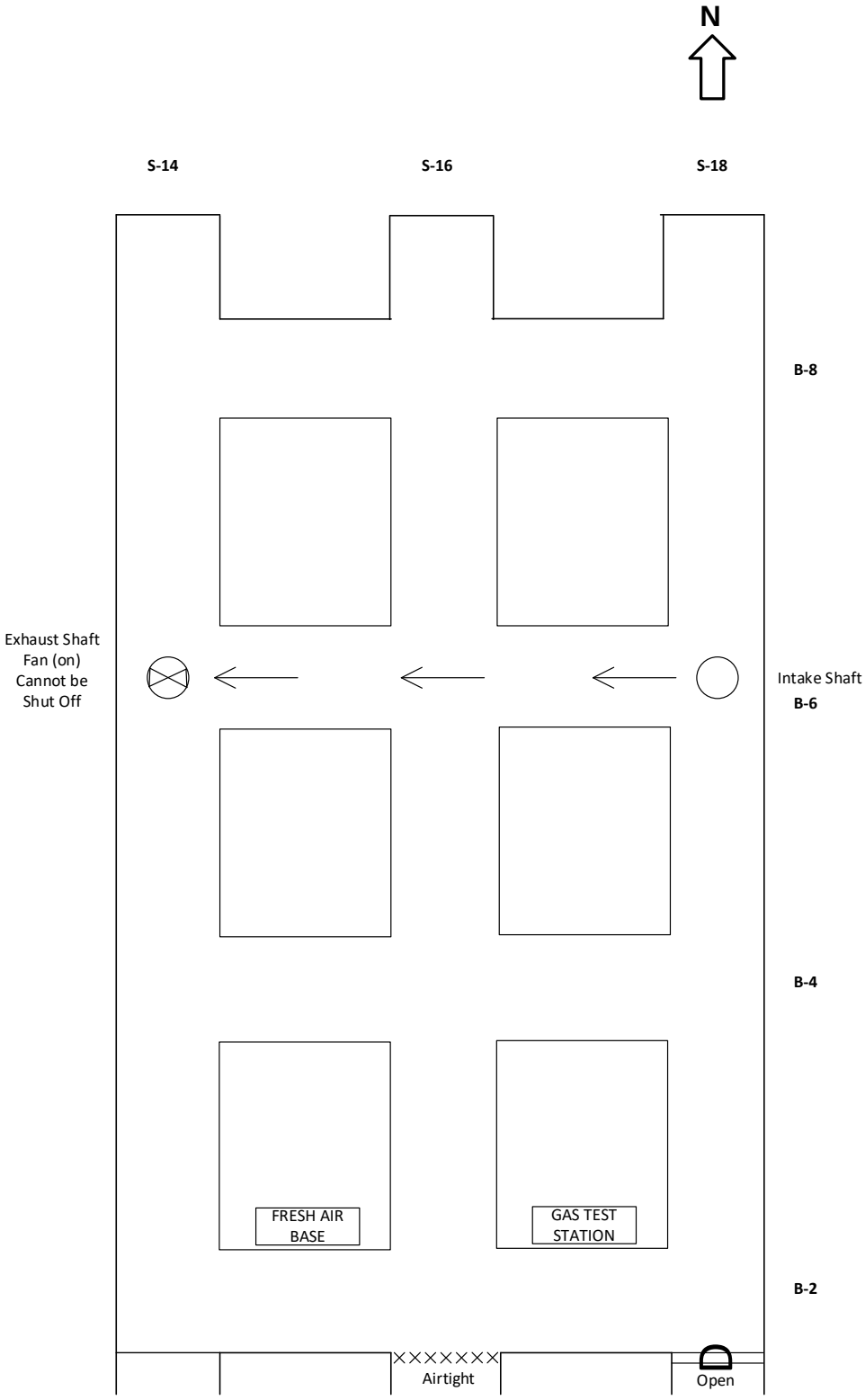
This morning at 5:00 a.m., twelve employees went underground to start their shift. A production crew (one foreman and five crew members) went to each of the production panels (Panel 1 and Panel 2). At about 6:30 a.m., three crew members from Panel 1 came out of the mine to get a load of cement blocks for use as permanent stoppings. Shortly afterward, the foreman called out from Panel 1 stating that there was an apparent explosion and he was separated from the remaining crew members. He was going to find them and bring them outside. The Mine Manager stopped the three crew members from re-entering the mine and activated the mine warning system. As a result, the Panel 2 crew proceeded outside through the Slope without incident.

The company's mine rescue team established an underground fresh air base in Panel 1 during their initial exploration of the mine. Ventilation has been re-established to this area and is being intentionally short-circuited to the return entries. All power to the underground has been locked out and guarded. The mine's Main Fan and the new Exhaust Shaft fan (for Panel 1) are operating.

2018 National Contest – Day 1

Team Working Order # _____

Team Map (Panel 1)



Gas monitoring has been established at all mine openings. Currently, the monitors at the Slope, the Return Airshaft and the new Exhaust Shaft indicate clear air: oxygen (O_2) - 20.9%; carbon monoxide (CO) - 2 ppm; methane (CH_4) - 0.0%; and nitrogen dioxide (NO_2) - 0.0 ppm.

At this time, we are unable to establish contact with anyone underground. We have called all of the government agencies for help. Guards have been posted at the Slope, at the Return Airshaft, and at the main fan. There is a fully equipped mine rescue team located at the Fresh Air Base and they are ready to serve as your team's backup. **Another team will be sent into the mine to replace you after 75 minutes.**

All available equipment and materials to work the problem are located in the mine and are identified with placards. If there is something else deemed necessary by the team, upon request, it can be delivered in a reasonable amount of time. **Note: the team will only be allowed to carry two sets of brattice material and frames at any given time. "Wing" curtains will not count toward this maximum.**

When you reach the mine rescue course you will be located at the underground fresh air base. At that time, the Mine Manager will introduce you to the judges. Once the Team Captain has started the timer, the Mine Manager will provide you with any changes to the briefing information that you have received. The Mine Manager will only respond to questions allowed by the rules while you are working the problem.

The fresh air base attendant and alternate will be assigned a location where they can study the team briefing information, mine information, and map. Only one attendant or alternate will be allowed to assist at the fresh air base. This fresh air base attendant can assist the team and communicate with them while they advance past the fresh air base using the communication system. He must maintain an accurate map indicating all initial information that the team relays to him. He may also assist the team by relaying information to the mine manager when required by the problem. He may also assist the team when they retreat to the fresh air base. The fresh air base attendant and mine rescue team alternate are not allowed to speak to anyone during the working of the problem except their team members, the mine manager, and the judging officials.

GOOD LUCK!

Team Instructions

- Explore and map all conditions found in Panel 1 (problem field) and any changes made by the team;
- Extinguish or seal any fires;
- Account for the three missing miners;
- If necessary, re-ventilate the level; and
- Bring any live miners to the fresh air base.

Fresh Air Base Instructions

- The fresh air base attendant and alternate will be assigned a location where they can study the team briefing information, mine information, and map.
- Only one attendant or alternate will be allowed to assist at the fresh air base. This person can assist the team and answer any questions the team may ask.
- The fresh air base attendant and mine rescue team alternate are not allowed to speak to anyone during the working of the problem except their team members, mine manager, and the judging officials.

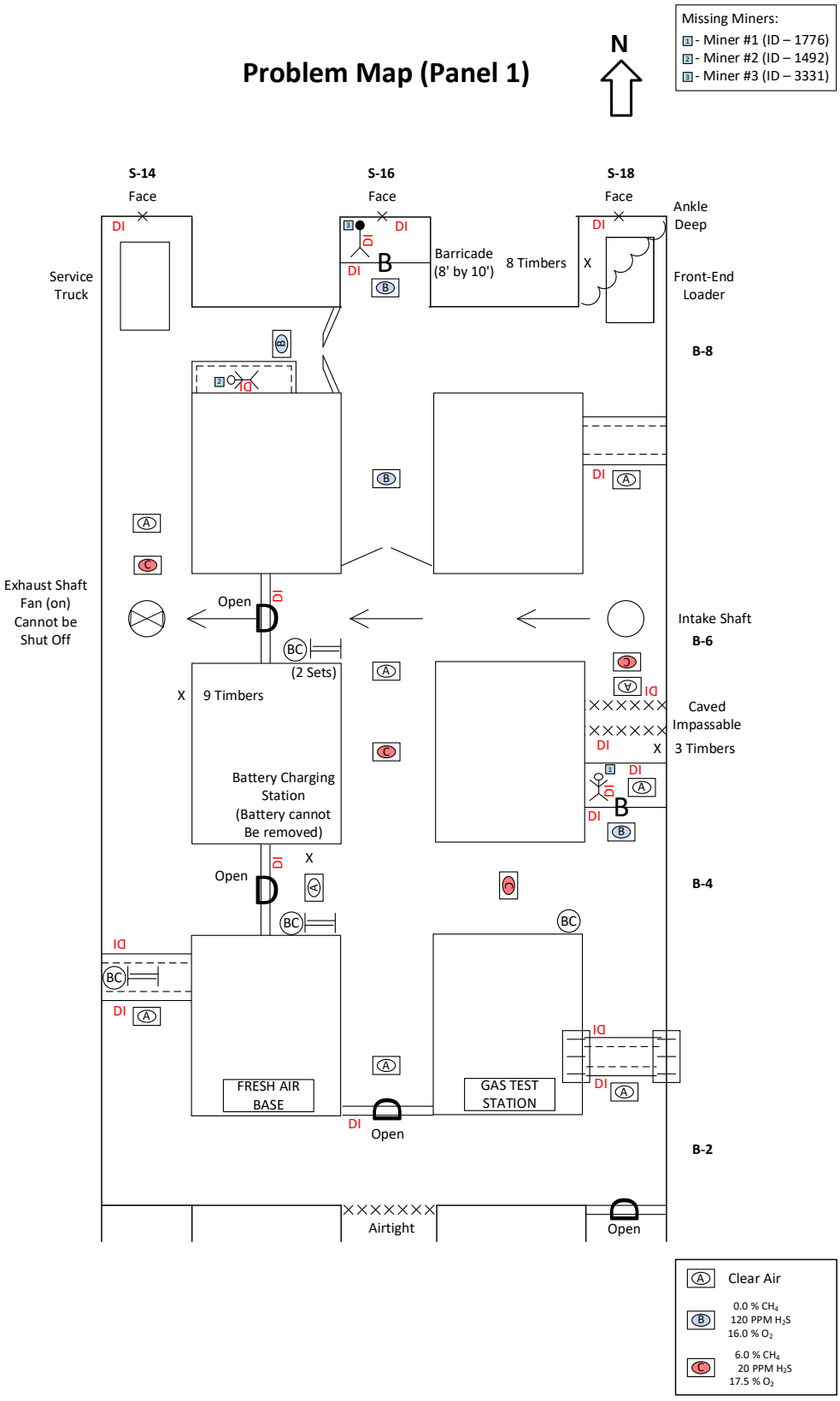
Problem Orientation

Introduce yourself to the team as the "Mine Manager." Then, introduce the #1, and #2 Judges. The team has been briefed on the problem and the mine information, and been provided with the mine maps in isolation. Read the following instructions to the team:

> **At this time, I have new information for your team. The main return fan for the mine has gone down and cannot be restarted. Therefore, it cannot be used to ventilate Panel No. 1. As a result, fresh air from the Slope cannot be used to ventilate the panel either. During the working of the problem, I will answer any question that you may have; however, by problem design, my response may be limited in scope. The fresh air base attendant and mine rescue team alternate must remain at the underground fresh air base. Only the fresh air base attendant can speak with the team via the communication system to discuss the rescue activities performed or proposed. If the team returns to the fresh air base, only the attendant or alternate will be allowed to assist them. However, neither the attendant nor the alternate can physically go beyond the fresh air base to assist the team unless he/she becomes a team member when someone drops out.**
>
> **After the team has completed its 50 foot check, they will not be allowed to physically compare the team map with the fresh air base attendant's map or the team alternate's map. No side by side comparison will be allowed and no changes (edits) can be made to any map while the team is at the surface fresh air base.**
>
> **The fresh air base attendant or team alternate is not allowed to speak with anyone <u>except</u> the team members, the mine manager, or the judges.**
>
> **At the end of the problem, both the team map and the fresh air base attendant's map will be collected and scored. All map editing must take place prior to stopping the clock. The alternate's map will also be collected at this time but it will not be scored.**
>
> **Do you understand these instructions?**

When they verify understanding the instructions, have the Team Captain start the clock and hand the team their copies of the Team Briefing Information, the Mine Information Sheets, and the <u>three</u> mine maps. Remember to add: **"Good Luck!"**

Problem Map (Panel 1)



Problem Solution

DISCLAIMER:
There are many ways to successfully solve this problem. The following outlines one possible way for use during MSHA field judges' training.

Each team received a briefing in isolation. At that time, each team was allowed to review the team briefing statement, mine information sheet, mine maps, and instructions for rescue teams and fresh air base attendants. However, copies of these documents and maps were collected at the conclusion of the briefing session.

Upon arrival at the fresh air base, the team will meet the Mine Manager and will be introduced to the judges. The Mine Manager will read the Problem Orientation and update the team with any information obtained since their briefing. Questions will be answered only as required by the rules or to explain the meaning of a term.

When the team verifies that they understand the instructions, the captain immediately starts the official clock. He writes the month, day, year, and the team position number on the sign-in board (or sheet). The captain's failure to perform any of these tasks will result in discounts (4 x each infraction) per Judge 1 – Surface Rule #8.

After receiving the information from the Mine Manager, the team may discuss the conditions presented by the problem and the map. The team is not required to check their equipment again. These equipment checks were conducted prior to reporting to the field and the team is fully equipped, physically fit, and ready to go. However, deficiencies with the team's equipment, identified by the judges during the working of the problem, should be discounted appropriately.

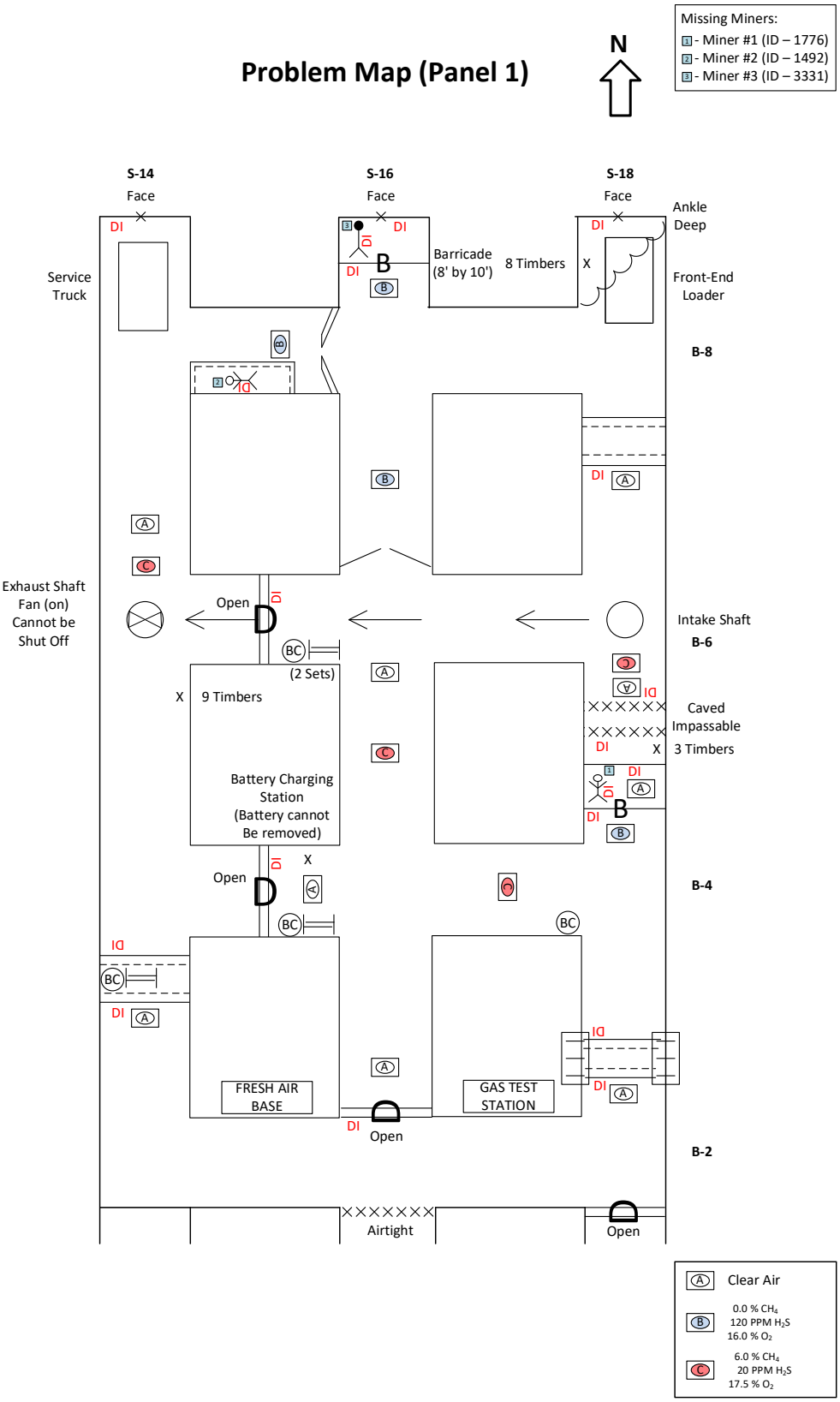
Since the mine is a Category IV, due to the potential presence of methane in the mine atmosphere, the team must use non-sparking tools to work the problem. They must notify the judges that they are using such tools. If the team does not have non-sparking tools and requests them from the official in charge, the tools that they brought with them will be deemed non-sparking. The team's failure to notify the judges that they have non-sparking tools to work the problem or need non-sparking tools and request them will result in a team endangerment (75 discounts) per Judge 1 – UG Rule #10(b)(2).

When ready, the team must examine all openings along the prior mine rescue team's furthest point of advance. The three drifts must be examined while under oxygen. In air clear of smoke, these checks may be made without a lifeline, provided the entire team does not go into the entrance. The examinations cannot cover more than 25 feet.

> **Drift S-14 checks reveal:** The team members can stretch northward in the drift to find an area of unsafe roof (stretching rib-to-rib) approximately 13 feet inby Crosscut B-2. The captain must warn the other team members to avoid this hazard. Then, the captain must perform roof or back checks as the team conducts necessary gas tests. They will find a gas placard indicating "clear air." The captain must date & initial (D&I) the unsafe roof as their furthest point of advance (FPA) in this direction.

2018 National Contest – Day 1

Problem Map (Panel 1)



Drift S-16 checks reveal: The team will find a permanent stopping and the installed door is open. The team members may stretch northward in the drift. As they pass through the open door, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find a placard indicating "clear air." The captain must D&I the stopping and their FPA in this direction.

Drift S-18 checks reveal: The team can stretch northward in the drift to find an area of unsafe roof and ribs (stretching rib-to-rib) approximately 5 feet inby Crosscut B-2. The captain must warn the other team members to avoid this hazard. Then, the captain must perform roof or back checks as the team conducts necessary gas tests. They will find a placard indicating "clear air." The captain must D&I the unsafe roof as their FPA in this direction.

Note: These checks must be made to assure the conditions are safe to proceed.

Note: For the Drift S-14 and Drift S-18 checks, if the team asks the Mine Manager for wooden timbers or posts, they will be told that all materials needed to work the problem can be found in the mine. Additional timbers have been ordered and a shipment is expected to arrive on the surface later today.

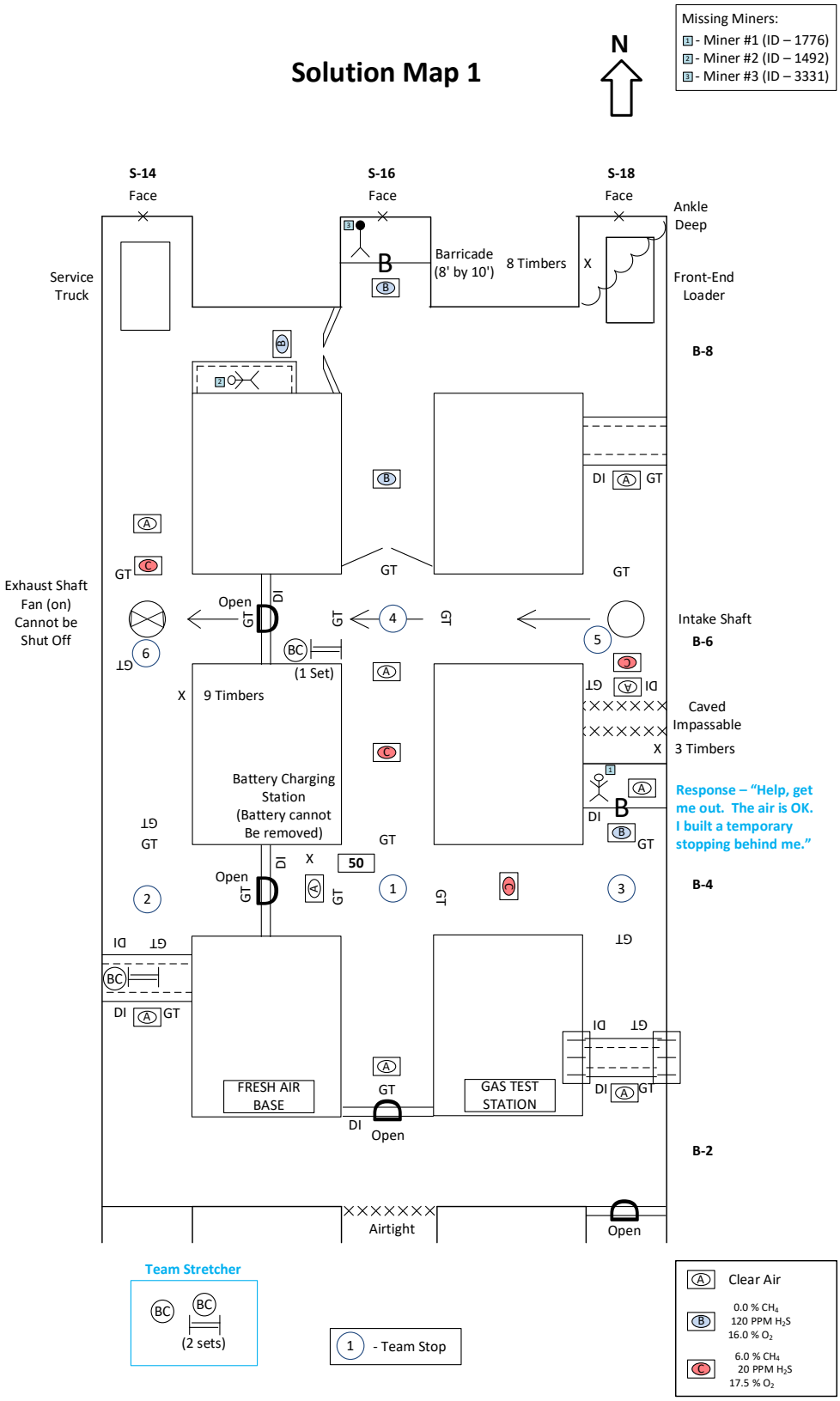
Note: The brattice material available for use by the team is relatively lightweight and compact (10-foot strips of brattice cloth with clips on each end). **As stated in the team briefing information, the team can only carry two sets of brattice material and frames at any given time. "Wing" curtains will not count toward this maximum.**

The team's failure to take necessary gas tests where required (each gas and each infraction) assess discounts (1x each omission) per Judge 2 - UG Rule #1. **All additional areas requiring gas testing by the team are shown on the Solution Maps as "GT".**

The captain's failure to D&I where required (at the point of farthest advance of the team in any direction such as at stoppings, faces of rooms and drifts, water over knee deep, impassable falls, barricades, fires out of control, and at the location of any survivors or bodies) assess discounts (2 x each place – max 10) per Judge 1 - UG Rule #9. **All additional areas requiring a D&I by the team captain are shown on the Solution Maps as "DI".**

Gas Box Testing Station:
The team will also find the gas box testing station located at the fresh air base. A team member must use the team's multi-gas instrument to determine the gas concentrations in the unknown mixture. The team must provide its own calibration cup to report: O_2, CH_4, CO, and NO_2. **This will be the only gas box on the mine rescue field.** Judge No. 2 will write down the team's measurements and have the team member initial the documentation. Afterward, Judge No. 2 can compare the team's measurements with the allowable tolerances for each gas and, if warranted, assess appropriate discounts (15 x each incorrect gas measurement) per Judge 2 – UG Rule #4.

Solution Map 1



Note: Team Stop Nos. 1 - 6 (see Solution Map 1)

Team Stop No. 1
The team can advance northward in Drift S-16 to Crosscut B-4. At the intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. The team will find that the drift to the north is open and the crosscut is not blocked in either direction (east or west). The team can stretch westward in the crosscut to the permanent stopping and find that the door is open. A gas placard located in the crosscut shows "clear air." The team will find a battery charging station located along the northern rib. A placard indicates that there is a battery on the charger which cannot be removed (which represents a potential ignition source). They will also find one set of brattice material and frames located along the southern rib. They can take this material with them for future use. The captain must D&I the stopping as their FPA in this direction.

If the team does not "count off" before entering the mine (beyond the FAB) for the first time or leaving the mine (upon completing the problem), assess discounts per Judge 1 - Surface Rule #10 (2x each occurrence).

Note: After advancing not more than fifty (50) feet from the fresh air base, the captain must give a signal for the team to stop. At this time, all team members and their apparatus must be checked. After the first 50 feet apparatus check, the team is required to conduct apparatus examinations not exceeding 20-minute intervals while working the problem. Additionally, apparatus removed in order to enter a confined area or apparatus that has sustained possible damage from impact must be checked before continuing. If team fails to conduct 50 foot check, assess 10 discounts per Judge 1 – UG Rule #3. Also, if the team fails to conduct apparatus examinations exceeding 20-minute intervals, assess discounts per Judge 1 - UG Rule #5 (5x each occurrence).

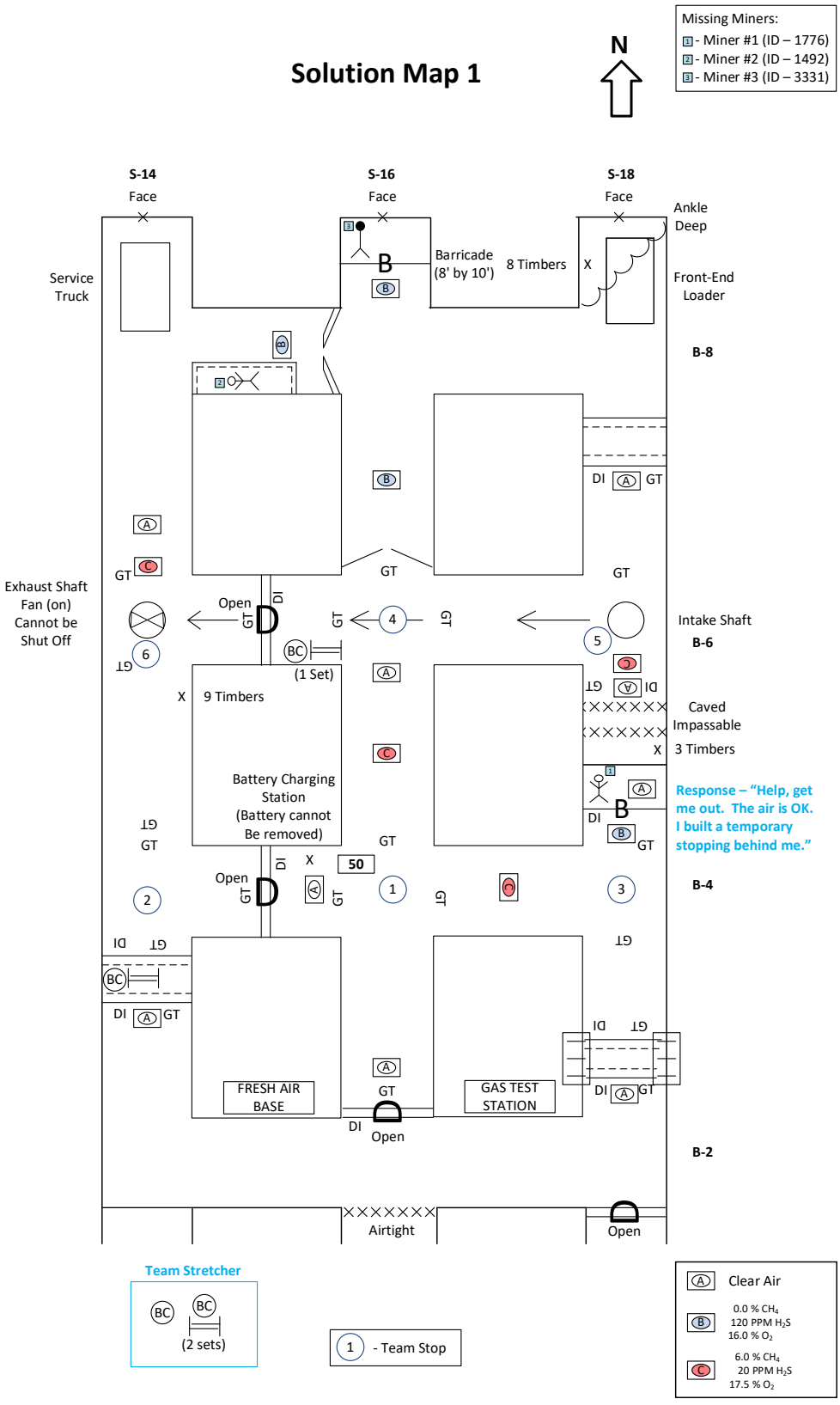
Note: No physical comparison of the fresh air base map and team map will be allowed after this initial entry into the mine. No changes can be made to any map while the team is at the surface fresh air base.

Team Stop No. 2
Now, the team can continue advancing westward to Drift S-14. As they pass through the open door, the captain performs roof or back checks and the team will conduct necessary gas checks. At the intersection, the captain will again perform roof or back checks and the team will conduct necessary gas checks. The team can stretch southward in the drift to tie in. Approximately 2 feet outby the intersection, they will find the northern extent of the unsafe roof (stretching rib-to-rib). The captain must warn the other team members to avoid this hazard. Then, the captain must D&I the unsafe roof as their FPA in this direction. **(Previous Note applies, if team asks for timbers or posts)**

If the captain does not verbally indicate he/she is checking the roof or back upon passing through any barricade stopping, bulkhead, air lock, door, check curtain, or similar barrier, assess discounts (5x each occurrence) per Judge 1 - UG Rule #8(b)(4).

2018 National Contest – Day 1

Solution Map 1



Team Stop No. 3
The team can retreat to the intersection of Drift S-16 and Crosscut B-4. Then, they can advance eastward in the crosscut toward Drift S-18. As they travel, they will find a placard about half-way into the crosscut indicating "6.0% CH_4, 20 ppm H_2S, and 17.5% O_2." The team must call out to the fresh air base to report that they had encountered an air/gas mixture that has reached its explosive range. Since the team has found no evidence indicating that there is a fire underground (i.e., smoke or CO concentrations), the team can continue systematic exploration. As they advance toward Drift S-18, they will find brattice material ("wing" curtain) lying along the southern rib. They can take it with them for future use (the wing curtain does not count toward the two set brattice material maximum). At the intersection, the captain will again perform roof or back checks and the team will conduct necessary gas checks. The team can stretch southward in the drift to tie in. About 12 feet outby the intersection, the team will find the northern extent of the unsafe roof (rib-to-rib). The captain must warn the other team members to avoid this hazard. Then, the captain must D&I the unsafe roof as their FPA in this direction. **(Previous Note applies, if team asks for timbers or posts)** The team can retreat to the intersection with Crosscut B-4 and stretch northward. They will find a placard indicating "0.0% CH_4, 120 ppm H_2S, and 16.0% O_2." They will also find an 8-foot by 10-foot brattice cloth barricade stretching rib-to-rib. If the team captain calls out to anyone inside, there is a response. The No. 1 judge will hand the team a placard with the following statement:

> *"Help get me out. I am Miner #1 (ID – 1776). I tried to escape but felt very sick and could not continue. I am alone in here. The air is O.K. I built a temporary stopping behind me to keep it that way."*

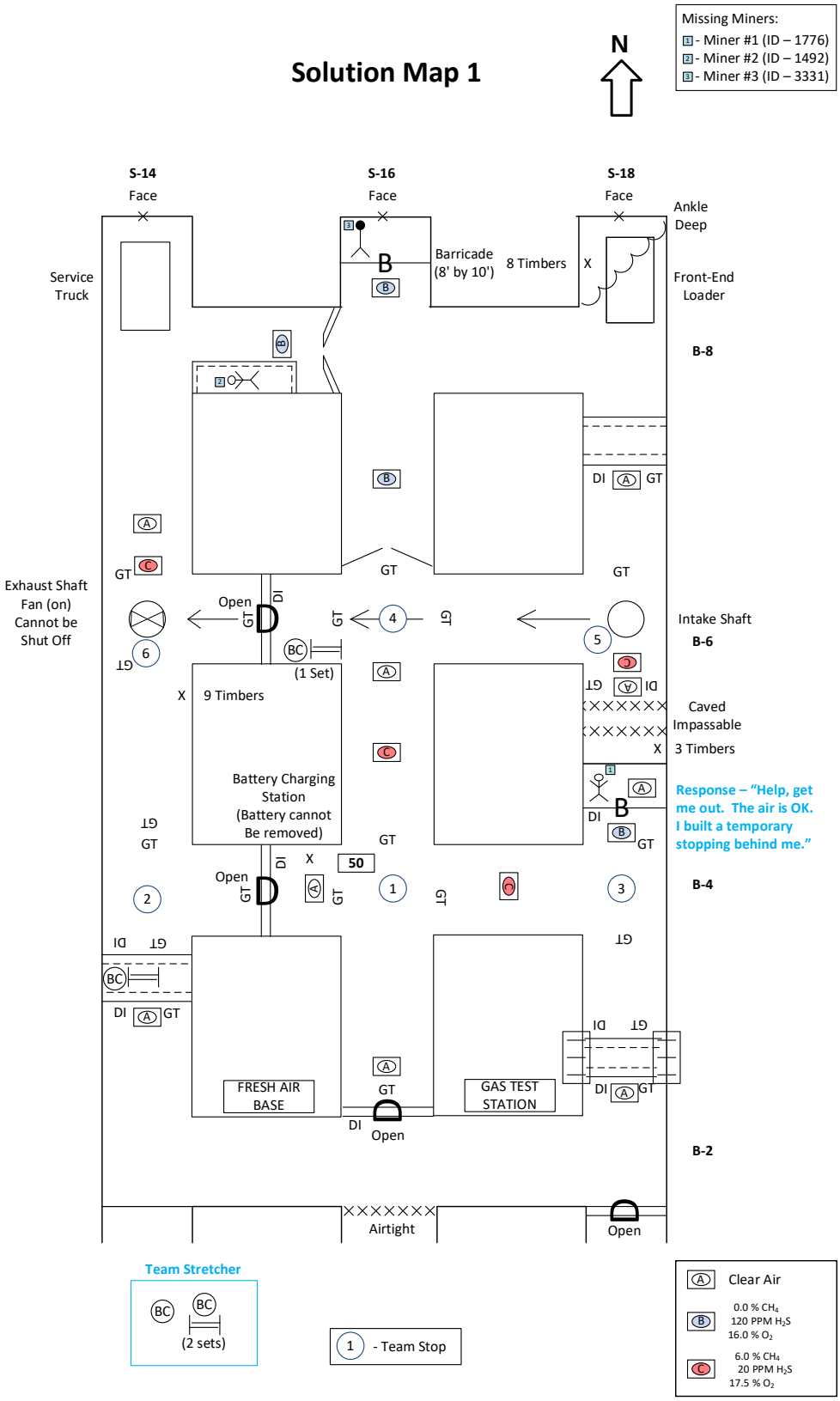
Because of the H_2S and the oxygen-deficiency in the area, the team cannot open the barricade. The team can instruct the miner to stay inside the enclosure until the area has been re-ventilated for safe evacuation. The captain must D&I the barricade as their FPA in this direction. Note: If the team chooses to open the barricade without ventilating first, assess 50 discounts per Judge 1 - UG Rule #18(a) for endangering the survivor by breaching a barricade with a toxic and oxygen-deficient atmosphere outside.

Note: If the team does not notify the fresh air base that they had encountered an air/gas mixture that has reached its explosive range, assess discounts (10x each occurrence) per Judge 1 - UG Rule #14.

Team Stop No. 4
The team will retreat to the intersection of Drift S-16 and Crosscut B-4. Then, they can advance northward in Drift S-16 toward Crosscut B-6. As they travel, they will find a placard about 10 feet into the drift indicating "6.0% CH_4, 20 ppm H_2S, and 17.5% O_2." The team must again call out to the fresh air base to report that they had encountered another air/gas mixture that has reached its explosive range. The team can continue systematic exploration. At the intersection with Crosscut B-6, the captain will perform roof or back checks and the team will conduct necessary gas checks. They will find a placard indicating "clear air." The will also find that the temporary stopping to the north is not intact.

2018 National Contest – Day 1

Solution Map 1



The team can stretch westward in Crosscut B-6 to the permanent stopping and find that the door is open. They will also find two sets of brattice material and frames located along the southern rib. They can take one set with them for future use. The captain must D&I the stopping as their FPA in this direction.

Note: If the team does not notify the fresh air base that they had encountered an air/gas mixture that has reached its explosive range, assess discounts (10x each occurrence) per Judge 1 - UG Rule #14. **This same Note applies to Team Stop No. 5 and Team Stop No. 6 (below).**

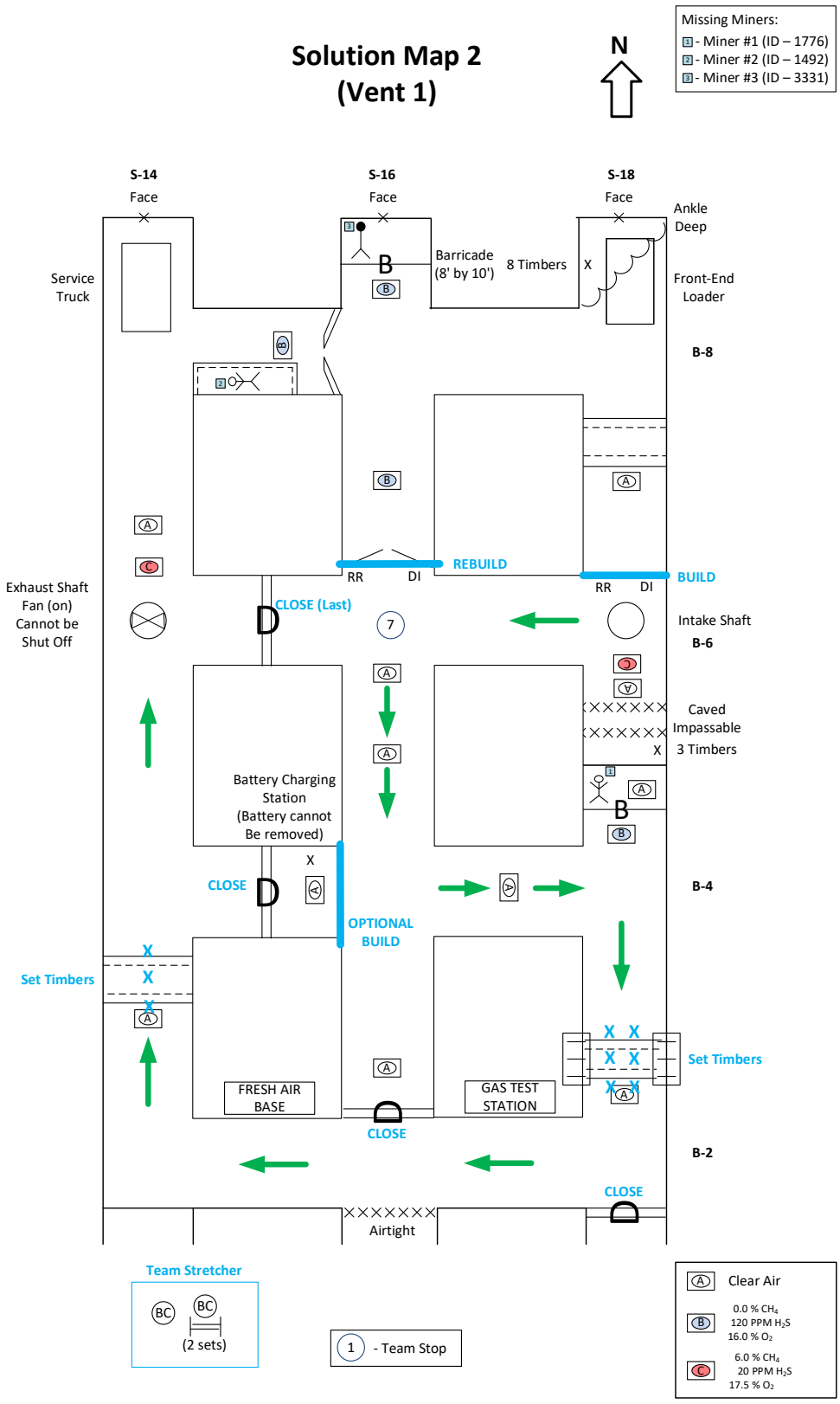
Team Stop No. 5

The team will retreat to Drift S-16 and advance eastward in Crosscut B-6 toward Drift S-18. At the intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find the Intake Shaft in the middle of the intersection (as outlined on the field floor as a 3-foot diameter circle). The captain must warn the team members to avoid passing under the shaft because of the potential for a falling material hazard from above. To the south in the drift, the team will find a placard indicating "6.0% CH_4, 20 ppm H_2S, and 17.5% O_2." The team must again call out to the fresh air base to report that they had encountered an additional air/gas mixture that has reached their explosive range. Stretching southward in the drift to tie in, they will find placard indicating "clear air." They will also find the northern extent of an impassable cave stretching rib-to-rib. The captain must warn the other team members to avoid this hazard. The captain must conduct roof or back checks and the team will conduct necessary gas checks. The captain must D&I the impassable cave as their FPA in this direction. Then, the team can retreat to Crosscut B-6 and stretch northward. About 12 feet inby the intersection, they will find the southern extent of an area of unsafe roof stretching rib-to-rib. The captain must warn the other team members to avoid this hazard. Then, the captain must D&I the unsafe roof as their FPA in this direction **(See Note above concerning notification to FAB).**

Team Stop No. 6

The team will retreat to Drift S-16 and advance westward in Crosscut B-6 toward Drift S-14. As they pass through the open door, the captain performs roof or back checks and the team will conduct necessary gas checks. At the intersection with Drift S-14, the captain will again perform roof or back checks and the team will conduct necessary gas checks. They will find the Exhaust Shaft in the middle of the intersection (as outlined on the field floor as a 3-foot diameter circle). The associated placard will indicate that that the exhaust fan is "on" and "cannot be shut off." The captain must warn the team members to avoid passing under the shaft because of the potential for a falling material hazard from above. To the north in the drift, the team will find a placard indicating "6.0% CH_4, 20 ppm H_2S, and 17.5% O_2." The team must again call out to the fresh air base to report that they had encountered an additional air/gas mixture that has reached its explosive range. Stretching southward in the drift to tie in, they will find 9 timbers lying along the eastern rib. They can take the timbers with them for future use **(See Note above above concerning notification to FAB).**

Solution Map 2 (Vent 1)



Note: Team Stop No. 7 (see Solution Map 2 – Vent 1)

Team Stop No. 7
At this point, the team has explored all accessible areas from the fresh air base to Crosscut B-6. They have located one of the missing miners and roof support materials (9 timbers). Now, they can post their way through the two unsafe areas in Drift S-14 and Drift S-18 since any attempt to re-ventilate and clear the area in front of the barricade will involve passing airflow through these areas.

In Drift S-14, the team can use three of the timbers to support the area of unsafe roof. They will find a set of brattice material and frames which they can take with them, as long as they do not have two sets already on their stretcher. **Note: The team should follow the example shown in Figure 1 on page 36 of the 2016 Metal and Nonmetal Mine Rescue Contest Rules booklet.** If the team removes any installed post after it has been set, assess a team endangerment (75 discounts) or individual endangerment (15 x each person) per Judge 1 – UG Rule #10(b)(7).

For the area of unsafe roof and ribs in Drift S-18, the team can use six of the timbers to support the area (double row of posts). They will not find anything in the area. **Note: The team should follow the example shown in Figure 2 on page 37 of the 2016 Metal and Nonmetal Mine Rescue Contest Rules booklet.** See previous note on discounts for removing an installed post after it has been set.

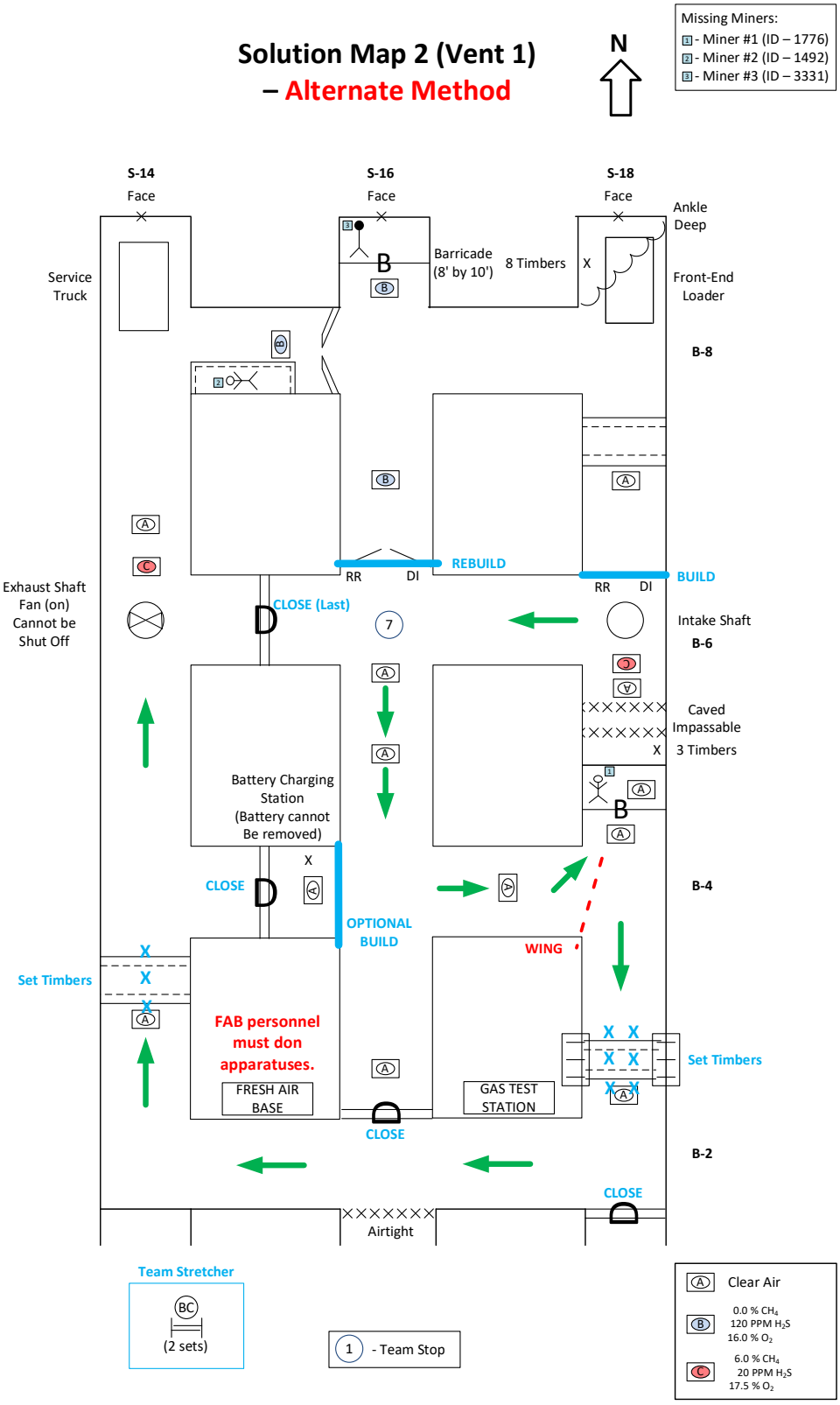
Now, that these two areas have been explored, ventilation changes are necessary to safely rescue Miner #1 from behind the barricade. The first change is needed to clear the explosive mixtures from Drift S-16 and Crosscut B-4 without passing the airflow over the battery charging station (a potential ignition source). The team must confer with the mine manager through their fresh air base coordinator by using the communication line, or by returning to the fresh air base. The team must explain the following changes prior to implementing them:

1) Build a temporary stopping in Drift S-18 just north of Crosscut B-6;
2) Rebuild the temporary stopping in Drift S-16 just north of Crosscut B-6;
3) Close the door in Crosscut B-4 between Drift S-14 and Drift S-16;
4) Close the door in Drift S-16 just north of Crosscut B-2;
5) Build a temporary stopping in Crosscut B-4 to isolate battery charging station (**OPTIONAL BUILD**);
6) Close the door in Drift S-18 just south of Crosscut B-2; and
7) Lastly, close the door in Crosscut B-6 between Drift S-14 and Drift S-16.

These six or seven changes will allow air to flow from the Intake Shaft to the Exhaust Shaft along the established route to flush away the explosive mixtures. **Note: If the team implements these changes, the two gas placards will quickly revert to "clear air" along this route as shown on Solution Map 2 (Vent 1).**

2018 National Contest – Day 1

Solution Map 2 (Vent 1) – Alternate Method

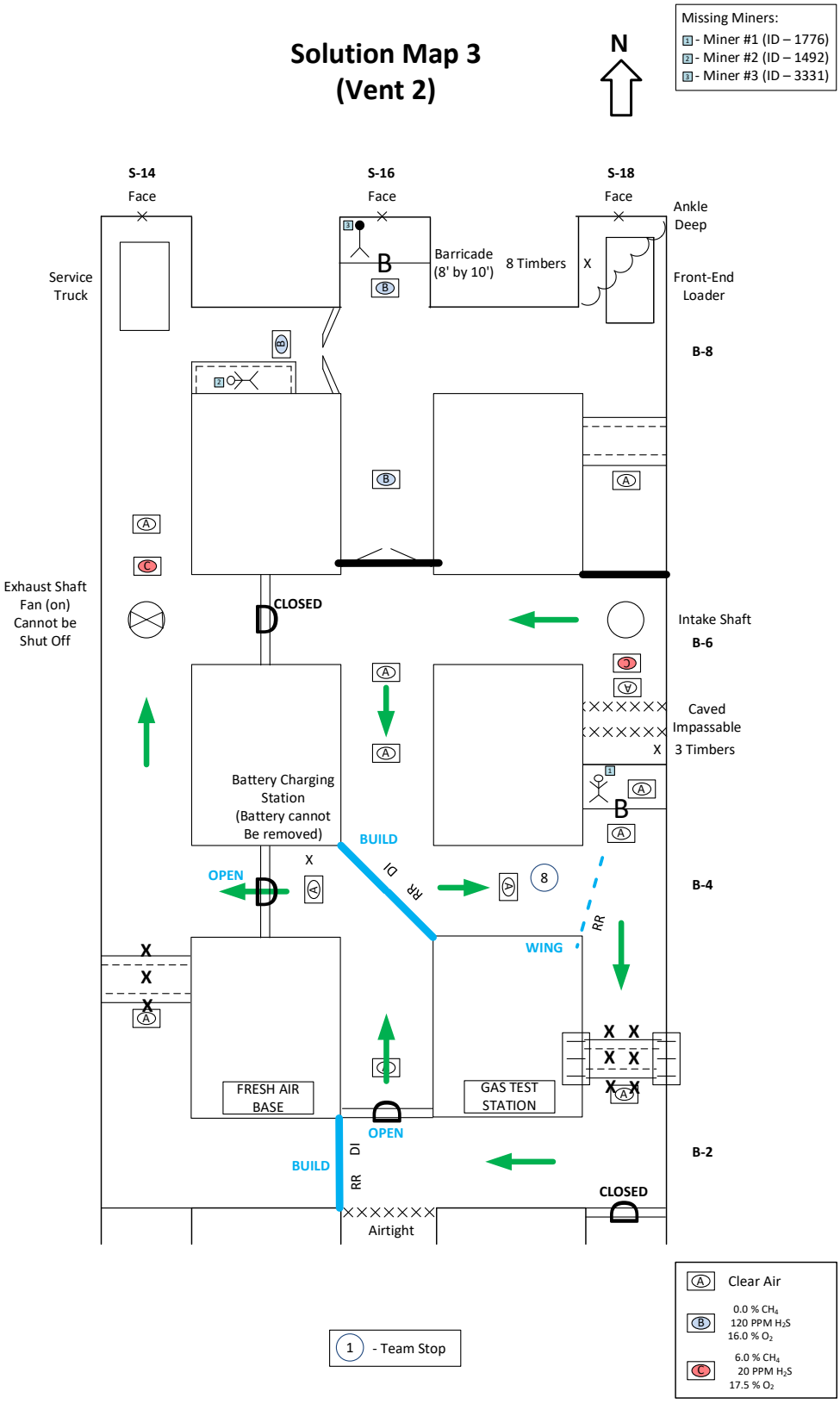


Note: If the team chooses to erect a “wing” curtain in Drift S-18 to direct airflow toward the barricade in addition to the changes outlined in **Team Stop 7**, they will sweep the area and send toxic contaminants (120 ppm H_2S) and an oxygen deficient atmosphere (16.0 % O_2) over the fresh air base. **This is an acceptable method as long as the team member / members stationed at the fresh air base don their apparatuses or the fresh air base is moved to an alternate location that will remain in fresh air before the outlined changes are implemented.** If the team does not take measures to protect the additional team members stationed at the fresh air base and sends the toxic contaminants (120 ppm H_2S) and oxygen deficient atmosphere (16% O_2) over the area, then assess an individual team member endangerment (15 x each person) per Judge 1 – UG Rule #10(a).

If the team chooses to re-ventilate as shown on Solution Map 2 (Vent 1) without erecting a “wing” curtain, they will need to make a second ventilation change to clear the atmosphere in front of the barricade. The following **Team Stop No. 8** describes this second option in detail.

2018 National Contest – Day 1

Solution Map 3 (Vent 2)



Note: Team Stop No. 8 (see Solution Map 3 – Vent 2)

Team Stop No. 8

Now, a second ventilation change is necessary to clear the hydrogen sulfide (H_2S) concentrations and oxygen-deficient atmosphere from in front of the barricade in Drift S-18 to safely rescue Miner #1 without passing the airflow across the fresh air base (in Crosscut B-2) and endangering the team member(s) stationed there. The team must confer with the mine manager through their fresh air base coordinator by using the communication line, or by returning to the fresh air base. The team must explain the following changes prior to implementing them:

1) Build a diagonal temporary stopping in the intersection of Drift S-16 and Crosscut B-4 (this will necessitate the use of two sets of brattice material to span the distance between the corners of the northwest and southeast pillars);

2) Build the temporary stopping east of the fresh air base in Crosscut B-2 (to isolate the team members);

3) Open the door in Drift S-16 just north of Crosscut B-2;

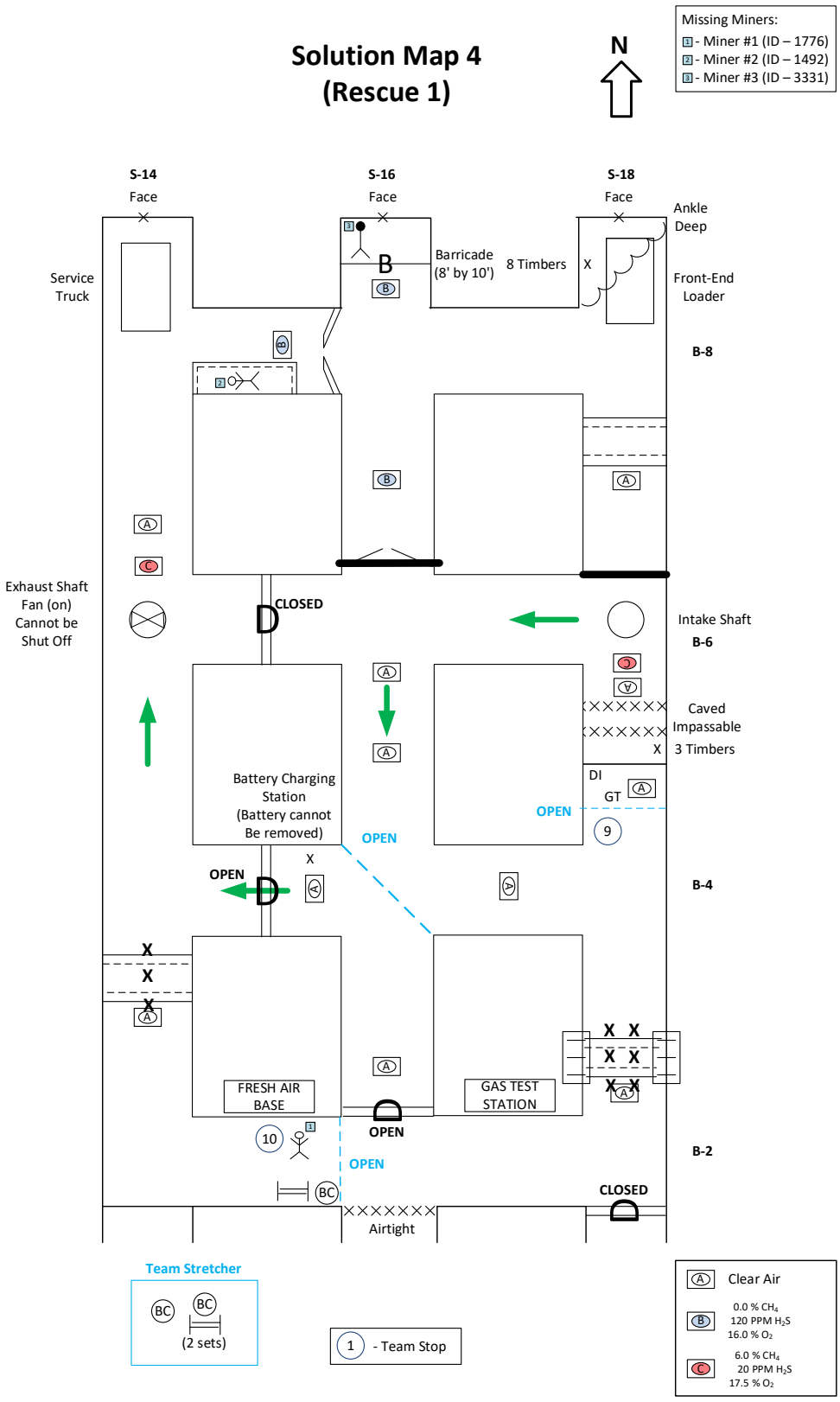
4) Open the door in Crosscut B-4 between Drift S-14 and Drift S-16; and

5) Lastly, deploy a "wing" curtain in Drift S-18 to direct airflow toward the barricade.

These five changes will allow the air to flow from the Intake Shaft to the Exhaust Shaft along the established route to flush away the contaminants and increase the oxygen content in front of the barricade. **Note: If the team implements these changes, the gas placard will quickly revert to "clear air" along this route as shown on Solution Map 3 (Vent 2).**

Again, if the team does not take measures to protect the additional team members stationed at the fresh air base and sends the toxic contaminants (120 ppm H_2S) and oxygen deficient atmosphere (16% O_2) over the area, then assess an individual team member endangerment (15 x each person) per Judge 1 – UG Rule #10(a).

Solution Map 4
(Rescue 1)



Note: Team Stop Nos. 9 - 10 (see Solution Map 4 – Rescue 1)

Team Stop No. 9

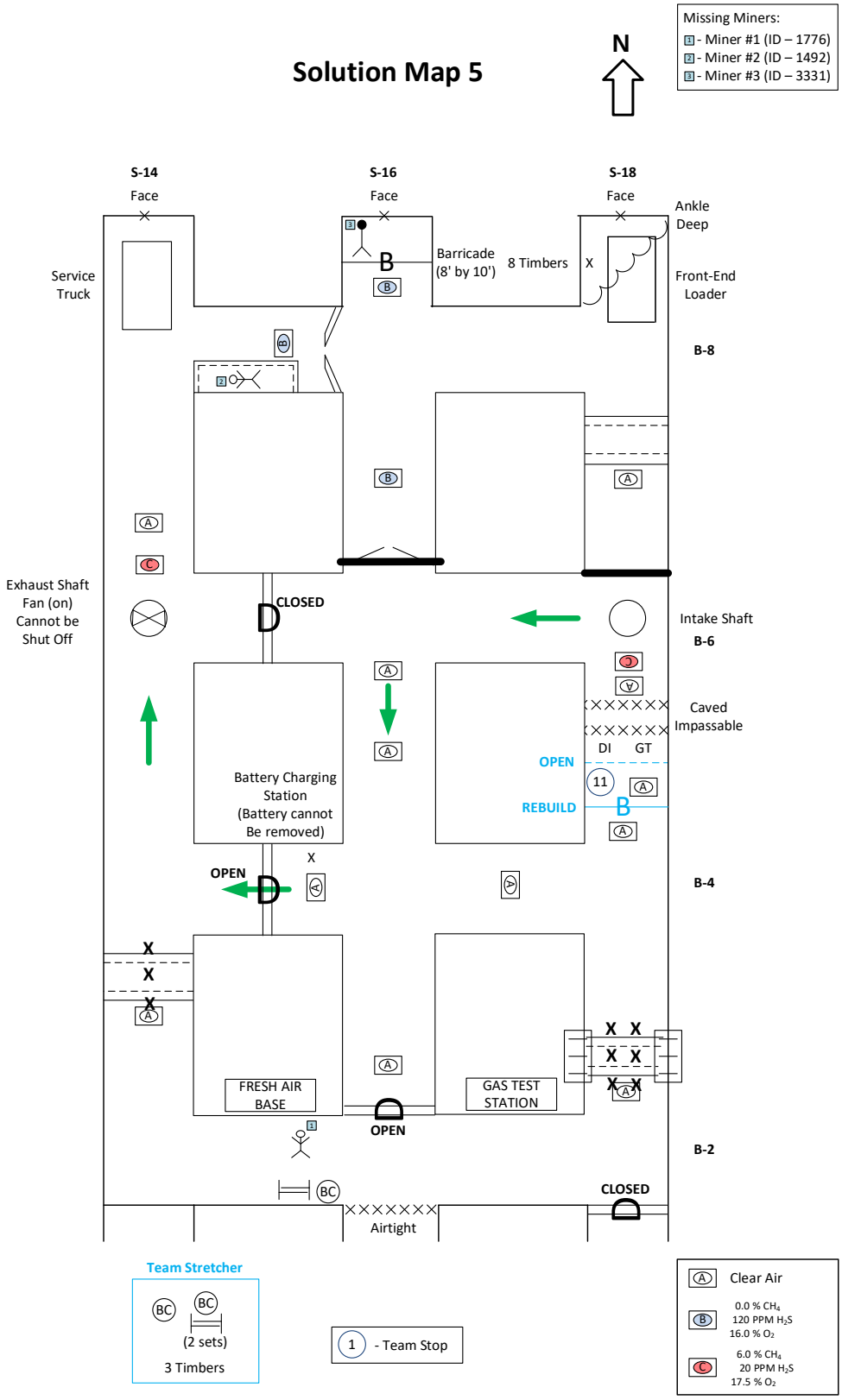
Now, the team can return to the barricade and open it up. Once inside they will find Miner #1. The team members can assess the miner's condition and find that he/she is not injured and able to walk out with the team. At this time, the captain and another team member can perform roof or back checks and the team can conduct necessary gas tests. They will find a placard indicating "clear air" and the temporary stopping that the miner had erected previously. Before leaving the area, the captain must D&I the temporary stopping as their FPA in that direction, as well as the location of the miner.

Team Stop No. 10

The team can escort Miner #1 to the fresh air base. The miner will not need to wear respiratory protection since the drifts and crosscuts have been cleared. To ensure the safety of the survivor, all areas that had been cleared of toxic gases must be gas tested from rib-to-rib along the route that they travel. Once at the fresh air base, the team can leave Miner #1 with the attendants for any follow-up medical treatment.

2018 National Contest – Day 1

Solution Map 5



Note: Team Stop No. 11 (see Solution Map 5)

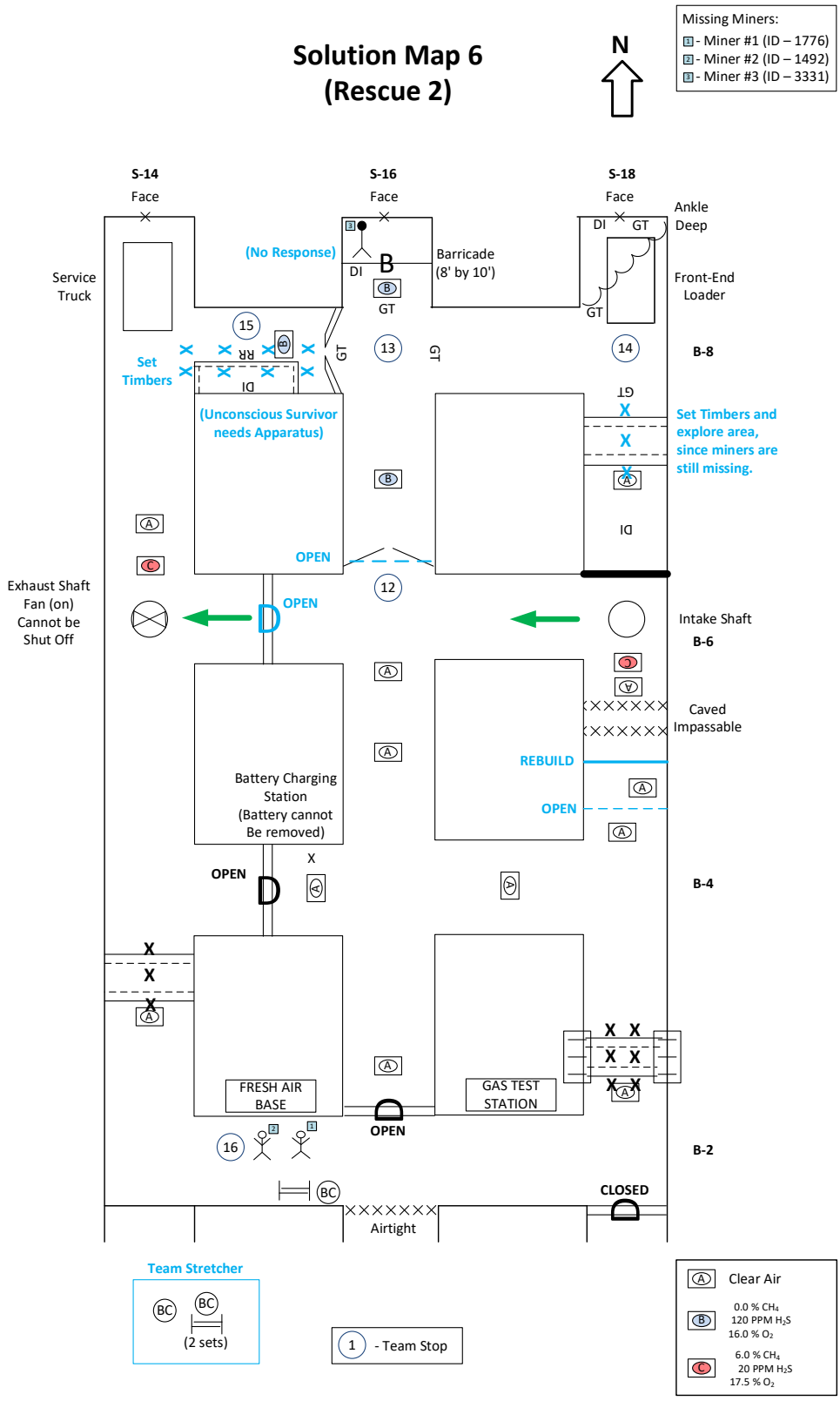
Team Stop No. 11

At this point, the team must continue systematic exploration to locate the remaining two missing miners. Before advancing beyond Crosscut B-6 (to the north); however, to tie in, the team must return to Drift S-18 (where they had rescued Miner #1) and complete the exploration of the area north of the temporary stopping toward the impassable cave. In order to accomplish this, the team can rebuild the barricade to form an airlock. Then, they can open the temporary stopping and stretch northward. The team will find 3 timbers lying along the eastern rib. They can take the timbers with them for future use. The team will also find the southern extent of the impassable cave stretching rib-to-rib. The captain must warn the other team members to avoid this hazard. The captain must conduct roof or back checks and the team will conduct necessary gas checks. The captain must D&I the impassable cave as their FPA in this direction.

Note: To avoid an unintentional ventilation change, the team cannot open the temporary stopping without constructing an airlock. If they do, assess 15 discounts per Judge 2 - UG Rule #12 for changing ventilation before the effects of such changes are known. In addition, the explosive air/gas mixture (located north of the impassable cave) will pass through the cave and travel westward in Crosscut B-4 toward the Exhaust Shaft, passing over the battery charging station (a potential ignition source). As a result, the team will be assessed 75 discounts for team endangerment per Judge 1 – UG Rule #10(b)(3).

If the team does not complete the exploration of this accessible area, assess discounts for unsystematic exploration (25 x each infraction) per Judge 1 – UG Rule #11.

Solution Map 6 (Rescue 2)



Note: Team Stop Nos. 12 - 16 (see Solution Map 6 – Rescue 2)

Team Stop No. 12
Now, the team must rebuild the temporary stopping before opening the barricade and leaving the area. **If they do not, see the Note for Team Stop No. 11 for appropriate discounts.** The team can then travel to the intersection of Drift S-16 and Crosscut B-6 to continue systematic exploration.

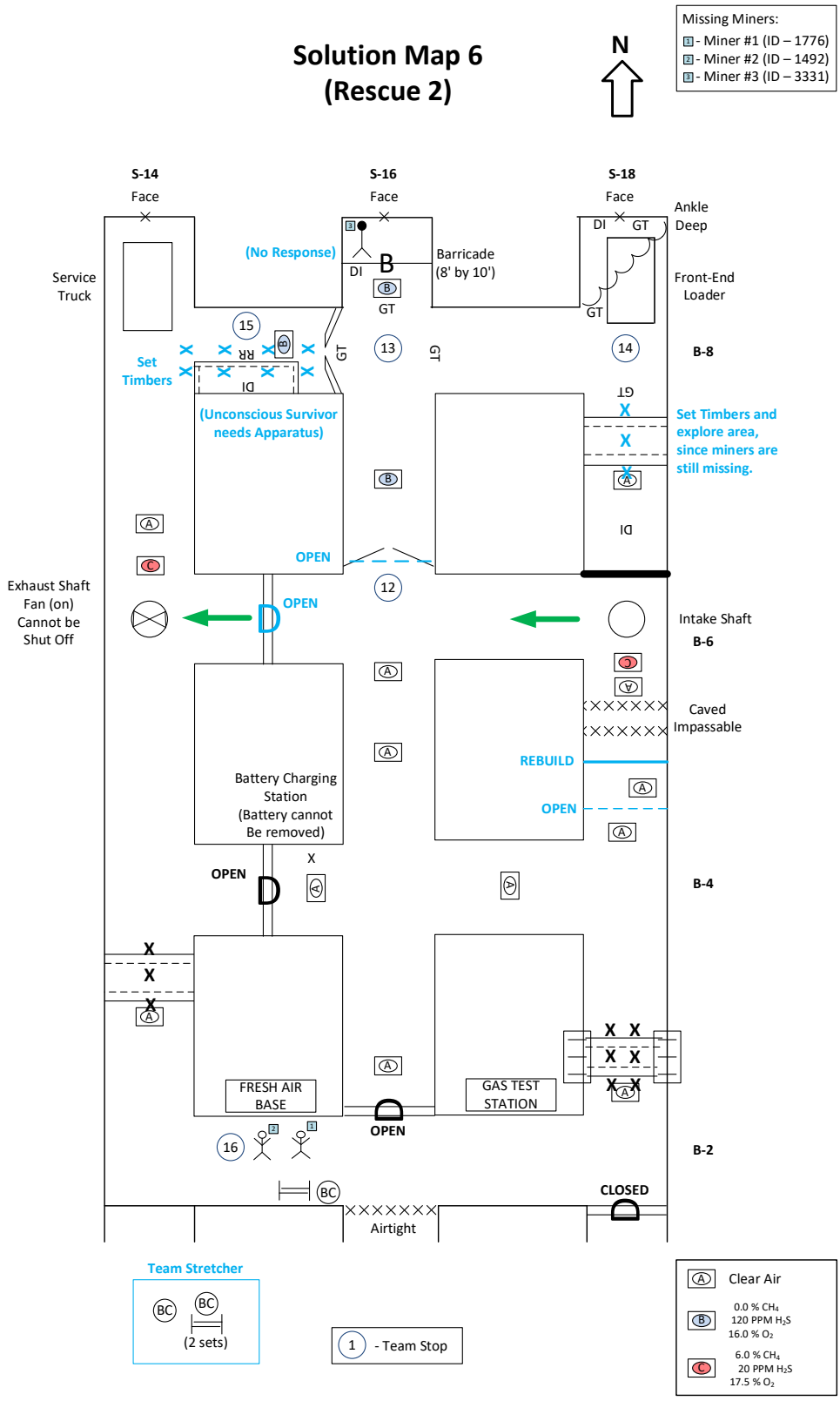
Team Stop No. 13
Before advancing northward, the team must re-open the door in the permanent stopping in Crosscut B-6 between Drift S-14 and Drift S-16. This will short-circuit airflow from the Intake Shaft to the Exhaust Shaft (restoring the same condition as found at the beginning of the problem). Then, the team can re-open the temporary stopping that they had previously rebuilt immediately north of the intersection. Afterward, they can advance northward in Drift S-16 to Crosscut B-8. About 10 feet north of the intersection, the team will find a placard indicating "0.0% CH_4, 120 ppm H_2S, and 16.0% O_2." Once they reach the intersection with Crosscut B-8, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find that the crosscut is open to the east and the west (through a partially intact permanent stopping). To the north, they will find a placard indicating that the same gas concentrations extend into the face area. Stretching northward, the team will find an 8-foot by 10-foot brattice cloth barricade stretching rib-to-rib. If the team captain calls out to anyone inside, there is no response. The captain must D&I the barricade as their FPA in this direction.

Because of the H_2S and the oxygen-deficiency in the area, the team cannot open the barricade. Note: If the team chooses to open the barricade without ventilating first, assess 50 discounts per Judge 1 - UG Rule #18(a) for endangering the survivor by breaching a barricade with a toxic and oxygen-deficient atmosphere outside.

Note: If the team does not re-open the door in the permanent stopping in Crosscut B-6 between Drift S-14 and Drift S-16, an airlock will be needed to prevent an inadvertent ventilation change when re-opening the temporary stopping that they had previously rebuilt north of the intersection. This omission would send airflow into an unexplored area along this parallel path. If they do not, assess 15 discounts per Judge 2 - UG Rule #12 for changing ventilation before the effects of such changes are known.

Team Stop No. 14
The team can advance eastward in Crosscut B-8 toward Drift S-18. At the intersection with Drift S-18, the captain will perform roof or back checks and the team will conduct necessary gas checks. They will find a front-end loader parked in the face area, extending into the intersection. Stretching southward, the team will find the northern extent of the area of unsafe roof (stretching rib to rib). Since there are still miners missing, the team can use the 3 timbers which they had previously found to support and explore the area to tie in. They will not find anything in the area. The captain must D&I their FPA in this direction.

Solution Map 6 (Rescue 2)



The team will retreat to the intersection and stretch northward into the face area past the front-end loader. They will find 8 timbers lying along the western rib. The team can take these with them for future use. At the face, the captain performs roof or back checks and the team will conduct necessary gas checks. The captain must D&I the face as their FPA in this direction.

Note: The team should follow the example shown in Figure 1 on page 36 of the 2016 Metal and Nonmetal Mine Rescue Contest Rules booklet. If the team removes any installed post after it has been set, assess a team endangerment (75 discounts) or individual endangerment (15 x each person) per Judge 1 – UG Rule #10(b)(7).

Team Stop No. 15

The team can retreat to the intersection of Drift S-16 and Crosscut B-8 and then advance westward in the crosscut toward Drift S-14. As they pass through the partially intact permanent stopping, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find a placard indicating "0.0% CH_4, 120 ppm H_2S, and 16.0% O_2." They will also find an area of unsafe roof extending from the southern rib (4-feet wide by 10-feet long). They will see one of the missing miners (Miner #2, ID 1492) lying in this area and unresponsive. They can use the 8 timbers that they previously found in Drift S-18 to support the area. The team captain must perform necessary roof or back checks directly over the miner. After a primary assessment, the #1 Judge will hand the team member a placard which reads: **"The miner is unconscious with no apparent injuries."** The captain must D&I the location of the miner. **Since there are no injuries, the team must follow the prescribed treatment for prevention of shock (listed in Brady's 10th Edition on page 397).** At this time, the team can continue with their secondary survey and then secure the miner to the stretcher.

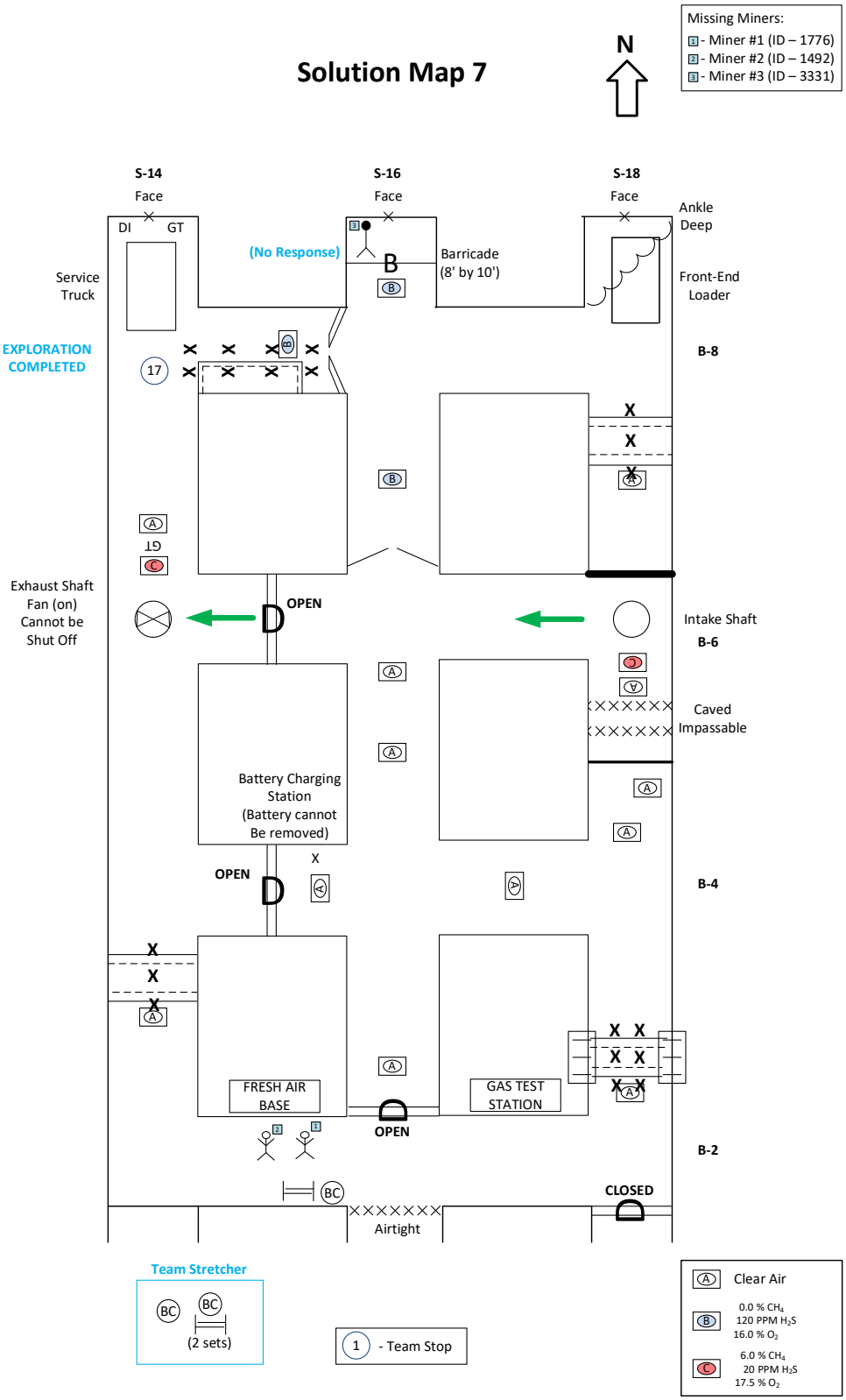
Note: The team should follow the example shown in Figure 4 on page 39 of the 2016 Metal and Nonmetal Mine Rescue Contest Rules booklet. If the team removes any installed post after it has been set, assess a team endangerment (75 discounts) or individual endangerment (15 x each person) per Judge 1 – UG Rule #10(b)(7).

The unconscious miner must be fitted with proper respiratory protection. If the team performs any act that may result in death or injury to the survivor, including failure to provide proper respiratory protection when needed, assess discounts (50 x each person) per Judge 1 – UG Rule 18(a) – 18(d).

Team Stop No. 16

When ready, the team can carry Miner #2 toward the fresh air base. Once at the fresh air base, the team can leave Miner #1 with the attendants and arrange for any follow-up medical treatment.

Solution Map 7

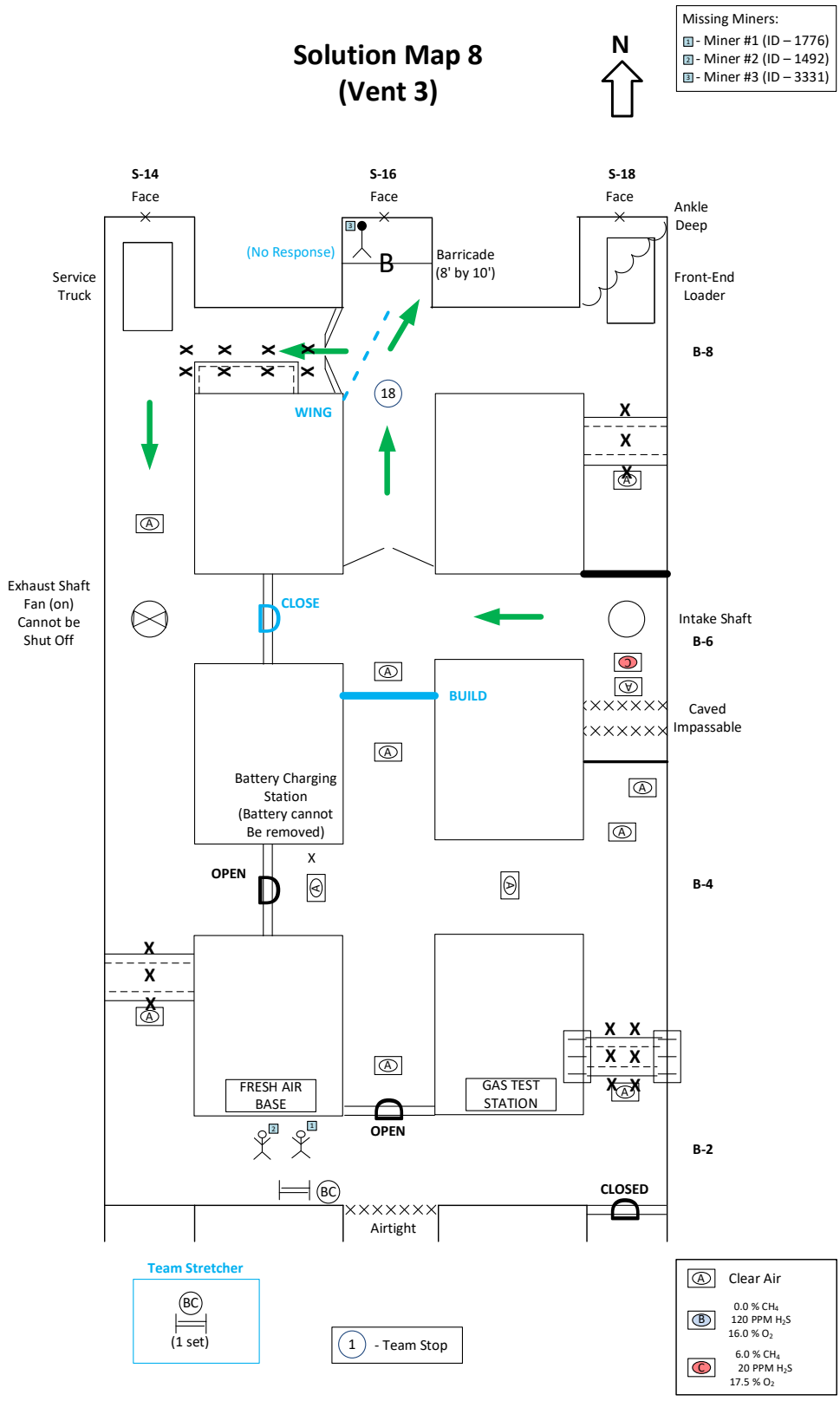


Note: Team Stop No. 17 (see Solution Map 7)

Team Stop No. 17

To complete systematic exploration, the team can return to the intersection of Drift S-16 and Crosscut B-8. Then, they can travel westward in the crosscut to Drift S-14. At the intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find a service truck parked in the middle of the face area, extending into the intersection. The team can stretch southward in the drift to tie in. After retreating to Crosscut B-8, the team can advance northward beside the service truck to the face of Drift S-14. The captain performs roof or back checks and the team will conduct necessary gas checks. The captain must D&I the face as their FPA in this direction. Now, that all accessible areas of the mine have been explored, they can conclude that the last missing miner is located behind the barricade in Drift S-16.

Solution Map 8 (Vent 3)



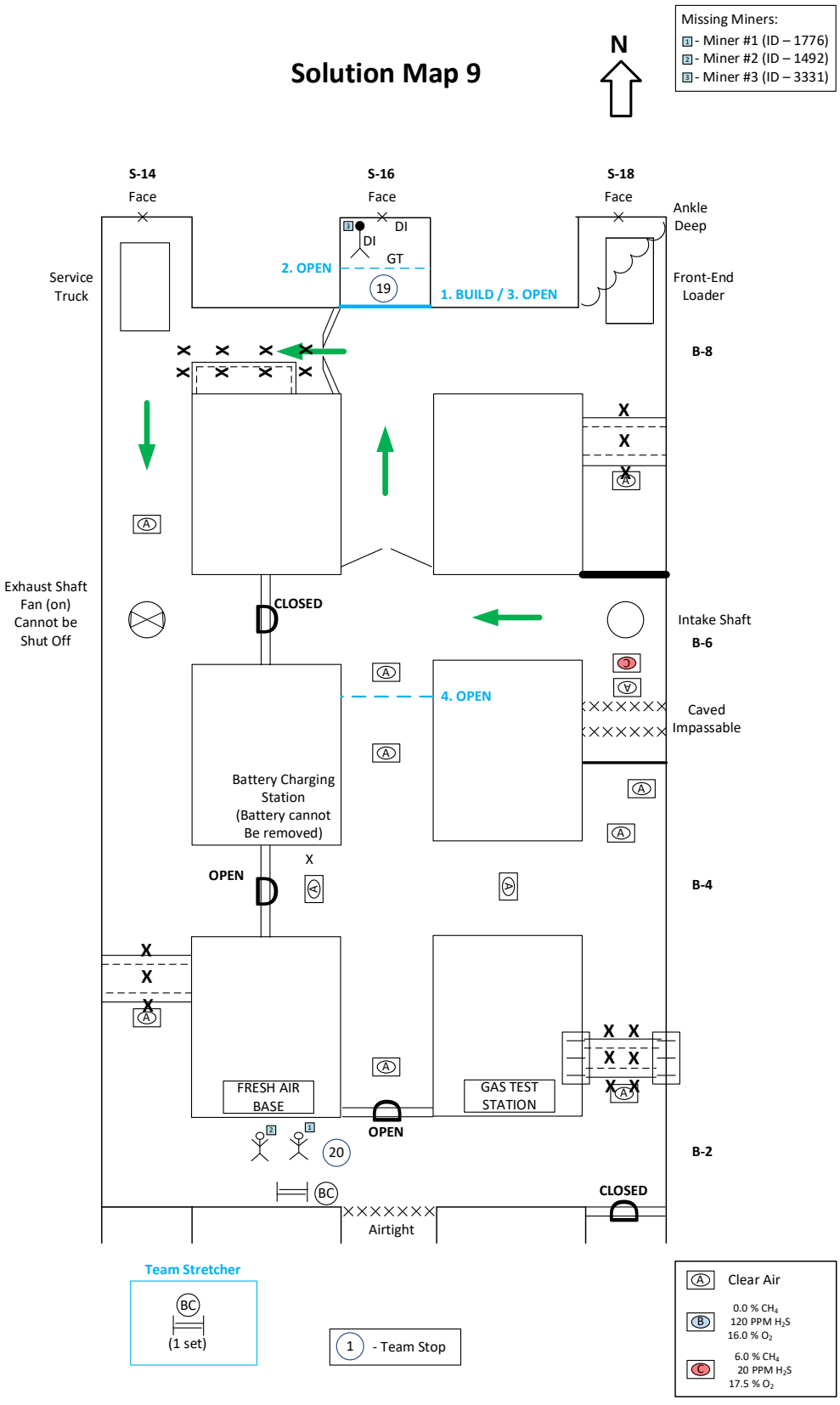
Note: Team Stop No. 18 (see Solution Map 8 – Vent 3)

Team Stop No. 18
At this point, a ventilation change is necessary to clear the area in front of the barricade in Drift S-16. The team must confer with the mine manager through their fresh air base coordinator by using the communication line, or by returning to the surface. The team must explain the following changes prior to implementing them:

1) Build a temporary stopping in Drift S-16 south of Crosscut B-6;
2) Close the door in Crosscut B-6 between Drift S-14 and Drift S-16; and
3) Deploy a “wing” curtain in Drift S-16 to direct airflow toward the barricade.

These two changes will allow the air to flow from the Intake Shaft to the Exhaust Shaft along the established route to flush away the contaminants and increase the oxygen content in front of the barricade. **Note: If the team implements these changes, the gas placard will quickly revert to “clear air” along this route as shown on Solution Map 8 (Vent 3).**

Solution Map 9



Note: Team Stop Nos. 19 - 20 (see Solution Map 9)

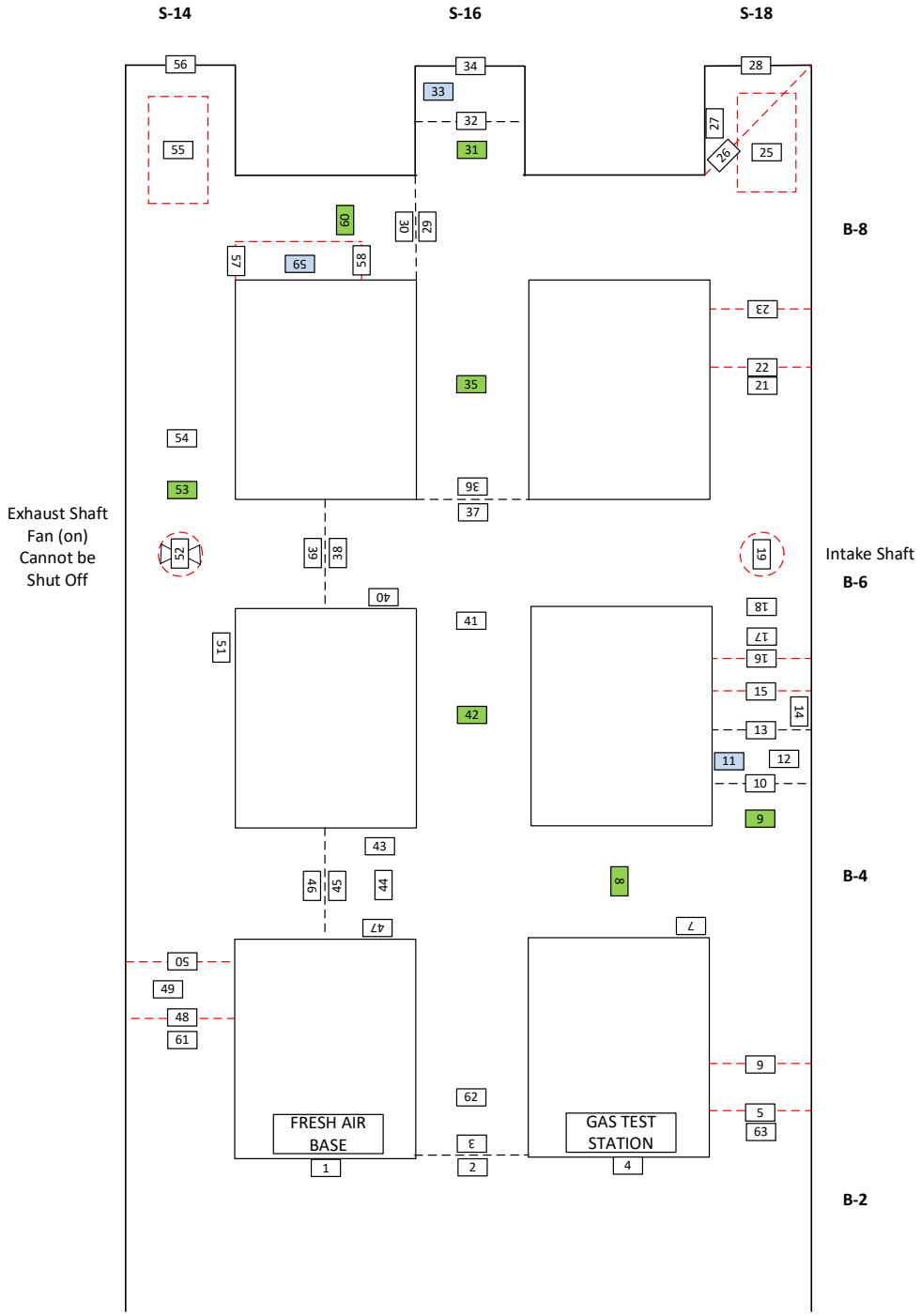
Team Stop No. 19
Because there is no response from behind the barricade, it represents an "unknown' for the team. Therefore, they must erect an airlock across the drift behind them before opening the barricade. As they pass through the opened barricade, the captain performs roof or back checks and the team will conduct necessary gas checks. Once inside they will find Miner #3 (ID – 3331), lying on the ground and unresponsive. The team captain must perform necessary roof or back checks directly over the miner. After a primary assessment, the #1 Judge will hand the team member a placard which reads: **"The miner is badly burned and exhibits no vital signs. The miner is dead."** The captain must D&I the location of the body. Before leaving the area, the captain must also D&I the face as their FPA in this direction. Then, they can tear down the airlock that they had previously constructed and proceed southward in Drift S-16.

Team Stop No. 20
As the team travels to the fresh air base, they can tear down the temporary stopping that they had previously erected in Drift S-16 and continue southward. Once at the fresh air base, the captain can state that the team has completed its mission. That is, they have explored all accessible areas of Panel 1, re-ventilated the areas as needed, located the three missing miners, and brought two of them out alive.

***** THE END *****

2 = Single-sided Placard
31 = Double-sided Gas Placard
59 = Double-sided Miner Placard

Placard Map

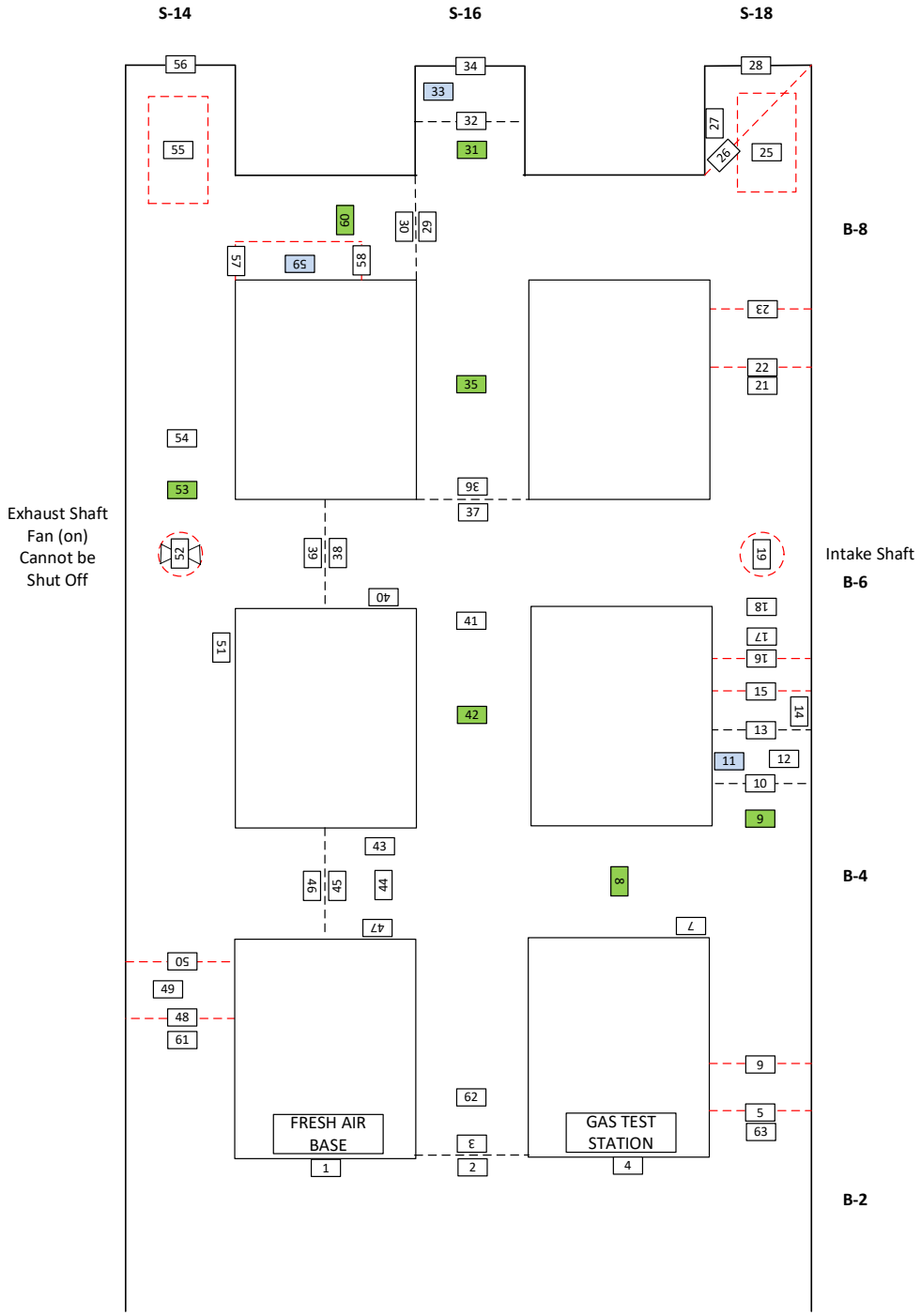


Placard Key:

1. Fresh Air Base
2. Permanent Stopping with Door (open)
3. Permanent Stopping with Door (open)
4. Gas Test Station
5. Unsafe Roof & Ribs ▲
6. Unsafe Roof & Ribs ▲
7. Brattice Material (Wing)
8. 6.0 % CH_4
20 ppm H_2S
17.5 % O_2
9. 0.0 % CH_4
120 ppm H_2S
16.0 % O_2
10. Barricade (8’ by 10’)
11. Person / Miner #1 (ID – 1776)
12. Clear Air
13. Temporary Stopping
14. 3 Timbers
15. Caved Impassable (Rib-to-Rib)
16. Caved Impassable (Rib-to-Rib)
17. Clear Air
18. 6.0 % CH_4
20 ppm H_2S
17.5 % O_2
19. Intake Shaft
21. Clear Air
22. Unsafe Roof (Rib-to-Rib) ▲
23. Unsafe Roof (Rib-to-Rib) ▲
25. Front-End Loader
26. Water Ankle Deep
27. 8 Timbers
28. Face Drift S-18
29. Permanent Stopping Not Intact
30. Permanent Stopping Not Intact
31. 0.0 % CH_4
120 ppm H_2S
16.0 % O_2
32. Barricade (8’ by 10’)
33. Person / Miner #3 (ID – 3331)
34. Face Drift S-16
35. 0.0 % CH_4
120 ppm H_2S
16.0 % O_2
36. Temporary Stopping Not Intact
37. Temporary Stopping Not Intact
38. Permanent Stopping with Door (open)
39. Permanent Stopping with Door (open)
40. Brattice Material & Frames (2 sets)
41. Clear Air
42. 6.0 % CH_4
20 ppm H_2S
17.5 % O_2
43. Battery Charging Station
(Battery Cannot be Removed)

2 = Single-sided Placard
31 = Double-sided Gas Placard
59 = Double-sided Miner Placard

Placard Map



Placard Key (continued):

44. Clear Air

45. Permanent Stopping with Door (open)

46. Permanent Stopping with Door (open)

47. Brattice Material & Frames (1 set)

48. Unsafe Roof (Rib-to-Rib) ▲

49. Brattice Material & Frames (1 set)

50. Unsafe Roof (Rib-to-Rib) ▲

51. 9 Timbers

52. Exhaust Shaft
    Fan Operating
    (cannot be shut off)

53. 6.0 % CH_4
    20 ppm H_2S
    17.5 % O_2

54. Clear Air

55. Service Truck

56. Face Drift S-14

57. Unsafe Roof ▲

58. Unsafe Roof ▲

59. Person / Miner #2 (ID – 1492)

60. 0.0 % CH_4
    120 ppm H_2S
    16.0 % O_2

61. Clear Air

62. Clear Air

63. Clear Air

Note: Double-sided Placards

Five gas placards (8, 35, 42, 53 and 60) can be flipped when changes are made by the team to successfully ventilate these areas.

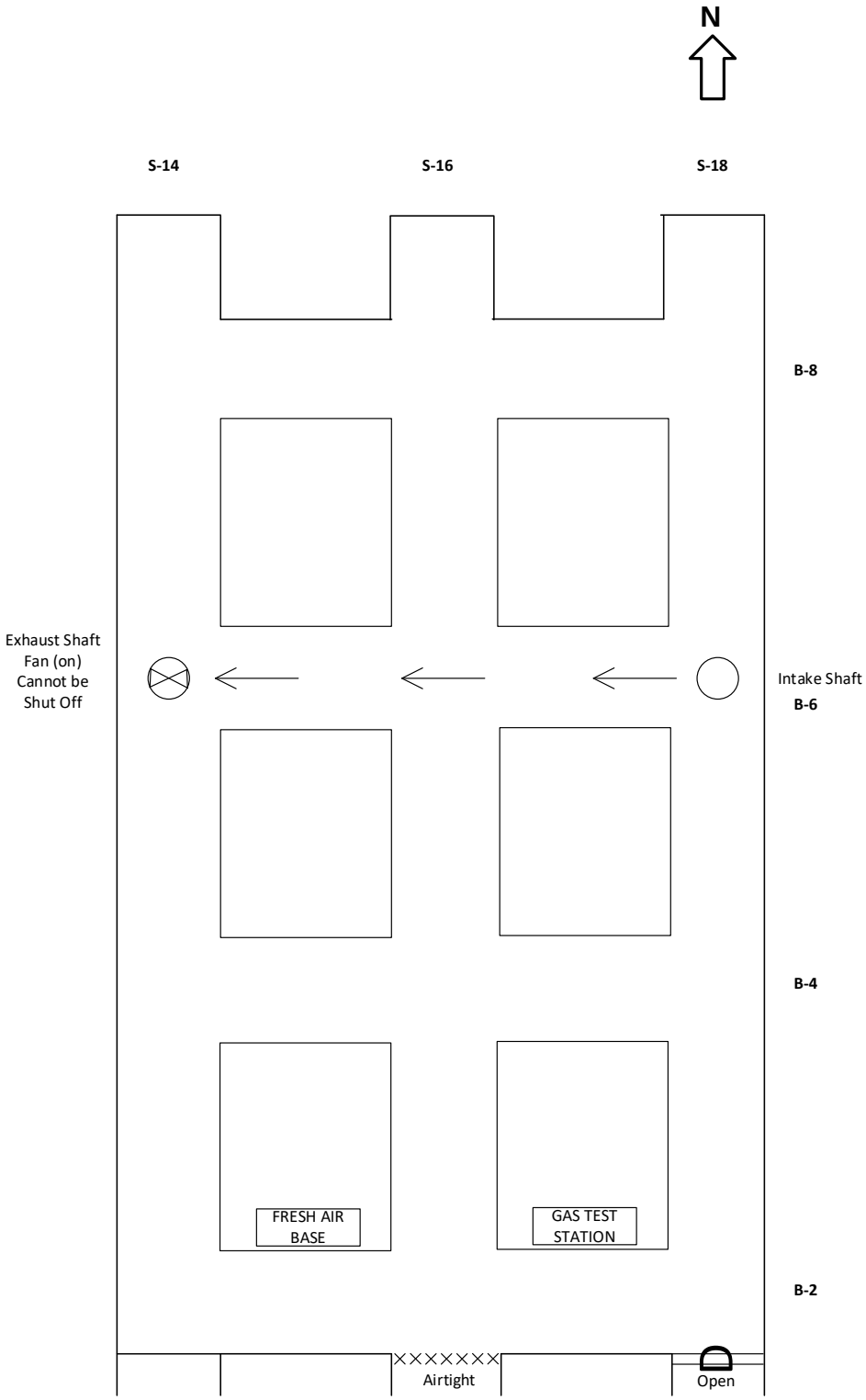
Two gas placards (9 and 31) can be flipped when a brattice cloth wing curtain is utilized to sweep contaminants away from the respective barricade.

Three placards (11, 33 and 59), one for each missing miner, can be flipped to show their respective identification number.

2018 National Contest – Day 1

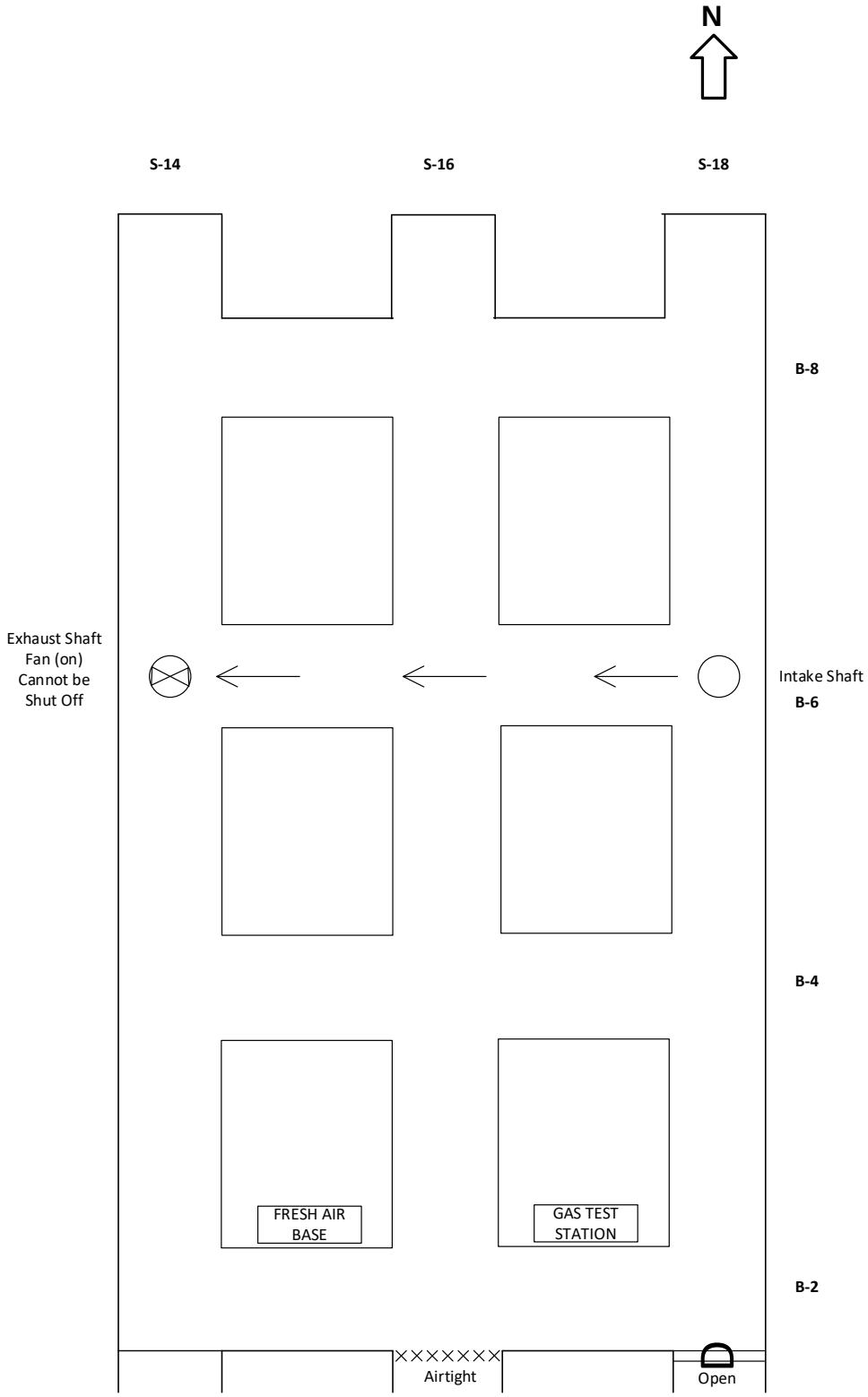
Team Working Order # _____

Team Map (Panel 1)



Team Working Order # _____

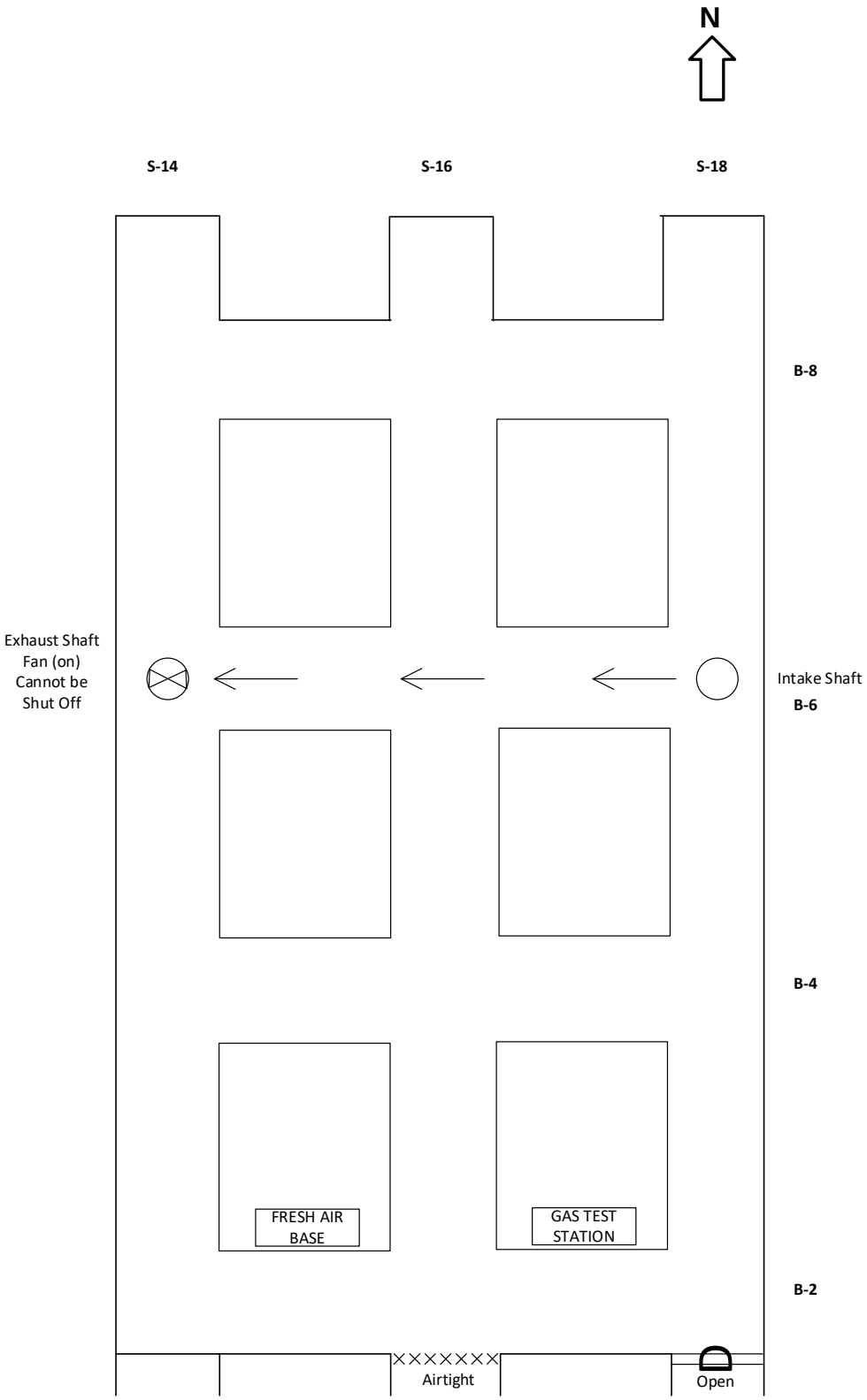
Fresh Air Base Map (Panel 1)



2018 National Contest – Day 1

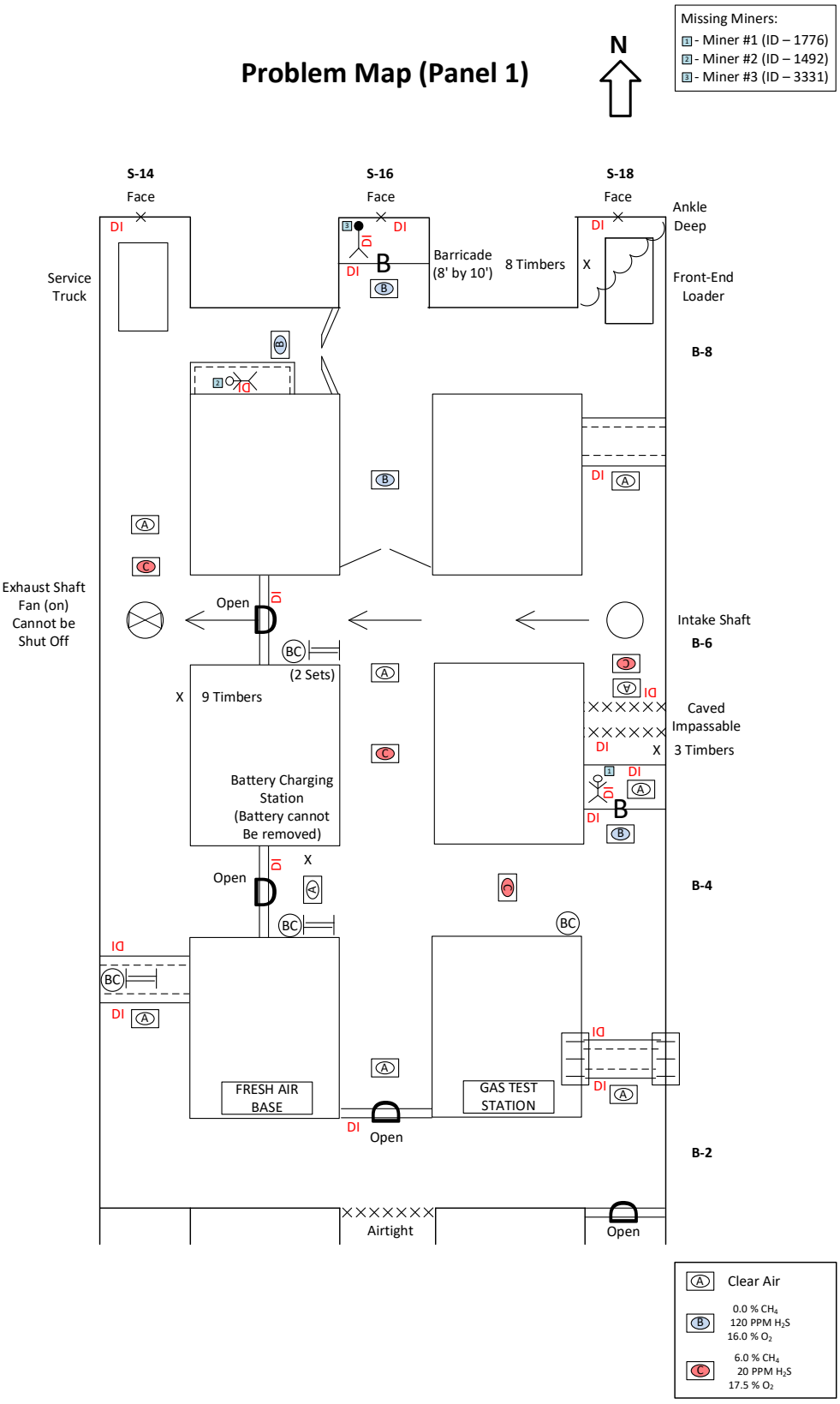
Team Working Order # _____

Fresh Air Base Alternate Map (Do Not Score)



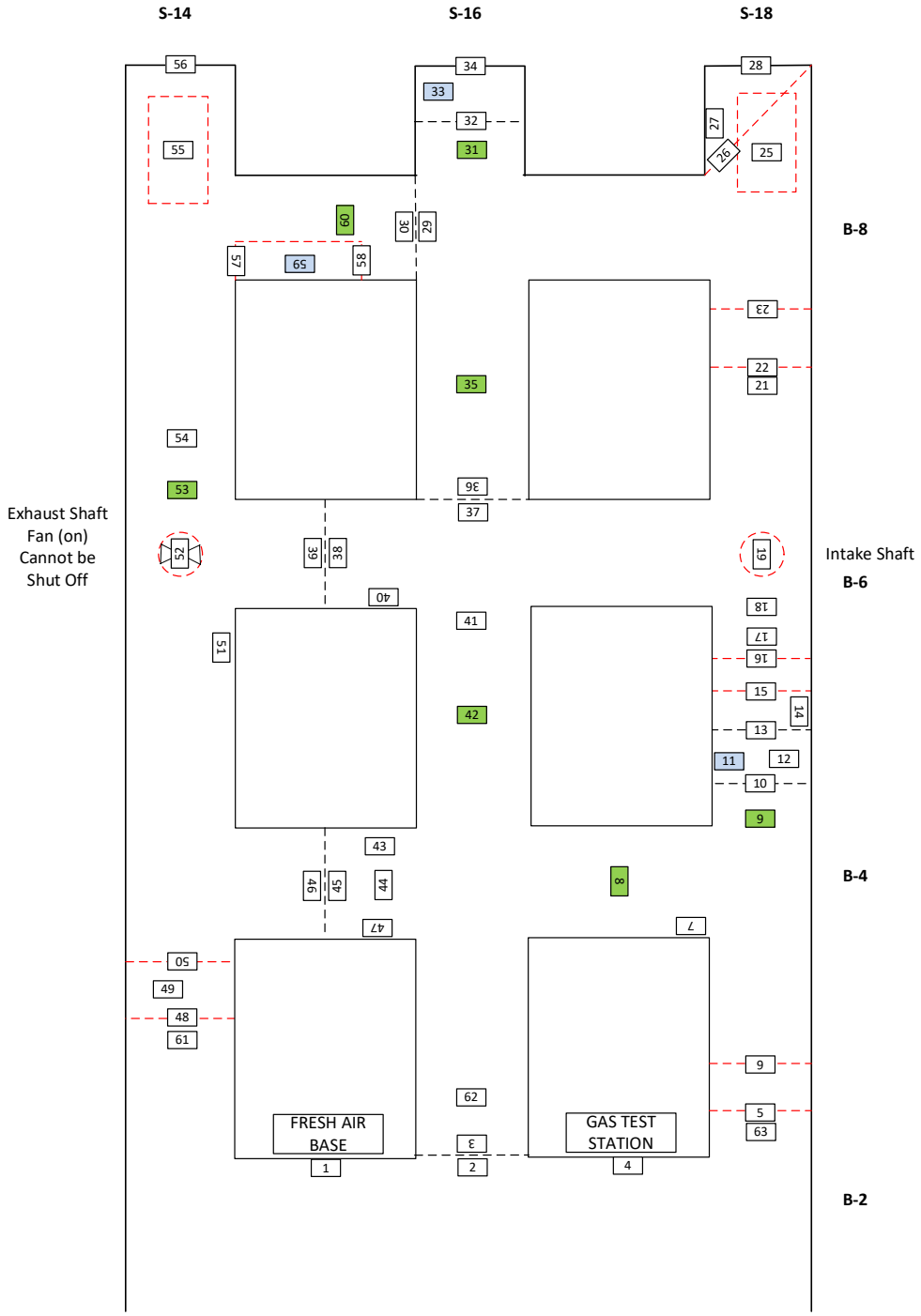
2018 National Contest – Day 1

Problem Map (Panel 1)

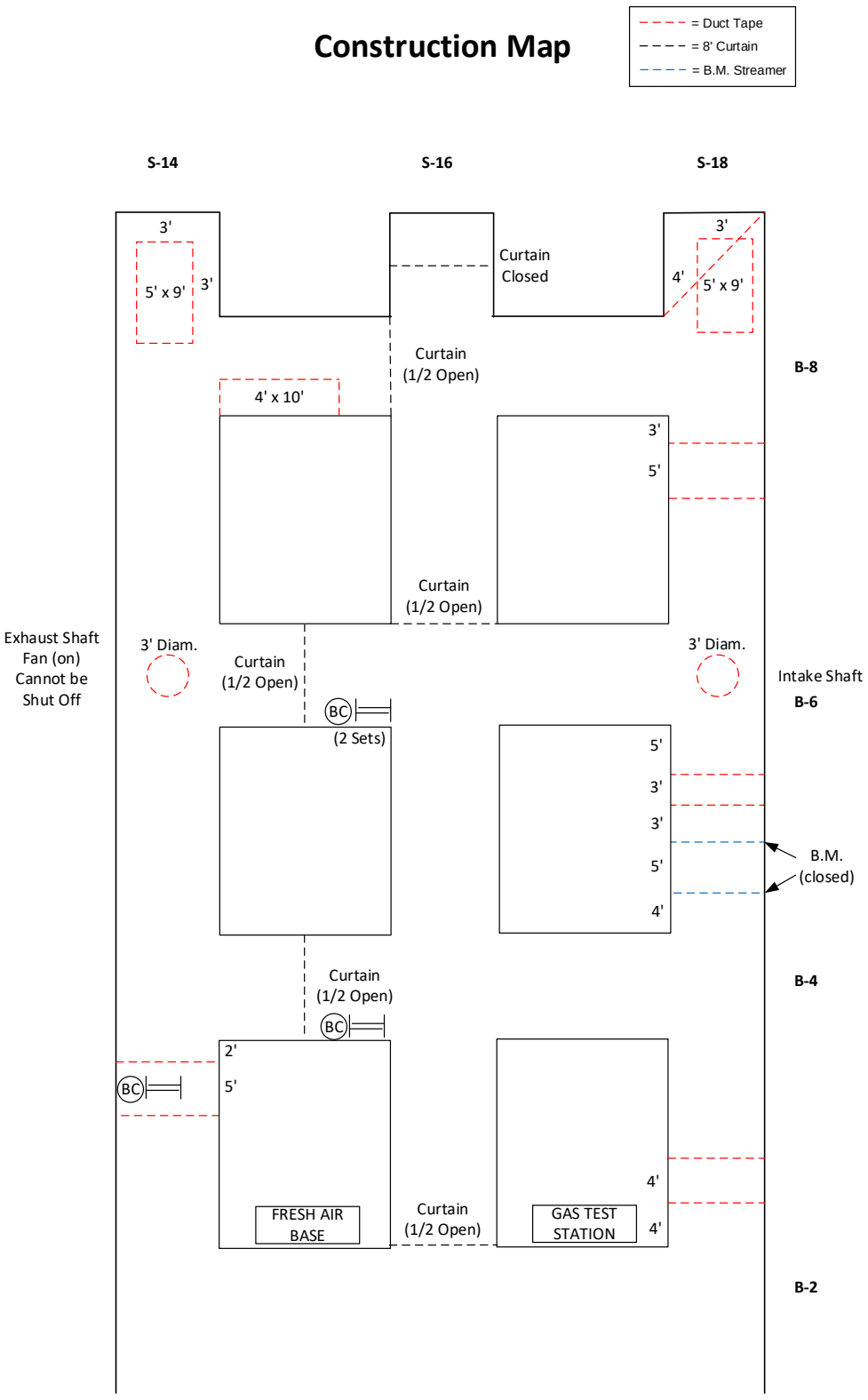


2 = Single-sided Placard
31 = Double-sided Gas Placard
59 = Double-sided Miner Placard

Placard Map



Construction Map



2018 National Metal and Nonmetal Mine Rescue Contest

JUDGES' PACKET
Field Competition
Day 2

July 25, 2018
Lexington, Kentucky

Table of Contents

Introduction

Congratulations! Each team has survived the Day 1 field problem and has returned today for more. Whether it is an opportunity to improve over yesterday's totals or to put your team further ahead of the others, we want to again commend each of you for your dedication to mine rescue and your willingness to participate in this important training function.

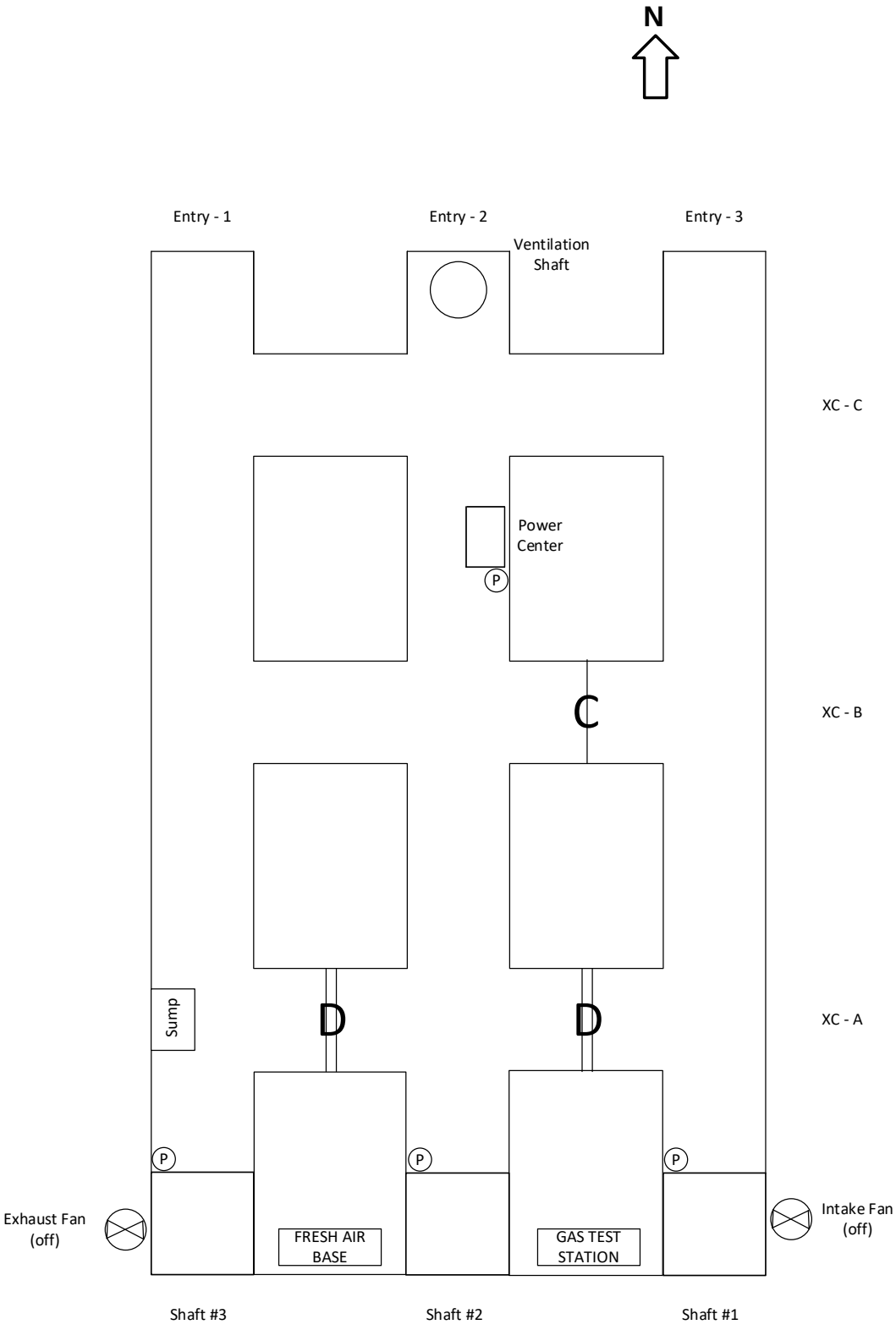
Remember, your team's final placement will be based on your combined cumulative discounts for both day's field problems plus your written test discounts. Those teams with the least amount of total discounts will vie for the trophies. No matter what the outcome, we think that today's problem will test your mine rescue skills and serve to reinforce your preparedness for an actual emergency.

Based on what we have seen so far, the miners and their families, the communities, and the companies you represent can rest assured that you will continue to serve them well. Even though there can only be a handful of contest winners, each team has earned the respect and heartfelt thanks for a job well done!

Now, let us continue with the briefing for this year's Day 2 mine rescue problem.

Team Working Order # _____

Team Map (1,650-foot Level)



Mine Information Sheet
Lexington Mining Co. – Wild Stallion Mine

Mine Design & Openings:
The Lexington Mining Co.'s Wild Stallion Mine is a multi-level underground mine opened by three 18-foot diameter shafts approximately 1,700 feet deep. The downcast Shaft #1 is equipped with hoists used to transport equipment, personnel and supplies to all levels of the mine. Shaft #1 serves as the primary escape way for all personnel on the production levels. The downcast Shaft #2 is equipped with hoists used to transport personnel and supplies to all levels of the mine. Shaft #2 serves as the secondary or alternate escape way. The upcast Shaft #3 is equipped with production skips, as well as an escape compartment which can be used to hoist a maximum of seven persons to the surface. Recently, a 6-foot diameter ventilation shaft has been completed from the surface to the lowest 1,650-foot level and has no conveyances. It will be used to course airflow to this lowest level for future development. **Note: The surface collar of the ventilation shaft cannot be accessed from the Fresh Air Base.**

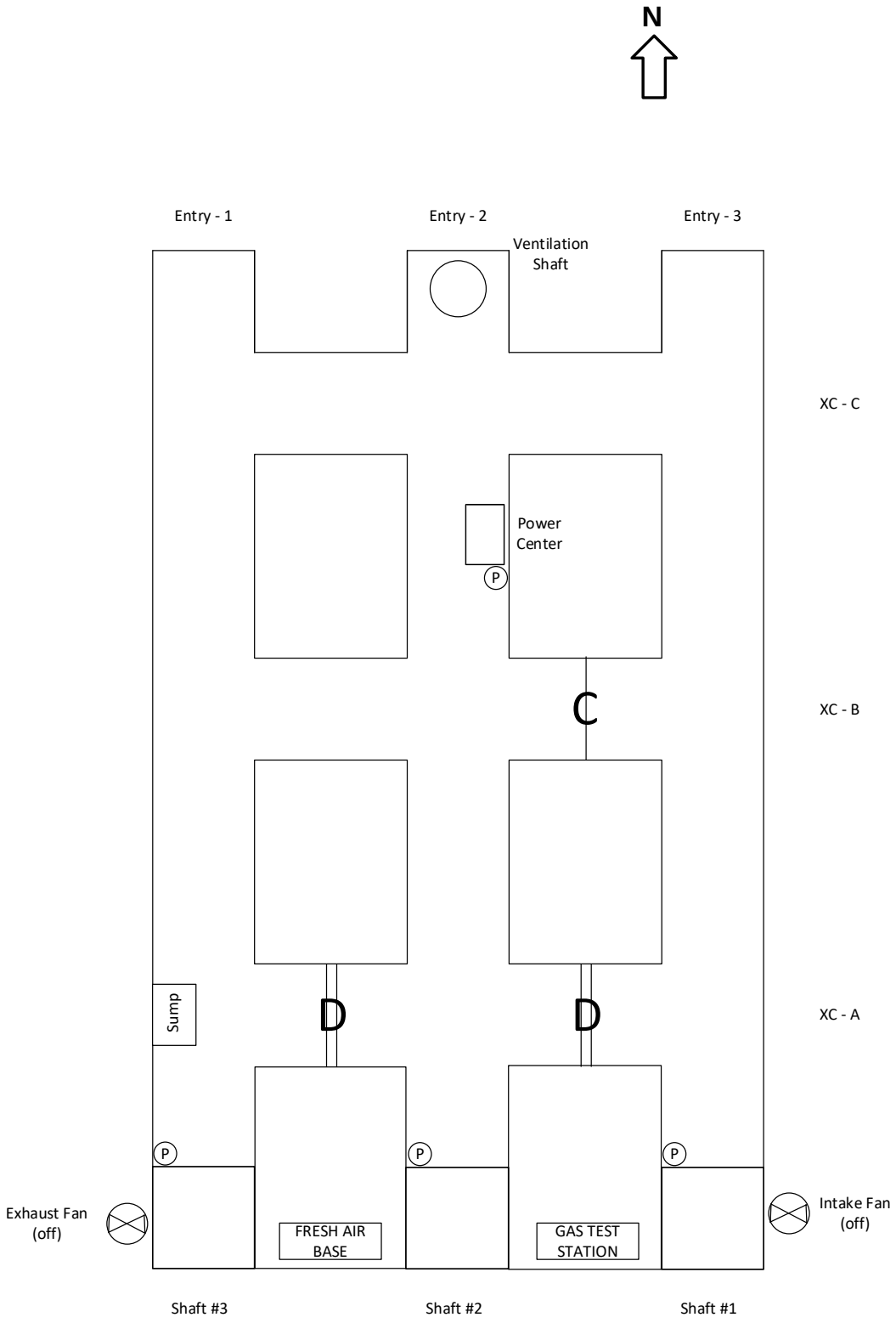
Ventilation:
The mine uses a push/pull ventilation system utilizing two main fans. The Intake Fan is located on the surface at Shaft #1 and pushes about 300,000 cfm of fresh air into the mine. The fan operates in the stable portion of its performance curve and cannot be reversed. The Exhaust Fan is located on the surface at Shaft #3 and pulls about 450,000 cfm from the mine. The fan operates in the stable portion of its performance curve and cannot be reversed. There is no fan at the downcast Shaft #2; however, fresh air is drawn into the mine through this opening due to exhaust pressures created by the Exhaust Fan. Separation of intake and exhaust airways is achieved utilizing concrete block stoppings, overcasts, and brattice curtains. Air is directed to the faces using these permanent and temporary ventilation controls. Currently, both the Intake Fan and Exhaust Fan are not operating. Either fan can be restarted, if the team decides it is safe to do so.

Mine Classification:
In accordance with Title 30 CFR § 57.22003, the mine was classified as a Category VI mine. That is, the presence of methane has not been established in this mine and there is no history of methane gas in any other mine in the area. Historical gas sampling at the mine has indicated no presence of methane.

Mining & Equipment:
The mine uses a conventional room and pillar method to extract ore from faces in the advancing production levels. The entries are initially driven 8 feet high and 10 feet wide. Typical pillar dimensions are 15 feet by 20 feet (W x L). On each level, the broken ore is loaded by load-haul-dumps (LHDs) which transport it to a feeder breaker and into a storage bunker. From there, ore flows to a skip pocket and hoisted to the surface via skips in Shaft #3. The mine operates three 8-hour shifts per day, five days per week with a single 10-hour maintenance shift on Sundays. Most underground mobile equipment is diesel-powered. The face drills and auxiliary fans are electric-powered via cables from power centers located on each level.

Team Working Order # _____

Team Map (1,650-foot Level)



Mine Information Sheet (continued)
Lexington Mining Co. – Wild Stallion Mine

Ground/Rib and Roof Control:
The immediate roof, or back, is supported by six-foot rock bolts. The back is fairly competent, but problem areas are supported by cribbing, wooden posts or roof jacks.

Water and Pumps:
The mine recently experienced water problems on the 1,650-foot Level which dips toward the west. Submersible pumps are used to remove water from the entries and direct it toward a sump located in Entry 1. Standing water is typical in this area. Each shaft is also equipped with a ten-foot deep sump. The main water pumps, located on the surface, can usually handle the volume of water produced in the mine and the shafts. The main water pumps are on and pumping water from the shaft sumps.

Electric Power:
The electrical power circuits for the shafts and the surface pumping station are on. Power circuits to the main fans and the underground installations have been locked out and guarded. Power circuits for the main fans and the underground installations can be energized at a moment's notice at the team's request.

Explosives:
Explosives are used during the mining cycle and are stored underground. The location of the explosives and caps storage facilities is marked on the maps for the respective mine levels. Blasting is conducted at the end of each shift while all persons are out of the mine. Only enough explosives for a day's use are stored in day boxes on the blasters' trucks.

Mine Map:
The onsite Engineering Department updated the mine map on July 15, 2018.

Other Mines:
There are several known mines, active and abandoned, in Lexington, Kentucky. At this time, the Wild Stallion Mine is not connected to any of these mines.

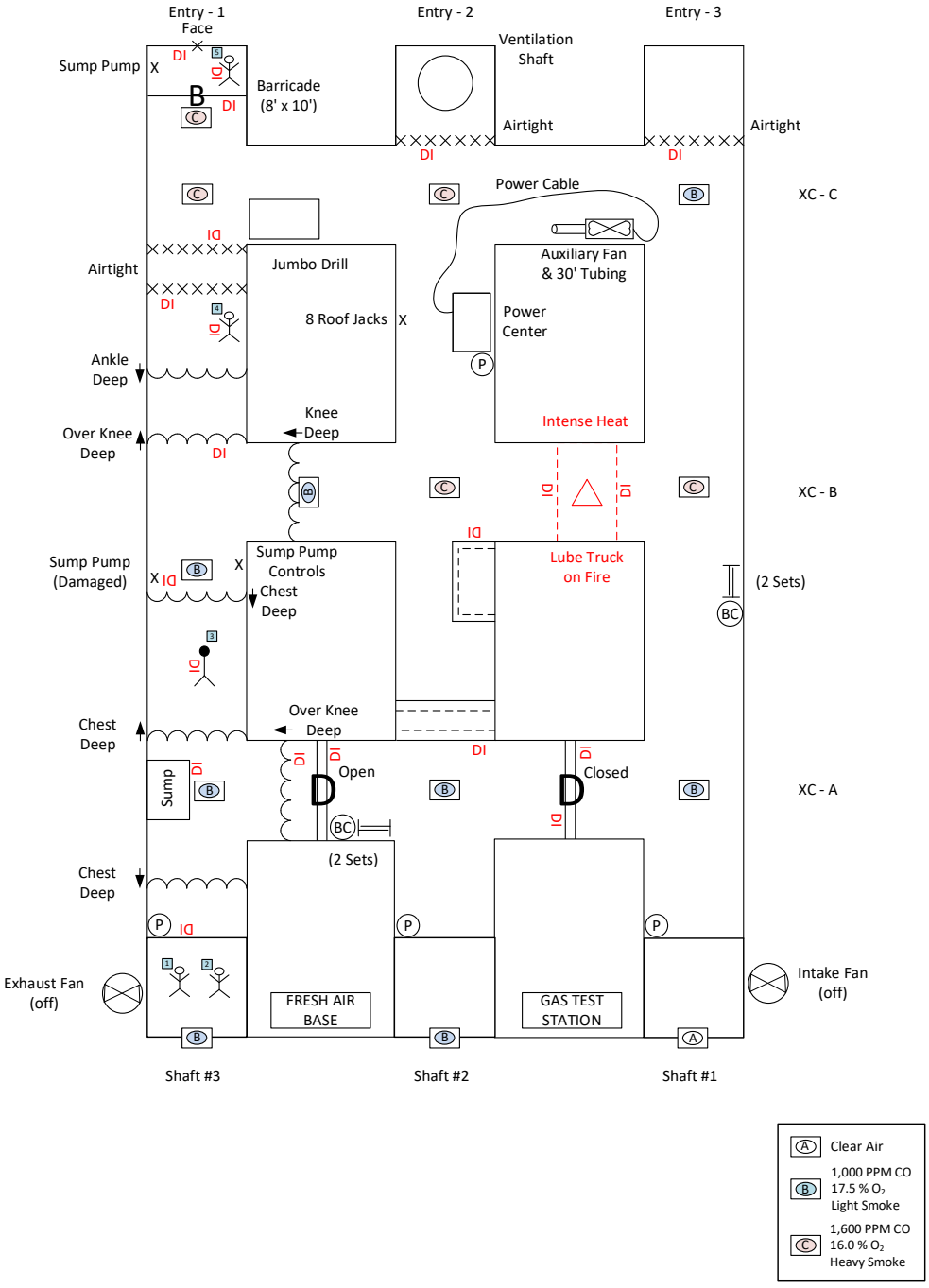
Materials:
Most available equipment and materials to work the problem are located in the mine and are identified with placards. If there is something else deemed necessary by the team, upon request, it can be delivered in a reasonable amount of time. **Note: The team will only be allowed to carry two sets of brattice material and frames at any given time. "Wing" curtains will not count toward this maximum.**

Communications:
Pager phones are available in the mine for contact with the surface. The current phone locations are marked on the Team and Fresh Air Base maps. At this time, there has been no contact with the missing miners.

2018 National Contest – Day 2

Missing Miners:
- Miner #1 (ID – 6771)
- Miner #2 (ID – 2941)
- Miner #3 (ID – 1333)
- Miner #4 (ID – 4235)
- Miner #5 (ID – 9361)

Problem Map (1,650-foot Level)



Team Briefing Statement

You are located at the fresh air base that has been established on the surface of the Lexington Mining Co.'s Wild Stallion Mine. The mine is a multi-level underground development opened by three 18-foot diameter shafts approximately 1,700 feet deep. The downcast Shaft #1 is equipped with hoists used to transport people and to convey supplies to all levels of the mine. The downcast Shaft #2 is equipped with hoists used to transport personnel to all levels of the mine. The upcast Shaft #3 is equipped with production skips, as well as an escape compartment which can be used to hoist a maximum of seven persons to the surface in the event of an emergency. A fourth 6-foot diameter ventilation shaft has been completed from the surface to the lowest 1,650-foot level and has no conveyances. It will be used to supply additional airflow to this lowest level for future development. **Note: The surface collar of the ventilation shaft cannot be accessed from the Fresh Air Base.**

The mine uses a push/pull ventilation system utilizing two main fans. The Intake Fan is located on the surface at Shaft #1 and pushes about 300,000 cfm of fresh air into the mine. The fan operates in the stable portion of its performance curve and cannot be reversed. The Exhaust Fan is located on the surface at Shaft #3 and pulls about 450,000 cfm from the mine. The fan operates in the stable portion of its performance curve and cannot be reversed. There is no fan at the downcast Shaft #2; however, fresh air is drawn into the mine through this opening due to exhaust pressures created by the Exhaust Fan.

The mine uses a conventional room and pillar method to extract ore from faces in the advancing production levels. The entries are initially driven 8 feet high and 10 feet wide. The immediate roof, or back, is supported by six-foot rock bolts. The back is fairly competent, but problem areas are supported by wooden posts or stacked crib blocks. The mine has recently experienced water problems on the 1,650-foot Level. Submersible pumps are used to remove accumulations from the entries and direct it toward a sump located in Entry 1. Standing water is typical in this area.

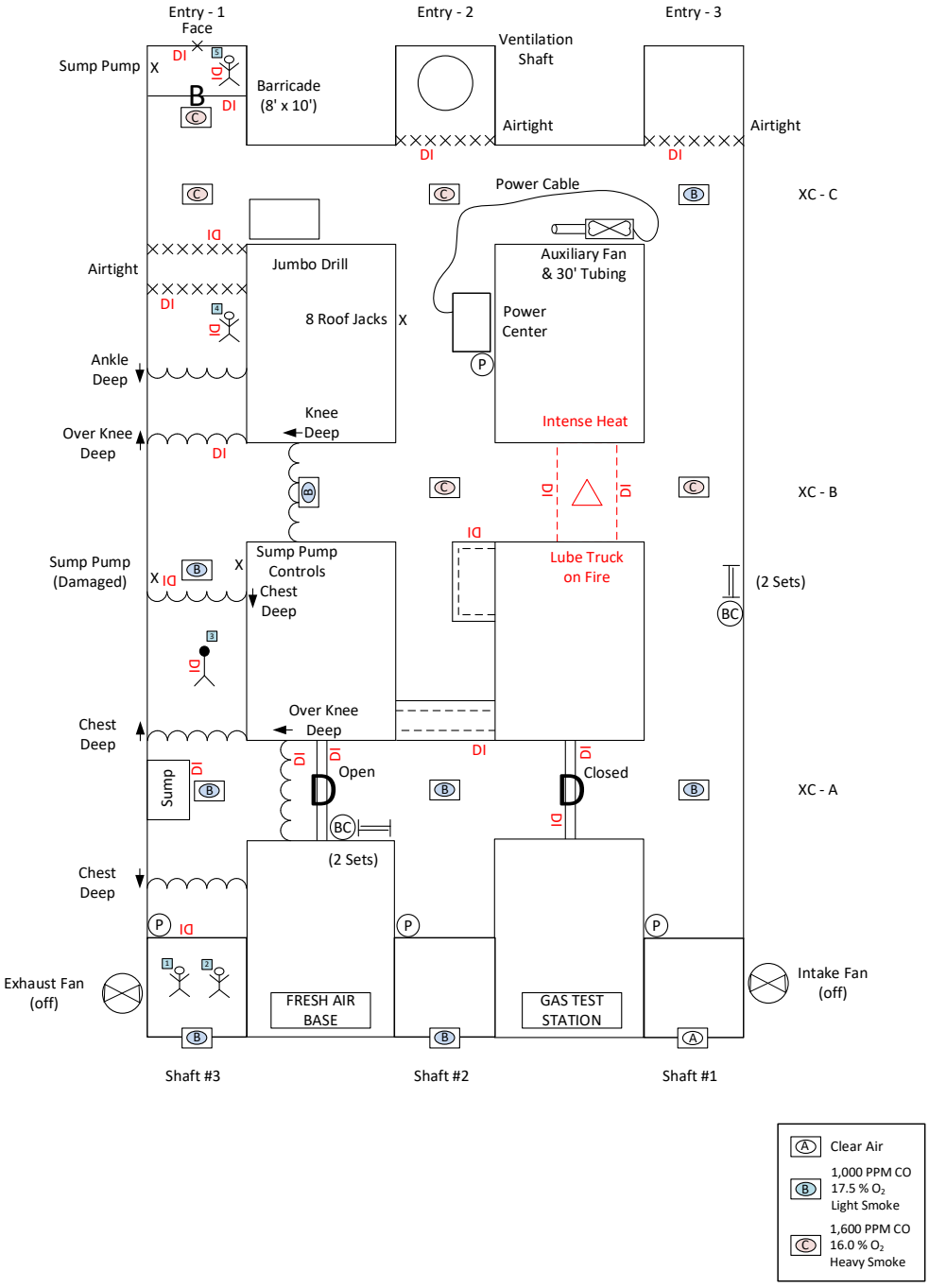
In accordance with Title 30 CFR § 57.22003, the mine was classified as a Category VI mine. That is, the presence of methane has not been established in this mine and there is no history of methane gas in any other mine in the area. At this time, the Wild Stallion Mine is not connected to any other active or abandoned mine in the area.

Today is Saturday. Six miners agreed to work overtime on the 1,650-foot level. The miners were assigned to conduct maintenance on the mining equipment and to replace a damaged sump pump. At 7:00 a.m., three miners went underground to gather tools and transport the lube truck to one of the jumbo drills. The other three miners remained on surface to complete an equipment repair project in the maintenance shop. Afterward, they were to go underground to help replace the sump pump. At 8:30 a.m., two of these miners entered the escape hoist at Shaft #3 to go underground. The third miner had been alerted to a family emergency and remained on the surface. As he prepared to leave the mine, he noticed smoke exiting Shaft #3 and overheard on the mine pager phone that an underground miner was badly burned and needed help.

2018 National Contest – Day 2

Missing Miners:
- Miner #1 (ID – 6771)
- Miner #2 (ID – 2941)
- Miner #3 (ID – 1333)
- Miner #4 (ID – 4235)
- Miner #5 (ID – 9361)

Problem Map (1,650-foot Level)



When the miner attempted to call underground for details, he heard the main fans shut down. Afterward, he contacted the hoist operator who stated that all power to the mine was lost and he was unable to contact anyone underground. Before leaving the mine, the miner called MSHA and requested mine rescue assistance.

At this time, all power to the underground has been locked out and guarded. Power has been restored to the hoists and surface pumps are operating. The main fans are off but can be restarted if needed. Continuous gas monitoring has been established at the four shafts. The latest readings show "clear air" at Shaft #1 and the ventilation shaft. Shaft #2 and Shaft #3 show "17.5 % oxygen (O_2), 1,000 ppm carbon monoxide (CO), with light smoke." We do not know the status of the communication system, because there has been no contact with the missing miners.

We have called all of the government agencies for help. Guards have been posted at the shafts and at the main fans. There is a fully equipped mine rescue team ready to serve as your team's backup. If your team is willing to help, we would like you to account for all missing miners; bring any live miners to the surface; extinguish or seal any fires; and explore and map all accessible areas of the mine. **Another team will be sent into the mine to replace you after 75 minutes.**

All available equipment and materials to work the problem are located in the mine and are identified with placards. If there is something else deemed necessary by the team, upon request, it can be delivered in a reasonable amount of time. **Note: The team will only be allowed to carry two sets of brattice material and frames at any given time. "Wing" curtains will not count toward this maximum.**

When you reach the mine rescue course you will be located at the surface fresh air base. At that time, the Mine Manager will introduce you to the judges. Once the Team Captain has started the timer, the Mine Manager will provide you with any changes to the briefing information that you have received. The Mine Manager will only respond to questions allowed by the rules while you are working the problem.

The fresh air base attendant and alternate will be assigned a location where they can study the team briefing information, mine information, and map. Only one attendant or alternate will be allowed to assist at the fresh air base. This fresh air base attendant can assist the team and communicate with them while they advance past the fresh air base using the communication system. He must maintain an accurate map indicating all initial information that the team relays to him. He may also assist the team by relaying information to the mine manager when required by the problem. He may also assist the team when they retreat to the fresh air base. The fresh air base attendant and mine rescue team alternate are not allowed to speak to anyone during the working of the problem except their team members, the mine manager, and the judging officials.

GOOD LUCK!

Team Instructions

- Explore and map all conditions found in the affected area (problem field) and any changes made by the team;
- Extinguish or seal any fires;
- Account for the five missing miners;
- If necessary, re-ventilate the affected area; and
- Bring any live miners to the surface fresh air base.

Fresh Air Base Instructions

- The fresh air base attendant and alternate will be assigned a location where they can study the team briefing information, mine information, and map.
- Only one attendant or alternate will be allowed to assist at the fresh air base. This person can assist the team and answer any questions the team may ask.
- The fresh air base attendant and mine rescue team alternate are not allowed to speak to anyone during the working of the problem except their team members, mine manager, and the judging officials.

Problem Orientation

Introduce yourself to the team as the "Mine Manager." Then, introduce the #1, and #2 Judges. The team has been briefed on the problem and the mine information in isolation. Read the following information to the team:

Captain, we have made contact with two of the missing miners. They stated that they are currently located inside of the Shaft #3 emergency hoist and the conveyance is stuck at the 1,625-foot Level (25 feet above the 1,650-foot Level shaft landing). They can hear water rushing toward the shaft below. Because of the smoke in the shaft, they have donned their MSA W-65 filter self-rescuers. The hoist operator stated that the cage cannot be raised due to a malfunction in the system; however, he does have the ability to lower the cage to the 1,650-foot Level landing. At this time, we have a hoist mechanic troubleshooting the system. We are not sure how long repairs will take but we will keep you updated on any progress. Additionally, we have found an electrical problem with the Exhaust Fan and it cannot be restarted.

During the working of the problem, I will answer any question that you may have; however, by problem design, my response may be limited in scope. The fresh air base attendant and mine rescue team alternate must remain at the surface fresh air base. Only the fresh air base attendant can speak with the team via the communication system to discuss the rescue activities performed or proposed. If the team returns to the fresh air base, only the attendant or alternate will be allowed to assist them. However, neither the attendant nor the alternate can physically go beyond the fresh air base to assist the team unless he/she becomes a team member when someone drops out.

After the team has completed its 50 foot check, they will not be allowed to physically compare the team map with the fresh air base attendant's map or the team alternate's map. No side by side comparison will be allowed and no changes (edits) can be made to any map while the team is at the surface fresh air base.

The fresh air base attendant or team alternate is not allowed to speak with anyone except the team members, the mine manager, or the judges.

At the end of the problem, both the team map and the fresh air base attendant's map will be collected and scored. All map editing must take place prior to stopping the clock. The alternate's map will also be collected at this time but it will not be scored.

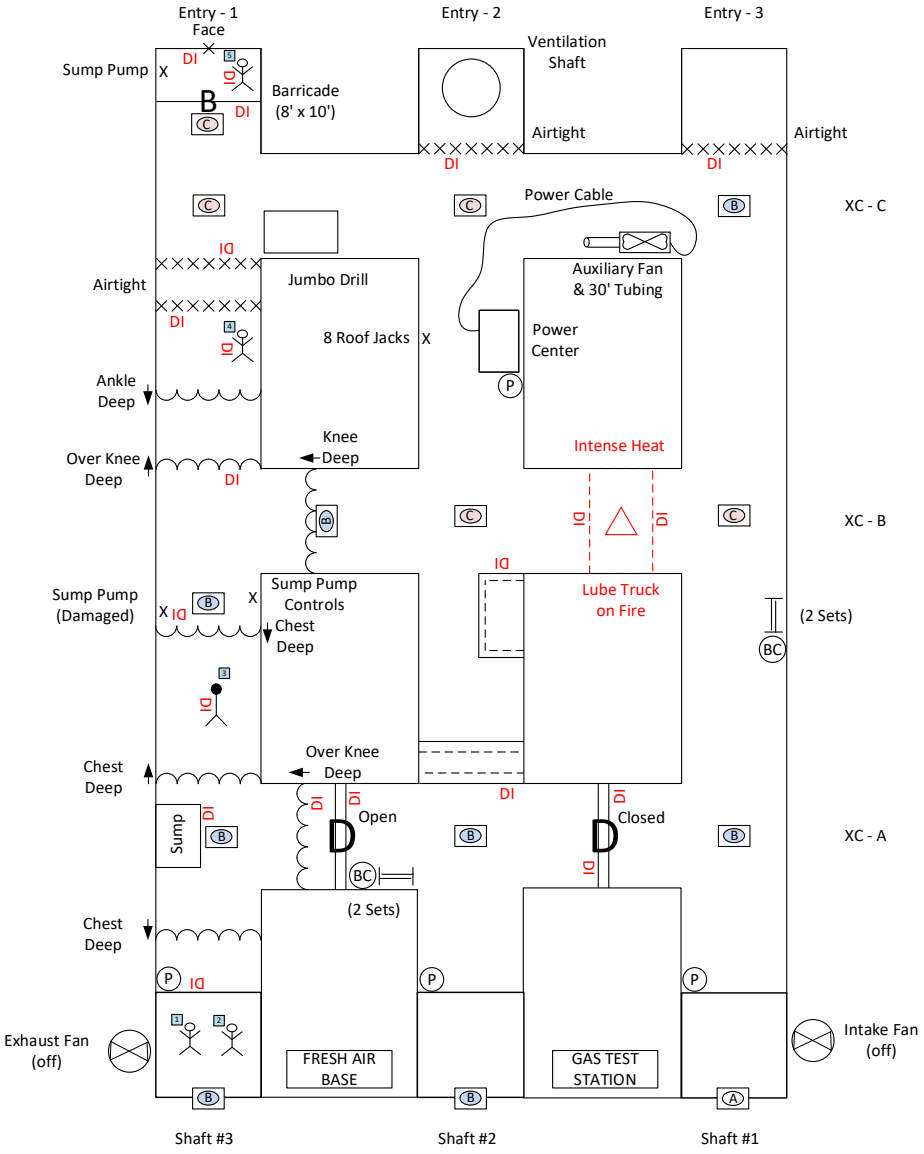
Do you understand this information and these instructions?

When they verify understanding the instructions, have the Team Captain start the clock and hand the team their copies of the Team Briefing Information, the Mine Information Sheets, and the three mine maps. Remember to add: **"Good Luck!"**

Missing Miners:
- 1 - Miner #1 (ID – 6771)
- 2 - Miner #2 (ID – 2941)
- 3 - Miner #3 (ID – 1333)
- 4 - Miner #4 (ID – 4235)
- 5 - Miner #5 (ID – 9361)

Problem Map (1,650-foot Level)

N



- A - Clear Air
- B - 1,000 PPM CO, 17.5 % O_2, Light Smoke
- C - 1,600 PPM CO, 16.0 % O_2, Heavy Smoke

Problem Solution

DISCLAIMER:
There are many ways to successfully solve this problem. The following outlines one possible way for use during MSHA field judges' training.

Each team received a briefing in isolation. At that time, each team was allowed to review the team briefing statement, mine information sheet, mine maps, and instructions for rescue teams and fresh air base attendants. However, copies of these documents and maps were collected at the conclusion of the briefing session.

Upon arrival at the fresh air base, the team will meet the Mine Manager and will be introduced to the judges. The Mine Manager will read the Problem Orientation and update the team with any information obtained since their briefing. Questions will be answered only as required by the rules or to explain the meaning of a term.

When the team verifies that they understand the instructions, the captain immediately starts the official clock. He writes the month, day, year, and the team position number on the sign-in board (or sheet). The captain's failure to perform any of these tasks will result in discounts (4 x each infraction) per Judge 1 – Surface Rule #8.

During the Problem Orientation, the Mine Manager informed the team that two of the missing miners were located inside of the Shaft #3 emergency cage and the conveyance is stuck at the 1,625-foot Level (25 feet above the 1,650-foot Level landing). They had donned their MSA W-65 filter self-rescuers because of the smoke in the shaft and can hear water rushing toward the shaft below. The hoist operator stated that the cage cannot be raised due to a malfunction in the system; however, the cage can be safely lowered to the bottom (1,650-foot Level landing). A hoist mechanic was troubleshooting the system. The Mine Manager was not sure how long repairs will take but updates will be provided. Note: If the team asks the Mine Manager to lower the cage to the 1,650-foot Level, it will be done. However, with unknown conditions in the shaft and an active fire somewhere on the 1,650-foot mine level, the team's action has endangered the miners by subjecting them to potentially life-threatening conditions. As a result, the team will be assessed 100 discounts (2 x 50 for each miner) for an act that may injure or result in the death of the survivors per Judge 1 – UG Rule #18.

After receiving the information from the Mine Manager, the team may discuss the conditions presented by the problem and the map. The team is not required to check their equipment again. These equipment checks were conducted prior to reporting to the field and the team is fully equipped, physically fit, and ready to go. However, deficiencies with the team's equipment, identified by the judges during the working of the problem, should be discounted appropriately.

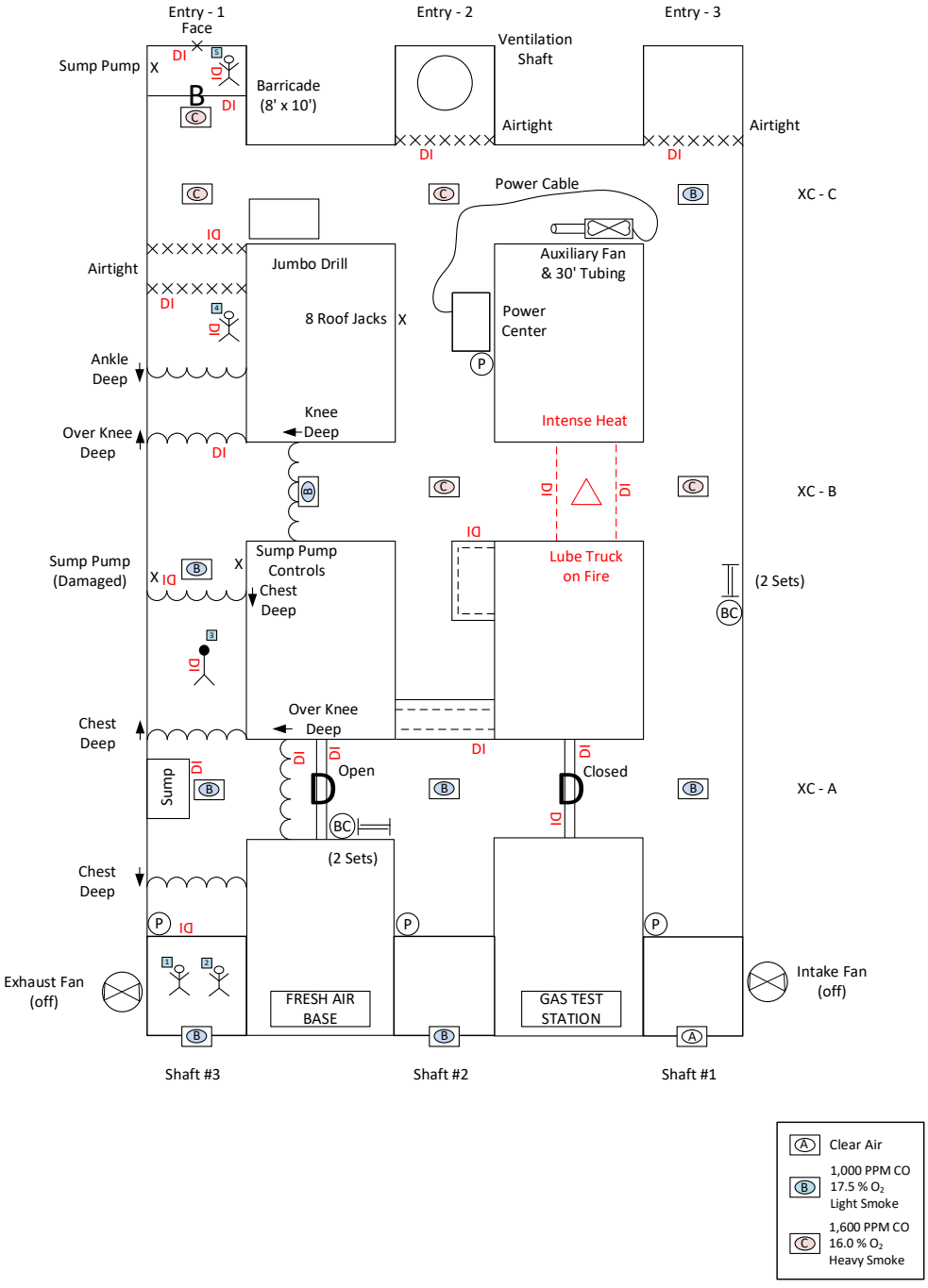
Since the mine is classified as Category VI, the team does not need to use non-sparking tools to work the problem. However, if the team requests non-sparking tools from the official in charge, their tools will be deemed non-sparking.

2018 National Contest – Day 2

Missing Miners:
- Miner #1 (ID – 6771)
- Miner #2 (ID – 2941)
- Miner #3 (ID – 1333)
- Miner #4 (ID – 4235)
- Miner #5 (ID – 9361)

Problem Map (1,650-foot Level)

N



- A – Clear Air
- B – 1,000 PPM CO, 17.5 % O_2, Light Smoke
- C – 1,600 PPM CO, 16.0 % O_2, Heavy Smoke

When ready, the team must examine all three shafts near the Fresh Air Base while under oxygen. In air clear of smoke, these checks may be made without a lifeline. These following checks must be made to assure the conditions are safe to proceed. The team's failure to wear apparatus while checking the shafts will result in individual endangerment discounts (15 x each person) per Judge 1 – UG Rule #10(a)(6).

Shaft #1 checks reveal:
The team must conduct necessary gas tests. A placard at the shaft shows "clear air." A second placard will indicate that the Intake Fan is off. The conveyance will be at the top of the shaft and the team will place combustible material on the cage and send it down, using the posted Nevada hoisting signal codes. The team must then signal the cage to return to the surface. When the material is checked, it will be intact and dry. The team's failure to check this shaft for damage will result in a team endangerment (75 discounts) per Judge 1 – UG Rule #10(b)(1).

Note: At each shaft, Judge No. 1 will allow 10 seconds for the conveyance to travel in each direction.

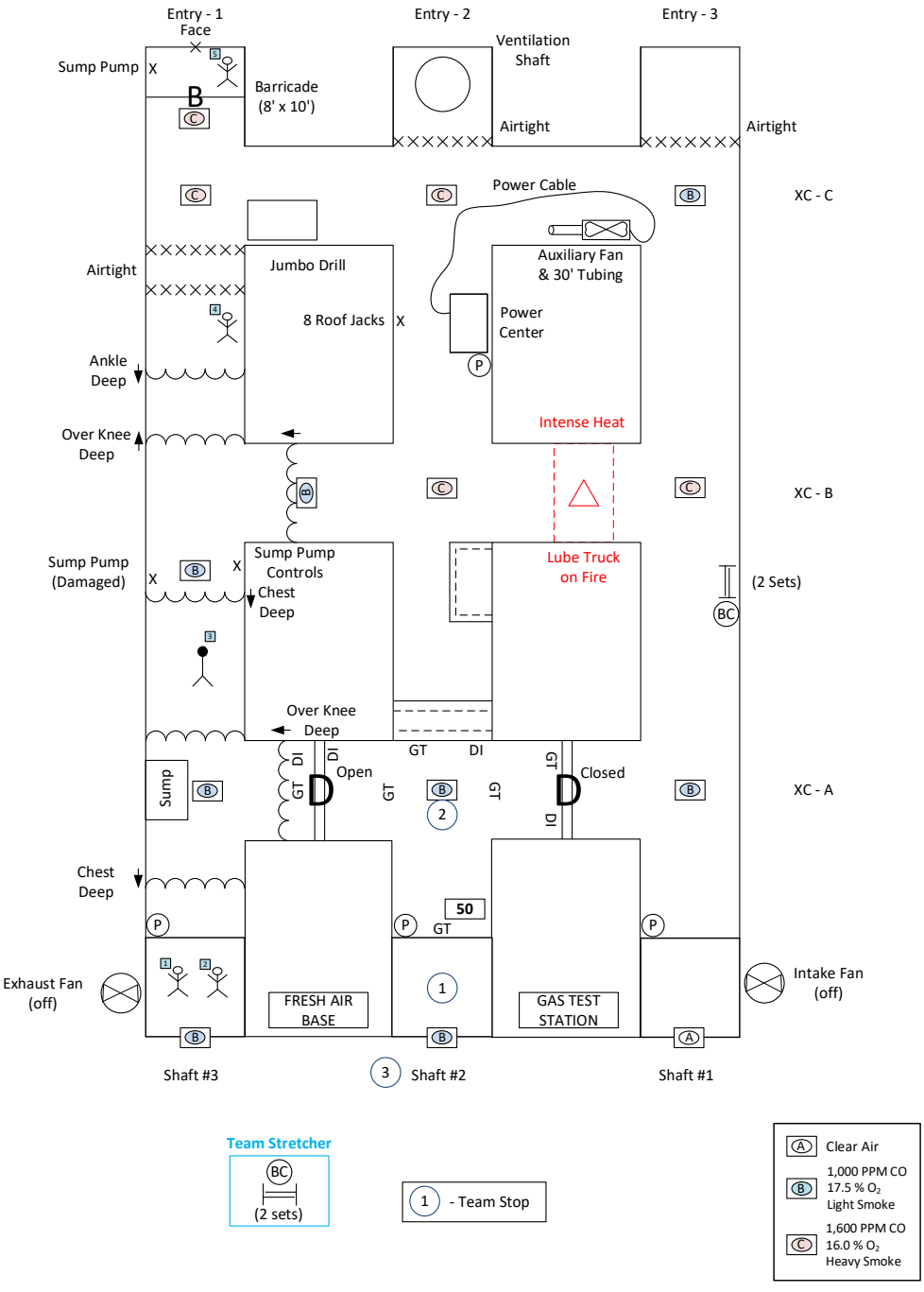
Shaft #2 checks reveal:
The team must conduct necessary gas tests. A placard at the shaft shows "17.5 % O_2, and 1,000 ppm CO with light smoke." The conveyance will be at the top of the shaft and the team will place combustible material on the cage and send it down, using the posted Nevada hoisting signal codes. The team must then signal the cage to return to the surface. When the material is checked, it will be intact and dry. The team's failure to check this shaft for damage will result in a team endangerment (75 discounts) per Judge 1 – UG Rule #10(b)(1).

Shaft #3 checks reveal:
The team must conduct necessary gas tests. A placard at the shaft shows "17.5 % O_2, and 1,000 ppm CO with light smoke." A second placard will indicate that the Exhaust Fan is off. Note: During the Problem Orientation, the Mine Manager informed the team that two of the missing miners were located inside of the Shaft #3 emergency cage, stuck 25-feet above the 1,650-foot Level landing. At this time, the cage cannot be raised to the surface due to a malfunction in the system. **Therefore, the shaft cannot be checked for damage or used by the team. See previous Note concerning a team's request to lower the cage and the resultant consequences.**

Gas Box Testing Station:
The team will also find the gas box testing station located at the fresh air base. A team member must use the team's multi-gas instrument to determine the gas concentrations in the unknown mixture. The team must provide its own calibration cup to report: O_2, CH_4, CO, and NO_2. **This will be the only gas box on the mine rescue field.** Judge No. 2 will write down the team's measurements and have the team member initial the documentation. Afterward, Judge No. 2 can compare the team's measurements with the allowable tolerances for each gas and, if warranted, apply appropriate discounts (15 x each incorrect gas measurement) per Judge 2 – UG Rule #4.

Missing Miners:
- 1 - Miner #1 (ID – 6771)
- 2 - Miner #2 (ID – 2941)
- 3 - Miner #3 (ID – 1333)
- 4 - Miner #4 (ID – 4235)
- 5 - Miner #5 (ID – 9361)

Solution Map 1



Note: Team Stop Nos. 1 - 3 (see Solution Map 1)

Team Stop No. 1

Since the team knows that two miners (Miner #1 and Miner #2) are stuck in Shaft #3 but can be safely lowered to the 1,650-foot Level, the team must enter the mine through Shaft #2 and explore to the bottom of Shaft #3 to ensure the miners' safe release. In order to do this, the team must count off before entering the cage (first time they go underground). Then, they must close the shaft gate and signal the hoist engineer. Afterward, the team will descend to Shaft #2 station. Before exiting the cage the captain must check for loose roof in front of the cage. A gas test will show that the gas concentrations have not changed from those found at the shaft collar. They will also find a working mine phone located near the shaft gate.

The team's failure to "count off" upon first entry into and final exit from the mine will result in discounts (2 x each infraction) per Judge 1 – Surface Rule #10.

The team's failure to close the shaft gate will result in discounts (5 x each infraction) per Judge 1 – UG Rule #7.

The team's failure to use the posted hoisting signals will result in discounts (1 x each infraction) per Judge 1 – UG Rule #6.

The captain's failure to verbally indicate he/she is checking the back or roof where required will result in discounts (5 x each occurrence) per Judge 1 – UG Rule #8(b)(4).

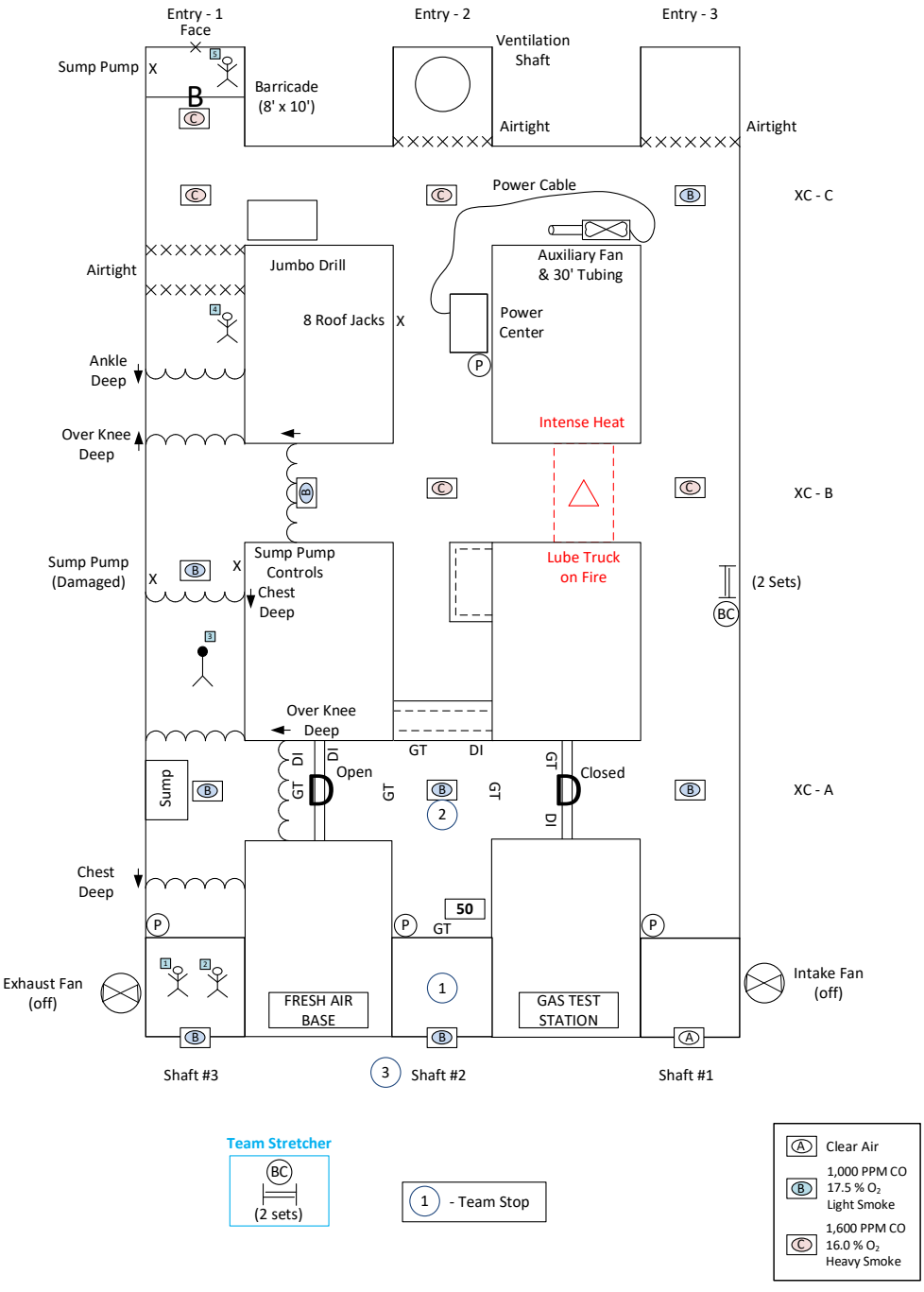
The team's failure to take necessary gas tests where required (each gas and each infraction) assess discounts (1x each omission) per Judge 2 - UG Rule #1. **All additional areas requiring gas testing by the team are shown on the Solution Maps (with Team Stops) as "GT".**

Note: After advancing not more than fifty (50) feet from the fresh air base, the captain must give a signal for the team to stop. At this time, all team members and their apparatus must be checked. After the 50 feet apparatus check, the team is required to conduct apparatus examinations not exceeding 20-minute intervals while working the problem. Apparatus removed in order to enter a confined area or apparatus that has sustained possible damage from impact must be checked before continuing. The team's failure to conduct a 50 foot check will result in discounts (10 discounts) per Judge 1 - UG Rule #3. Also, the team's failure to conduct apparatus examinations or examinations exceeding 20-minute intervals will result in discounts (5x each occurrence) per Judge 1 - UG Rule #5.

Note: No physical comparison of the fresh air base map and team map will be allowed after this initial entry into the mine. No changes can be made to any map while the team is at the surface fresh air base. If the team or fresh air base attendant does not adhere to this rule, 25 discounts will be assessed per Judge 2 – Surface Rule #5.

Missing Miners:
- 1 - Miner #1 (ID – 6771)
- 2 - Miner #2 (ID – 2941)
- 3 - Miner #3 (ID – 1333)
- 4 - Miner #4 (ID – 4235)
- 5 - Miner #5 (ID – 9361)

Solution Map 1



Team Stop No. 2
The team will advance northward in Entry 2 to Crosscut A (designated as "XC–A" on the Team and FAB Maps). At the intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find a placard indicating "17.5 % O_2, and 1,000 ppm CO with light smoke." To the north, the team will find an area of unsafe roof extending rib-to-rib. The captain must warn the team members to avoid this hazard. The captain will date and initial (D&I) the area of unsafe roof as their furthest point of advance (FPA) in this direction. The team can stretch to the east in XC-A to the permanent stopping and find that the door is closed. The captain performs roof or back checks as the team conducts necessary gas checks. The captain must D&I the stopping as their FPA in this direction. The team can now stretch to the west in the crosscut to the permanent stopping and find that the door is "open." The captain must D&I the stopping. They will also find two sets of brattice material lying along the southern rib and can take the material with them for future use.

The team can stretch westward in XC-A. The captain must verbally indicate he/she is checking the roof or back upon passing through the open door. A gas test must also be conducted at this time. About 3 feet east of the door, they will find a placard indicating "water over knee deep" stretching rib-to-rib. The team cannot pass the placard. The captain must warn the team members to stay clear of the water and D&I the location as their FPA in this direction. Any team member passing the water placard will result in individual endangerment discounts (15 x each person) per Judge 1 – UG Rule #10(a)(2). **Note: If the team asks for roof support materials to advance northward beyond XC-A, the Mine Manager will explain that everything needed to work the problem can be found in the mine. It will take at least one hour to obtain additional materials and send them to the 1,650-foot Level.**

The captain's failure to D&I where required (at the point of farthest advance of the team in any direction such as at stoppings, faces of rooms and drifts, water over knee deep, impassable falls, barricades, fires out of control, etc., assess discounts (2 x each place – max 10) per Judge 1 - UG Rule #9. **All additional areas requiring a D&I by the team captain are shown on the Solution Maps (with Team Stops) as "DI".**

The captain's failure to verbally indicate he/she is checking the roof or back upon passing through any barricade stopping, bulkead, air lock, door, check curtain, or similar barrier, will result in discounts (5x each occurrence) per Judge 1 - UG Rule #8(b)(4).

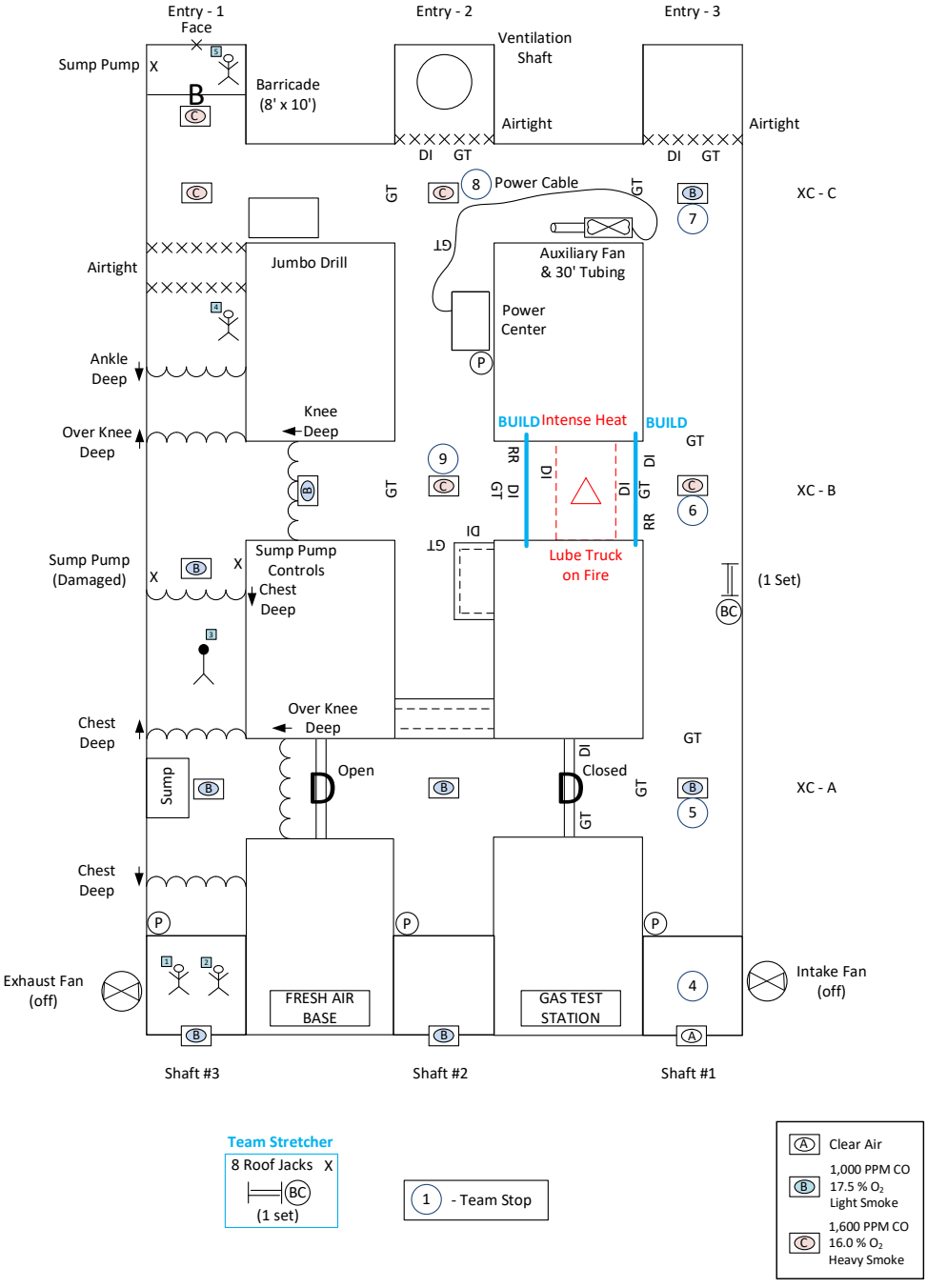
Note: As stated in the team briefing information, they will only be allowed to carry two sets of brattice material and frames at any given time. "Wing" curtains will not count toward this maximum.

Team Stop No. 3
The team can retreat to the #2 Shaft Station, enter the cage, close the shaft gate, signal the hoist engineer and be hoisted to the surface. Once on the surface, the team can exit the conveyance and close the shaft gate to release the cage.

2018 National Contest – Day 2

Missing Miners:
- Miner #1 (ID – 6771)
- Miner #2 (ID – 2941)
- Miner #3 (ID – 1333)
- Miner #4 (ID – 4235)
- Miner #5 (ID – 9361)

Solution Map 2



Note: Team Stop Nos. 4 - 9 (see Solution Map 2)

Team Stop No. 4
Now, the team can continue systematic exploration of the mine. The team will enter the mine through Shaft #1. After entering the cage, they must close the shaft gate and signal the hoist engineer. Afterward, the team will descend to Shaft #1 Station. Before exiting the cage the captain must check for loose roof in front of the cage. A gas test will show "clear air." They will also find a working mine phone near the shaft gate.

Team Stop No. 5
The team will advance northward in Entry 3 to XC-A. As they travel, they will find two additional sets of brattice material lying along the eastern rib. If they already have two sets with them, they will need to leave the material in place. At the intersection, the captain must perform roof or back checks as the team conducts necessary gas tests. They will find a placard indicating "17.5 % O_2, and 1,000 ppm CO with light smoke." The team can stretch westward in the crosscut to the stopping and find that the door is closed. The captain performs roof or back checks as the team conducts necessary gas checks. The captain must D&I the stopping as their FPA in this direction.

If the team does not check immediately before entering smoke, assess discount per Judge 1- UG Rule #12 (5x each infraction). If the team does not attach or hold onto the lifeline, assess discounts per Judge 2 - UG Rule #9 (2x each infraction).

Team Stop No. 6
The team will continue advancing northward in Entry 3 to XC-B. At the intersection, the captain must perform roof or back checks as the team conducts necessary gas tests. They will find a placard indicating "16.0 % O_2, and 1,600 ppm CO with heavy smoke." As the team attempts to stretch westward in the crosscut, they will find placards indicating "lube truck on fire" and "intense heat." The captain must D&I the location of the "fire." Then, the team must retreat and erect a seal across the drift to isolate the fire. The captain must check the condition of the roof and rib prior to building the seal and D&I the seal after it was built.

If a team member advances past the placard indicating "intense heat" assess individual endangerment discounts (15 x each person) per Judge 1 – UG Rule #10(a)(4). Also, if the captain doesn't check the roof and rib prior to building a temporary stopping, assess 5 discounts per Judge 1- UG Rule #8(b)(3). If the captain does not D&I the build, assess discounts per Judge 1 – UG Rule #9 (2x each place - 10 max).

Team Stop No. 7
Without undue delay, the team must find and seal all other approaches to the fire. At this time, the team has not found any roof support materials during their exploration. They may ask the mine manager for posts or roof jacks to access the area of unsafe roof in Entry 2 inby XC-A to find additional approaches to the fire. If so, they will be told that "All materials needed to work the problem can be found on the field. Additional posts or roof jacks can be delivered to the fresh air base in one (1) hour."

2018 National Contest – Day 2

Missing Miners:
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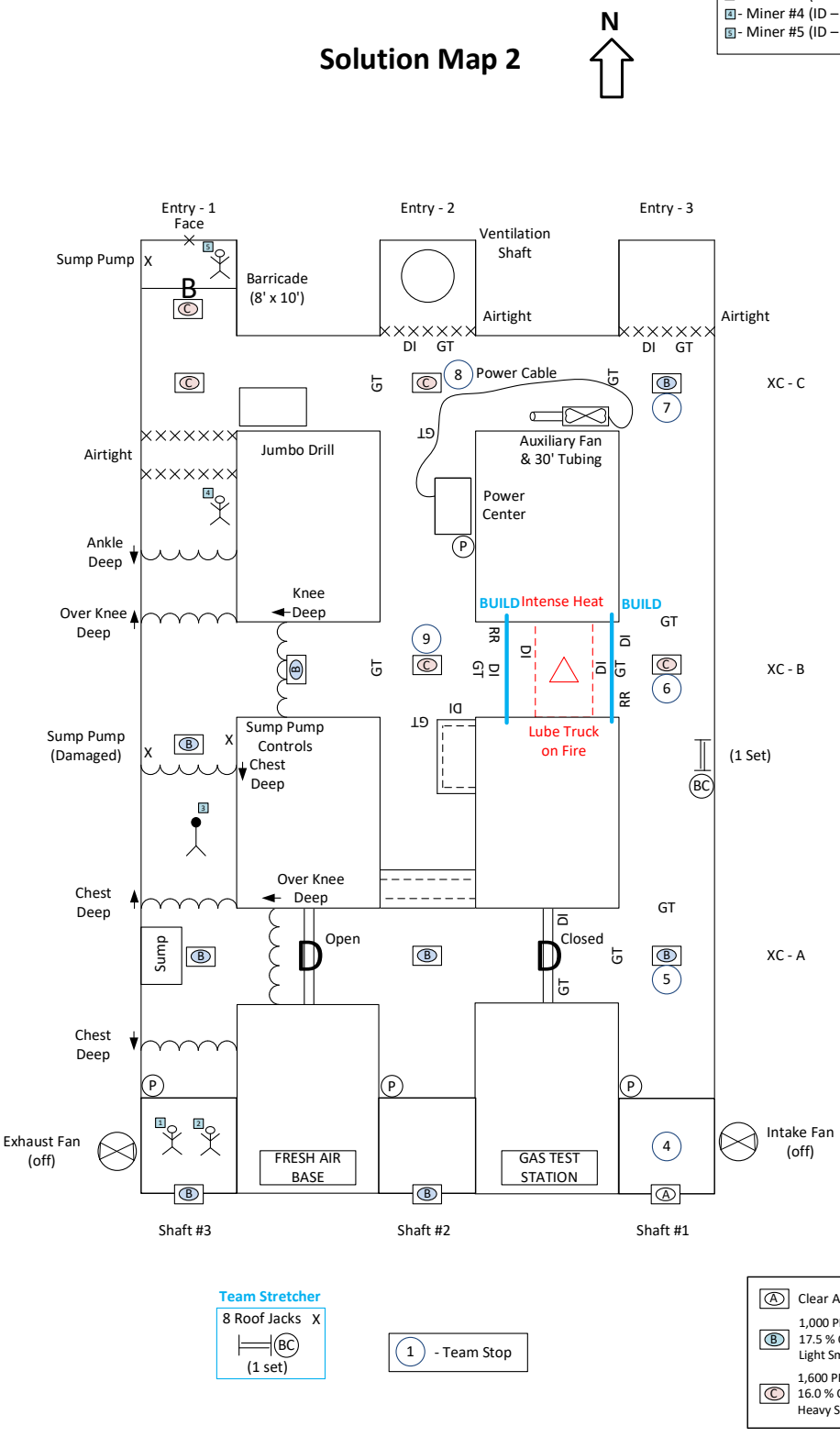
- Miner #2 (ID – 2941)
- Miner #3 (ID – 1333)
- Miner #4 (ID – 4235)
- Miner #5 (ID – 9361)

Solution Map 2



Team Stretcher
8 Roof Jacks X
(BC)
(1 set)

1 - Team Stop

- (A) Clear Air
- (B) 1,000 PPM CO, 17.5 % O_2, Light Smoke
- (C) 1,600 PPM CO, 16.0 % O_2, Heavy Smoke

Therefore, the team must continue advancing in Entry 3 to XC-C. Before moving on, they can pick up an additional set of brattice material and take it with them. At the intersection, the captain must perform roof or back checks as the team conducts necessary gas tests. They will find a placard indicating "17.5 % O_2, and 1,000 ppm CO with light smoke." To the north, the team will find an airtight cave stretching rib-to-rib and blocking the face area. The captain must D&I the cave as their FPA in this direction.

Team Stop No. 8

The team can advance westward in XC-C toward Entry 2. As they travel, they will find an auxiliary fan with 30 feet of tubing. The fan is attached to a 30-foot power cable and parked along the southern rib. At the intersection, the captain must perform roof or back checks as the team conducts necessary gas tests. They will find a placard indicating "16.0 % O_2, and 1,600 ppm CO with heavy smoke." To the north, they will find an airtight cave stretching rib-to-rib and blocking the face area and access to the ventilation shaft. The captain must D&I the cave as their FPA in this direction.

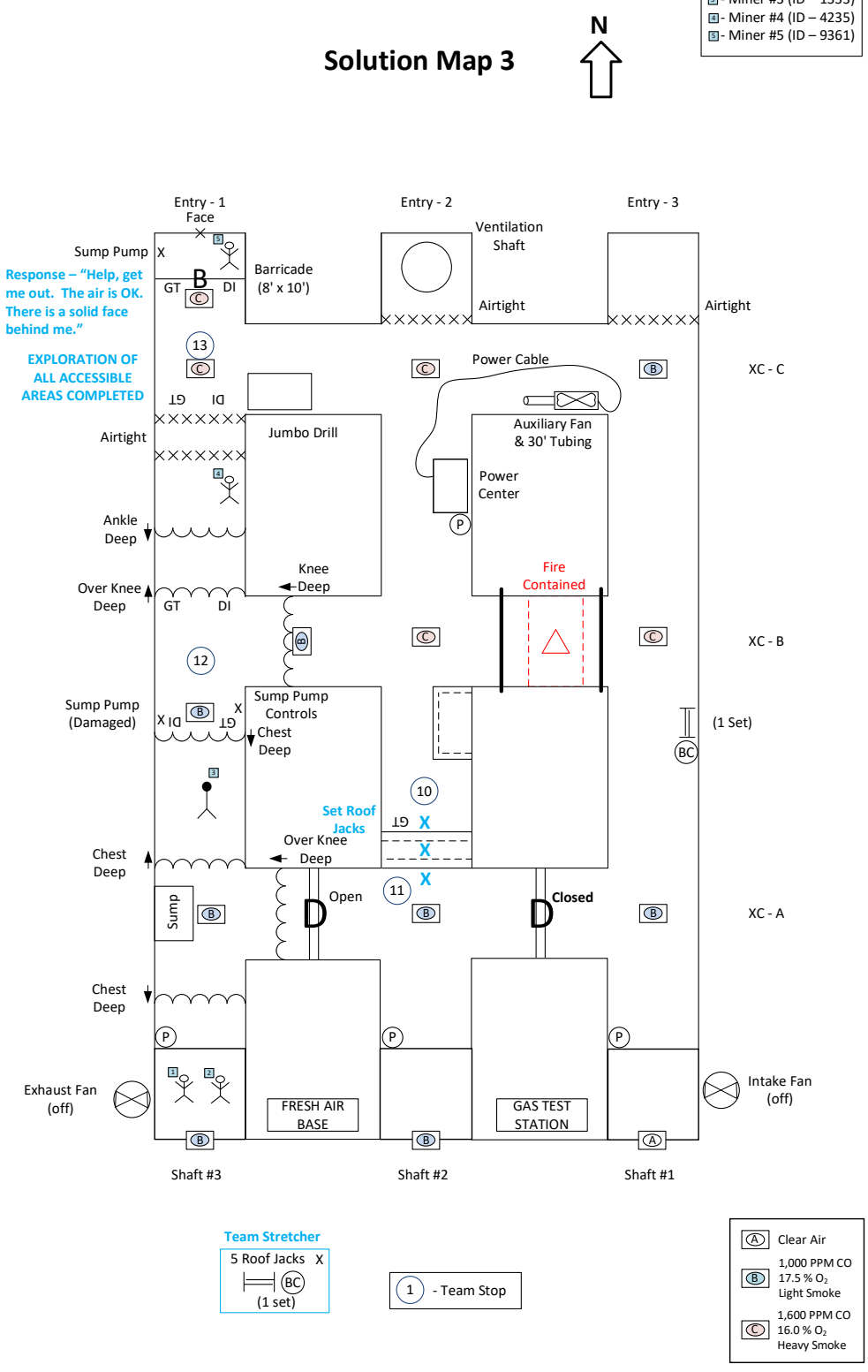
Team Stop No. 9

Without undue delay, the team can now advance southward in Entry 2 toward XC-B to find other approaches to the fire. As they travel, they will find that the power cable is attached to the power center located along the eastern rib. Since the mine power has been de-energized and locked out, the auxiliary fan and power center are off. The team will also find eight roof jacks lying along the western rib. The team can take these supports with them for future use. When they reach the intersection with Crosscut B, the captain must perform roof or back checks as the team conducts necessary gas tests. They will find that the gas concentrations have not changed from their previous location. To the south, the team will find an area of unsafe roof extending from the corner of the western pillar and southward toward XC-A. The captain must warn the team members to avoid this hazard. The captain will D&I the area of unsafe roof. The team can stretch eastward into the crosscut to find placards indicating "lube truck on fire" and "intense heat." The captain must D&I the location of the "fire." Then, the team must retreat and erect a seal across the drift to isolate the fire. The captain must check the condition of the roof and rib prior to building the seal and D&I the seal after it was built. Because of the limited space available, the team will need to be extra cautious to avoid the area of unsafe roof behind them as they build the seal.

If a team member advances past the placard indicating "intense heat" or under the unsafe roof, assess individual endangerment discounts (15 x each person) per Judge 1 – UG Rule #10(a)(4) and/or Rule #10(a)(1). Also, if the captain doesn't check the roof and rib prior to building a temporary stopping, assess 5 discounts per Judge 1- UG Rule #8(b)(3). If the captain does not D&I the build, assess discounts per Judge 1 – UG Rule #9 (2x each place - 10 max).

Missing Miners:
- 1 - Miner #1 (ID – 6771)
- 2 - Miner #2 (ID – 2941)
- 3 - Miner #3 (ID – 1333)
- 4 - Miner #4 (ID – 4235)
- 5 - Miner #5 (ID – 9361)

Solution Map 3



Note: Team Stop Nos. 10 - 13 (see Solution Map 3)

Team Stop No. 10
Now that the fire has been contained, the team can continue systematic exploration. The team can advance southward in Entry 2 toward XC-A to tie in. Since they still have not located the remaining three missing miners, the team can look for them as they advance. The team can see that there is no one located in the area of unsafe roof located along the eastern rib. So, the team can continue southward.

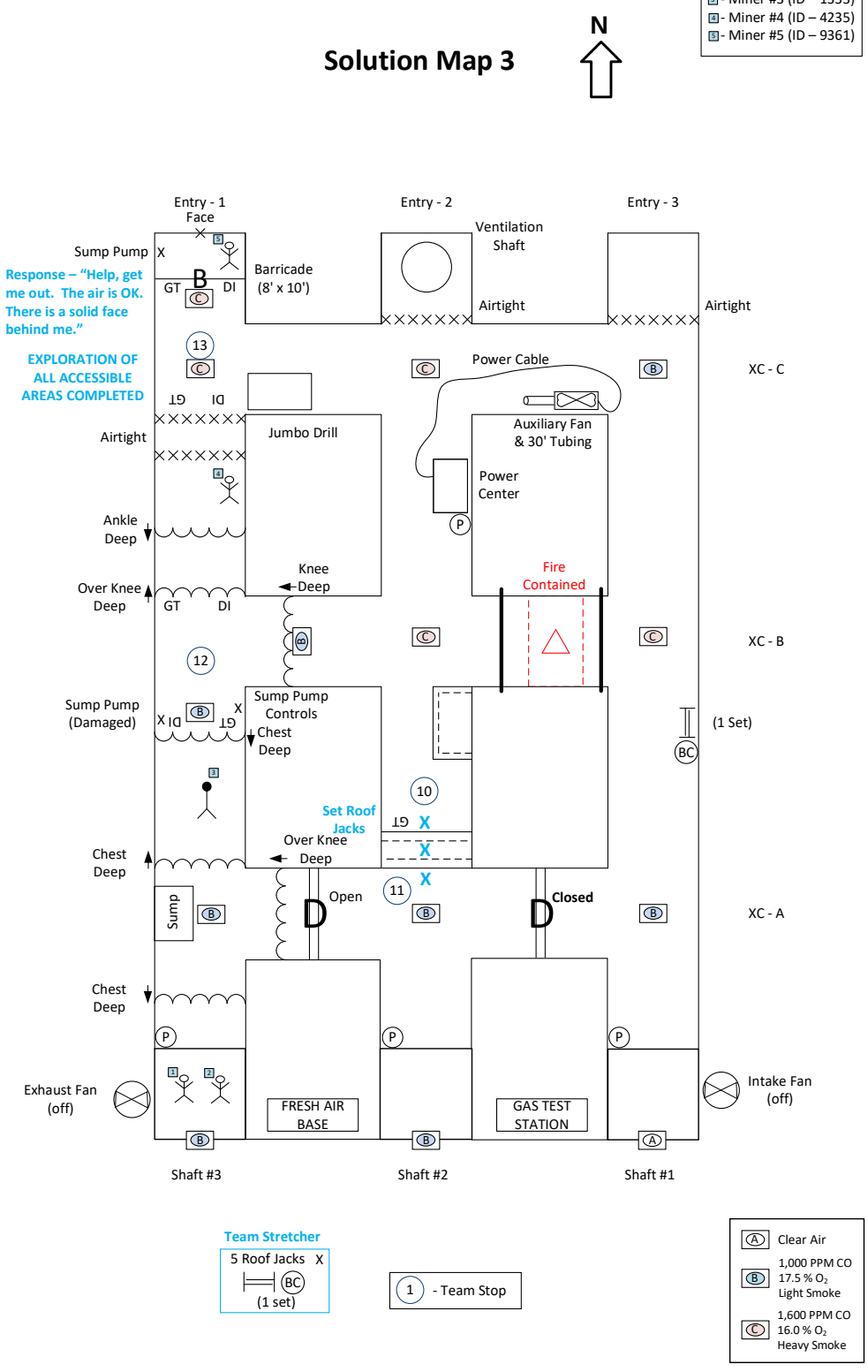
Team Stop No. 11
As the team approaches XC-A, they will find the northern extent of the area of unsafe roof stretching rib-to-rib. The captain will perform roof or back checks as the team will conduct necessary gas checks. Then, the team can use three of the roof jacks to safely support the area. None of the missing miners will be found in this area. So, the team can continue southward into the intersection to tie-in.

Note: The team should follow the example shown in Figure 1 on page 36 of the 2016 Metal and Nonmetal Mine Rescue Contest Rules booklet. If the team removes any installed post after it has been set, assess a team endangerment (75 discounts) or individual endangerment (15 x each person) per Judge 1 – UG Rule #10(b)(7).

Team Stop No. 12
Now that the team has tied-in the accessible entries behind them, they can retreat in Entry 2 to XC-B and advance westward in the crosscut toward Entry 1. Ten feet into the crosscut, the team will find a placard indicating “water knee deep” stretching rib-to-rib. They will also find a placard indicating “17.5 % O_2, and 1,000 ppm CO with light smoke.” The team can advance through the water to Entry 1. At the intersection, the captain will perform roof or back checks as the team will conduct necessary gas checks. To the north, the team will find a placard indicating “water over knee deep” stretching rib-to-rib. The team cannot pass the placard. The captain must D&I the water as their FPA in this direction. The team can advance southward to tie-in. Five feet south of the intersection, the team will find a placard indicating “water chest deep” stretching rib-to-rib. The team cannot pass the placard. The captain must D&I the water as their FPA in this direction. A gas test will show “17.5 % O_2, and 1,000 ppm CO with light smoke.” The team will also find a placard indicating “sump pump (damaged)” located along the western rib near the edge of the water. Along the eastern rib, the team will find the sump pump controls. If the team asks for the status of these controls, they will be informed that the pump controls are in the “off” position. If a team member advances past the placards indicating “water over knee deep” or “water chest deep”, assess individual endangerment discounts (15 x each person) per Judge 1 – UG Rule #10(a)(2).

Missing Miners:
- 1 - Miner #1 (ID – 6771)
- 2 - Miner #2 (ID – 2941)
- 3 - Miner #3 (ID – 1333)
- 4 - Miner #4 (ID – 4235)
- 5 - Miner #5 (ID – 9361)

Solution Map 3



Team Stop No. 13

To continue systematic exploration, the team will retreat to the intersection of Entry 2 and XC-C. Afterward, they can advance westward in the crosscut toward Entry 1. The team will find a jumbo drill parked half way into the crosscut along the southern rib. At the intersection, the captain will perform roof or back checks as the team will conduct necessary gas checks. They will find a placard indicating "16.0 % O_2, and 1,600 ppm CO with heavy smoke." To the south, the team will find a placard indicating an "airtight cave" stretching rib-to-rib. The captain must D&I the cave as their FPA in this direction. The team can stretch northward to find an 8-feet by 10-feet brattice cloth barricade stretching from rib-to-rib about 5 feet inby the intersection. A gas placard near the barricade indicates that the gas concentrations are the same as those found at the intersection. When the team captain calls out to anyone inside, there is a response:

> *"Help get me out. I am Miner No. 5 (I.D. 9361), the jumbo drill operator. I tried to get out of the mine but could not. I am not injured. The air inside this barricade is O.K. and there is a solid face behind me. I do not know the whereabouts or condition of my coworkers."* Note: no other information will be provided to the team.

Because of the low oxygen and high carbon monoxide concentrations in the area, the team cannot open the barricade. The team can instruct Miner #5 to stay inside of the barricade until ventilation can be safely restored and the area in front of the barricade can be cleared. The captain must D&I the barricade as their FPA in this direction. **If the team opens the barricade, assess 50 discounts per Judge 1 - UG Rule #18(a).**

Missing Miners:
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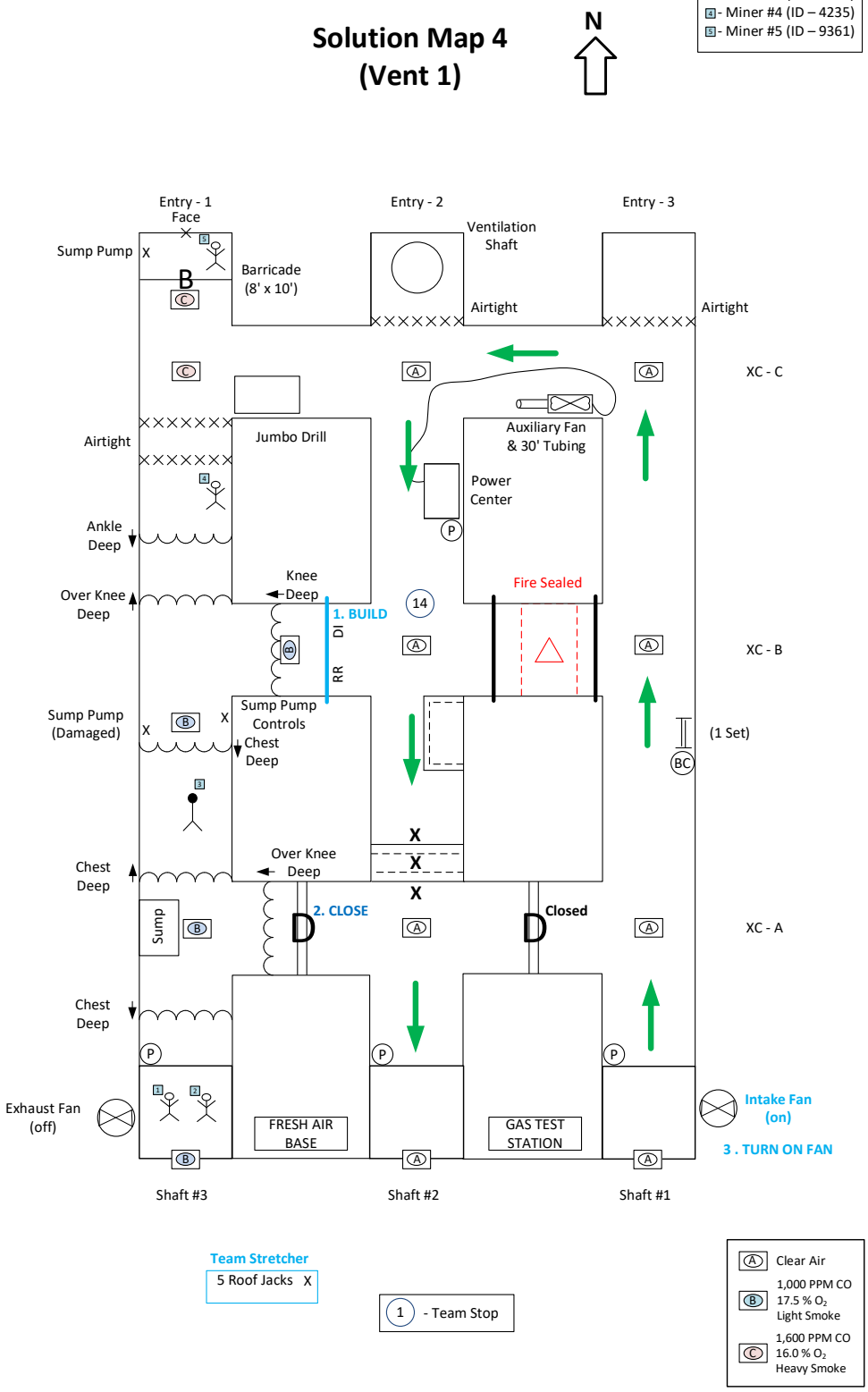
- Miner #2 (ID – 2941)
- Miner #3 (ID – 1333)
- Miner #4 (ID – 4235)
- Miner #5 (ID – 9361)

Solution Map 4 (Vent 1)



Note: Team Stop No. 14 (see Solution Map 4 – Vent 1)

Team Stop No. 14
At this point, the team has explored all accessible areas of the mine. In order to enter the barricade in Entry 1, the team must make a ventilation change in order to clear the area in front of the barricade. The team must confer with the mine manager through their fresh air base coordinator by using the communication line, or by returning to the surface.

The team must explain the necessary ventilation changes prior to implementing them. For the purposes of this problem solution, the following steps will be discussed to accomplish re-ventilation:

1) Build a temporary stopping in Crosscut B between Entry 1 and Entry 2;
2) Close the door in Crosscut A between Entry 1 and Entry 2; and
3) Turn on the Intake Fan at Shaft #1.

These changes will allow the team to remain in the mine while air flows from Shaft #1 northward in Entry 3, westward through XC-C, southward in Entry 2 and out of the mine via Shaft #2. This will flush away the contaminants and increase the oxygen content along this path.

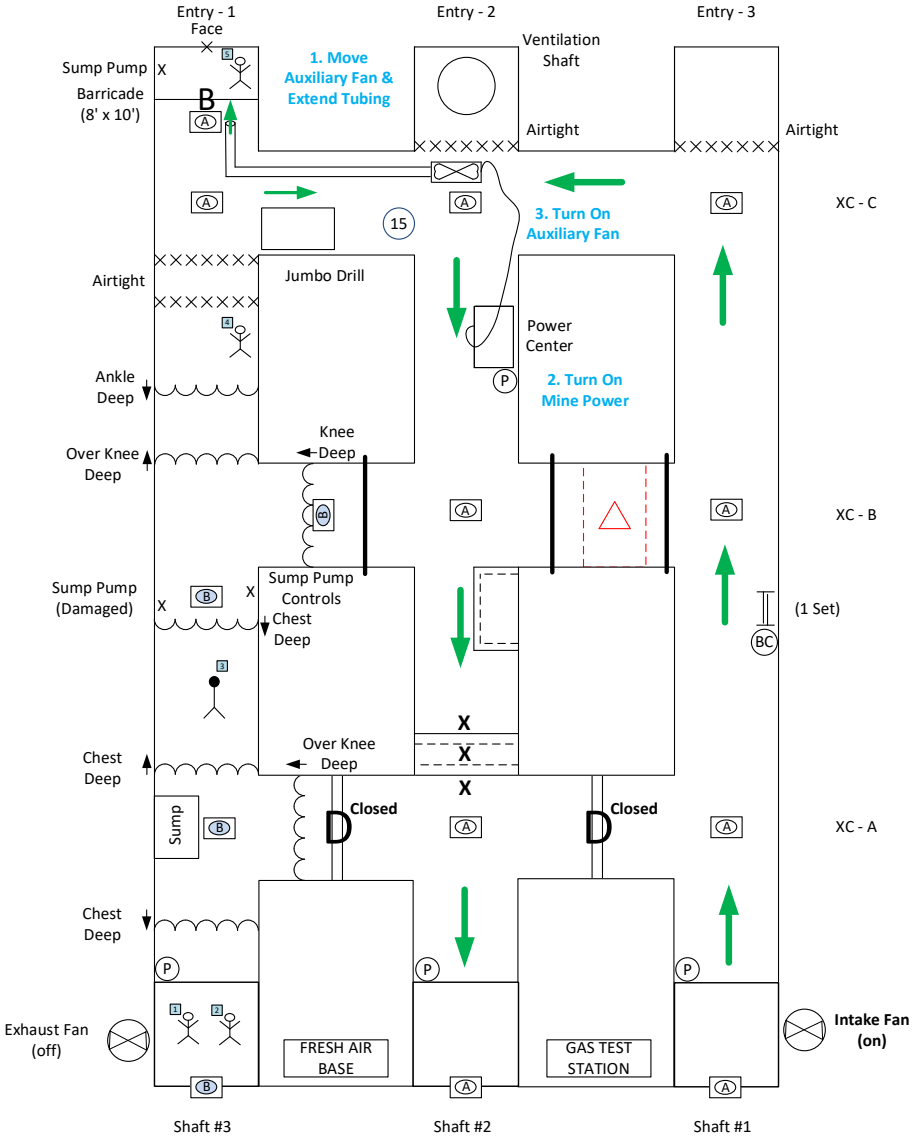
If the captain doesn't check the roof and rib prior to building a temporary stopping, assess 5 discounts per Judge 1- UG Rule #8(b)(3). If the captain does not D&I the build, assess discounts per Judge 1 – UG Rule #9 (2x each place - 10 max).

Note: If the team implements these changes, the seven gas placards in Entry 3 and Entry 2 and at the Shaft #2 collar will quickly revert to "clear air."

Missing Miners:
- 1 - Miner #1 (ID – 6771)
- 2 - Miner #2 (ID – 2941)
- 3 - Miner #3 (ID – 1333)
- 4 - Miner #4 (ID – 4235)
- 5 - Miner #5 (ID – 9361)

Solution Map 5 (Vent 2)

N



Team Stretcher
5 Roof Jacks X

1 - Team Stop

- A Clear Air
- B 1,000 PPM CO, 17.5 % O_2, Light Smoke
- C 1,600 PPM CO, 16.0 % O_2, Heavy Smoke

Note: Team Stop No. 15 (see Solution Map 5 – Vent 2)

Team Stop No. 15
When the team rechecks the areas, they will find that the air is clear. However, XC-C between Entry 2 and Entry 1 and the immediate area in front of the barricade did not clear. Therefore, the team must make a second ventilation change in order to clear the area in front of the barricade. The team must confer with the mine manager through their fresh air base coordinator by using the communication line, or by returning to the surface.

The team must explain the necessary ventilation changes prior to implementing them. For the purposes of this problem solution, the following steps will be discussed to accomplish re-ventilation:

1) Move the Auxiliary Fan and extend the 30 feet of Tubing toward the barricade (as shown on Solution Map 5);
2) Turn on the mine power leading to the Power Center; and
3) Turn on the Auxiliary Fan.

This will flush away the contaminants and increase the oxygen content along this path.

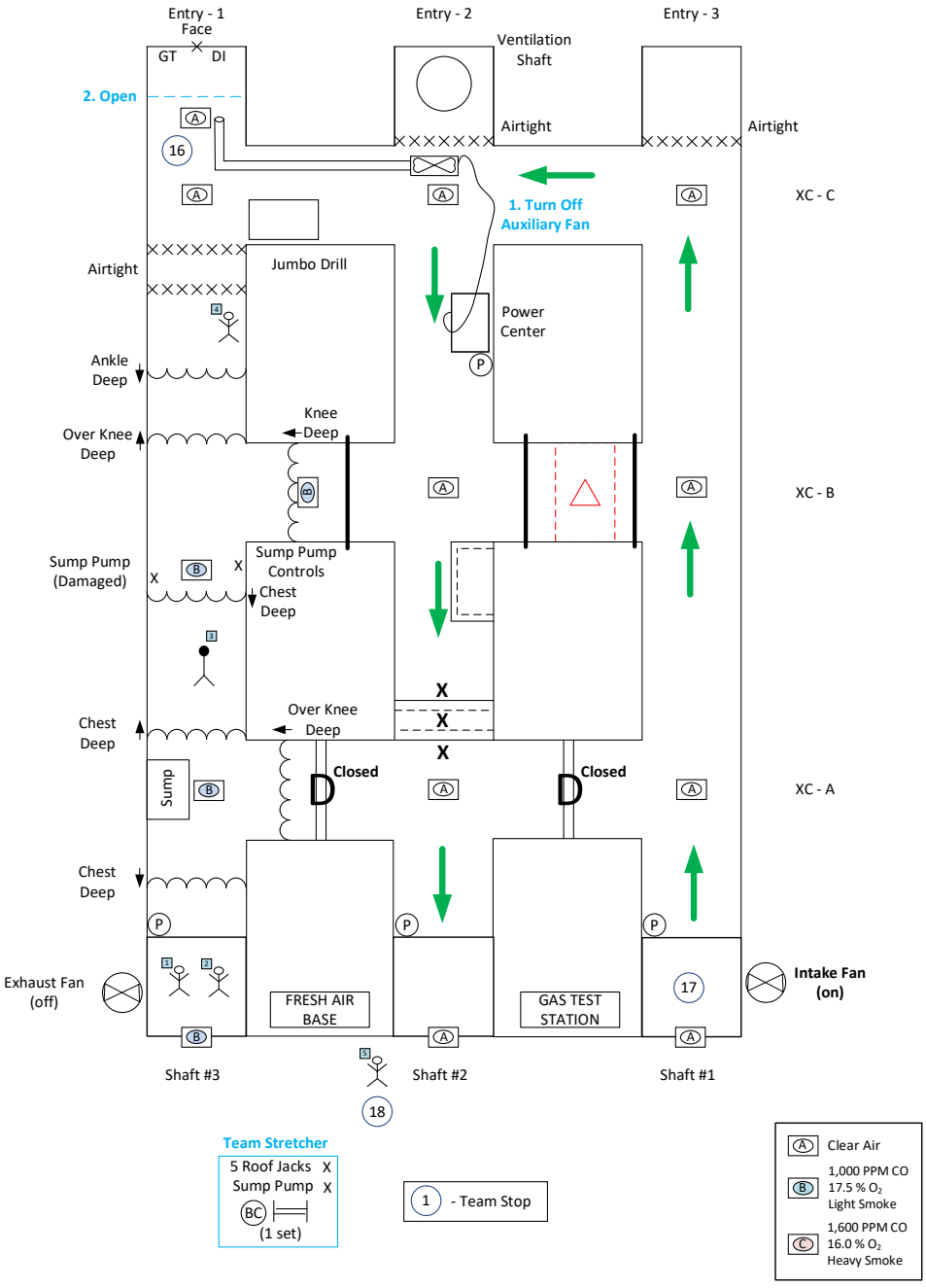
Note: If the team implements these changes, then the two gas placards in the crosscut and near the barricade will quickly revert to "clear air."

Note: Some teams may opt to combine Vent 1 (outlined in Team Stop No. 14) and Vent 2 (outlined in Team Stop No. 15) to clear the contaminants from the mine along the intended paths shown. This would be an acceptable option and would save the team valuable time with no added discounts.

Missing Miners:
- Miner #1 (ID – 6771)
- Miner #2 (ID – 2941)
- Miner #3 (ID – 1333)
- Miner #4 (ID – 4235)
- Miner #5 (ID – 9361)

Solution Map 6 (Rescue 1)

N



Note: Team Stop Nos. 16 - 18 (see Solution Map 6 – Rescue 1)

Team Stop No. 16
Once the area has been cleared, the team can turn off the auxiliary fan. Now the team can open the barricade and go inside. Upon passing through the barricade, the captain must verbally indicate he/she is checking the roof or back and the team must conduct necessary gas tests. Once inside, the team will meet Miner #5. He appears to be in good health but frightened. The captain can continue to explore the area while other team members conduct a secondary survey on Miner #5. They will find that the miner is uninjured and can walk out with the team. The captain will find a replacement sump pump lying near the western rib. **The team will carry it with them for future use.** Because the path back to Shaft #1 has been cleared, the miner will not need to wear an apparatus. Before leaving the area, the captain must D&I the location of the survivor and the face of Entry 1 as their FPA in that direction.

If the team does not adequately examine or evaluate Miner #5 for possible injury or illness, assess 4 discounts per Judge 2 – UG Rule #14(a).

Team Stop No. 17
The team will advance to the Shaft #1 Station. The team can enter the conveyance, close the shaft gate and signal the hoist engineer.

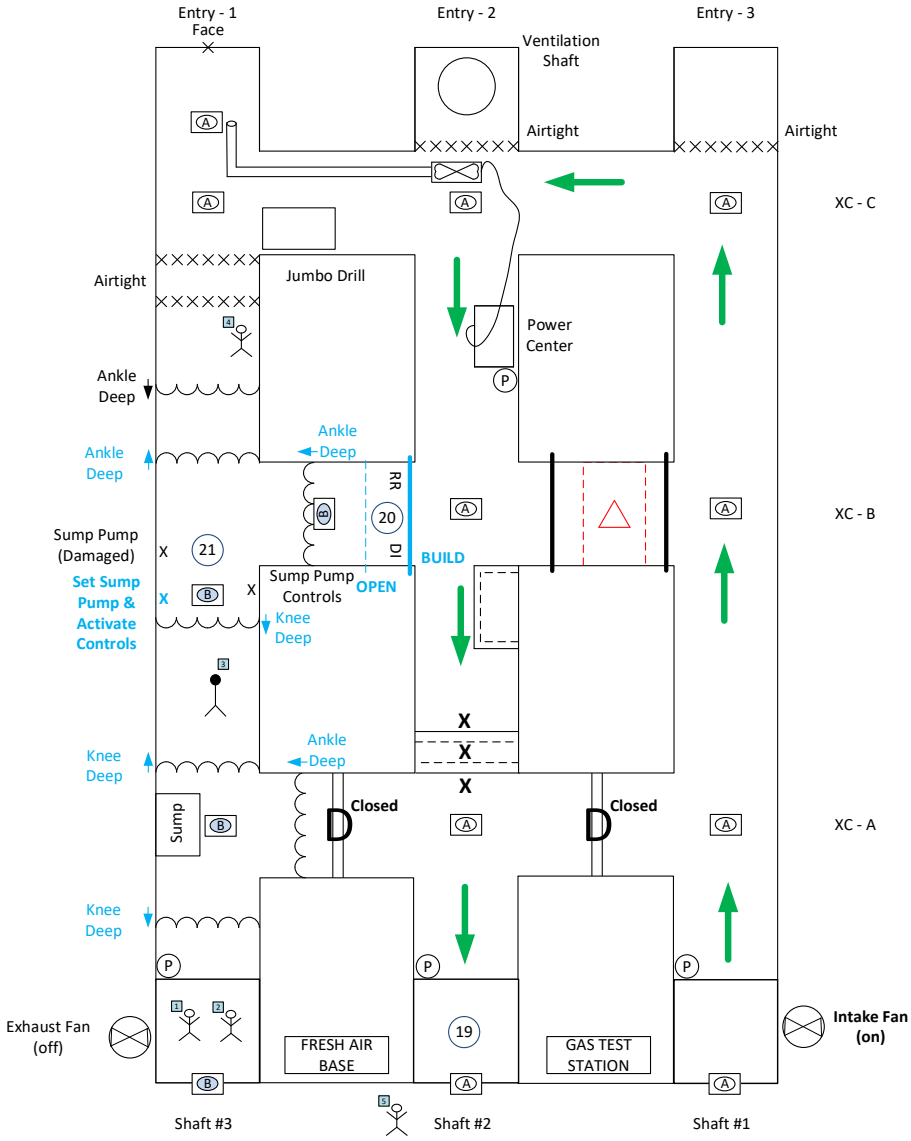
Note: All areas that had been cleared of smoke or toxic or dangerous gases must be gas tested rib-to-rib along the route that they travel.

Team Stop No. 18
When the team has been hoisted to the surface, the team can exit the cage and close the shaft gate behind them. They can escort Miner #5 to the fresh air base. At that time, the team can arrange for any follow-up care for the miner.

Missing Miners:
- 1 - Miner #1 (ID – 6771)
- 2 - Miner #2 (ID – 2941)
- 3 - Miner #3 (ID – 1333)
- 4 - Miner #4 (ID – 4235)
- 5 - Miner #5 (ID – 9361)

Solution Map 7 (Pump Water)

N



Team Stretcher

5 Roof Jacks X
BC
(1 set)

1 - Team Stop

A Clear Air

B 1,000 PPM CO
17.5 % O_2
Light Smoke

C 1,600 PPM CO
16.0 % O_2
Heavy Smoke

Note: Team Stop Nos. 19 - 21 (see Solution Map 7 – Pump Water)

Team Stop No. 19
Now that the team has the means to pump and lower the water levels in Entry 1, they can re-enter the mine through Shaft No. 2. After entering the cage, they must close the shaft gate and signal the hoist engineer. Afterward, the team will descend to Shaft #2 Station.

Team Stop No. 20
The team will travel northward in Entry 2 to XC-B. Then, they can turn westward and erect a temporary stopping in the crosscut for use as an airlock. Afterward, they can tear down the temporary stopping that they had previously erected for their initial ventilation change and proceed westward to Entry 1.

If the captain doesn't check the roof and rib prior to building a temporary stopping, assess 5 discounts per Judge 1- UG Rule #8(b)(3). If the captain does not D&I the build, assess discounts per Judge 1 – UG Rule #9 (2x each place - 10 max).

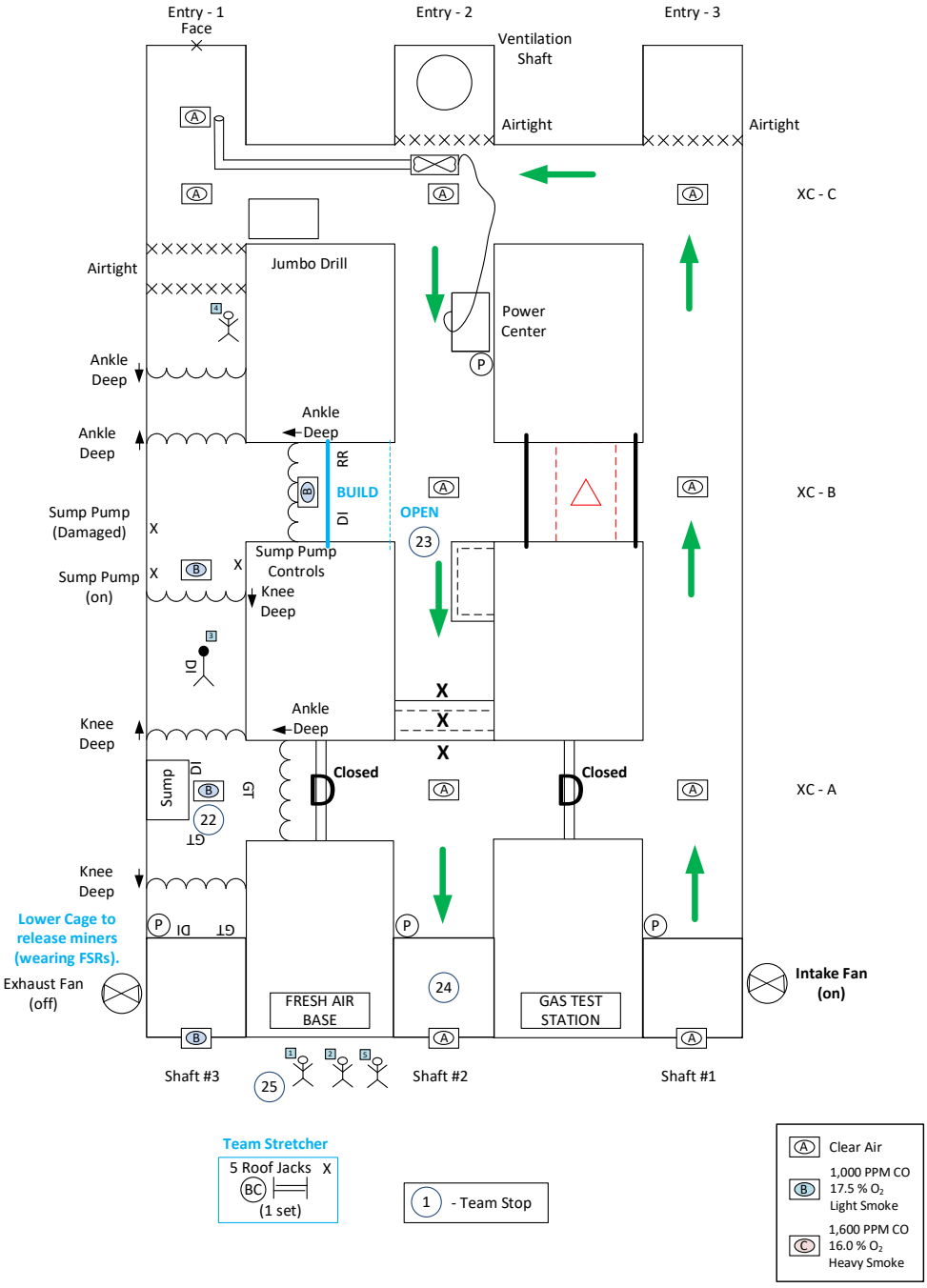
Team Stop No. 21
Once in the intersection, the team can turn southward in the entry and advance to the water's edge. They can remove the damaged sump pump and replace it with the one that they had retrieved in the face area behind the barricade. After the replacement pump is installed, the controls can be activated. Afterward, the water levels in the drift will drop to passable depths as shown on Solution Map 7.

Note: A total of six water placards in XC-A, XC-B and Entry 1 will be flipped to show the lower depths on their reverse sides. Based on these levels, the areas in are now accessible.

2018 National Contest – Day 2

Missing Miners:
- Miner #1 (ID – 6771)
- Miner #2 (ID – 2941)
- Miner #3 (ID – 1333)
- Miner #4 (ID – 4235)
- Miner #5 (ID – 9361)

Solution Map 8 (Rescue 2)



Note: Team Stop Nos. 22 - 25 (see Solution Map 8 – Rescue 2)

Team Stop No. 22
After the pump is activated and the water levels have dropped, the team can continue systematic exploration of the remaining areas in Entry 1 while searching for the last two missing miners. At that time, the team will advance southward toward XC-A to tie-in. The placard originally indicating "water chest deep" has changed to "water knee deep." As they travel, they will find the fourth missing miner (Miner #3, ID – 1333) lying in the water and unresponsive. The team captain must perform necessary roof or back checks over the miner. After a primary assessment, the #1 Judge will hand the team member a placard which reads: **"The miner is badly burned and exhibits no vital signs. The miner is dead."** The captain must D&I the location of the body. Then, the team can continue to XC-A where they will find that the placard originally indicating "water chest deep" has changed to "water knee deep." At the intersection, a gas test will show "17.5 % O2, and 1,000 ppm CO with light smoke." They can stretch eastward in the XC-A to tie in. In the crosscut, the placard originally indicating "water knee deep" has changed to "water ankle deep."

The team can return to the intersection and stretch southward in Entry 1 to the Shaft #3 Station. They will find a placard indicating "water knee deep" about 5 feet south of the intersection and extending toward the shaft. When they reach the shaft station, the captain must perform roof or back checks as the team conducts necessary gas tests. They will find that gas concentrations have not changed from their previous location. They will also find a working mine phone located near the shaft gate. At this point, the team can request that the escape hoist be lowered to release the two trapped miners (Miner #1 and Miner #2). **The Mine Manager will direct the hoist operator to lower the cage.** Once the cage reaches the station landing, the two miners can be escorted from the cage. The team members will perform secondary surveys to assess each miner's condition. They will find that the two miners are uninjured and can walk out with the team.

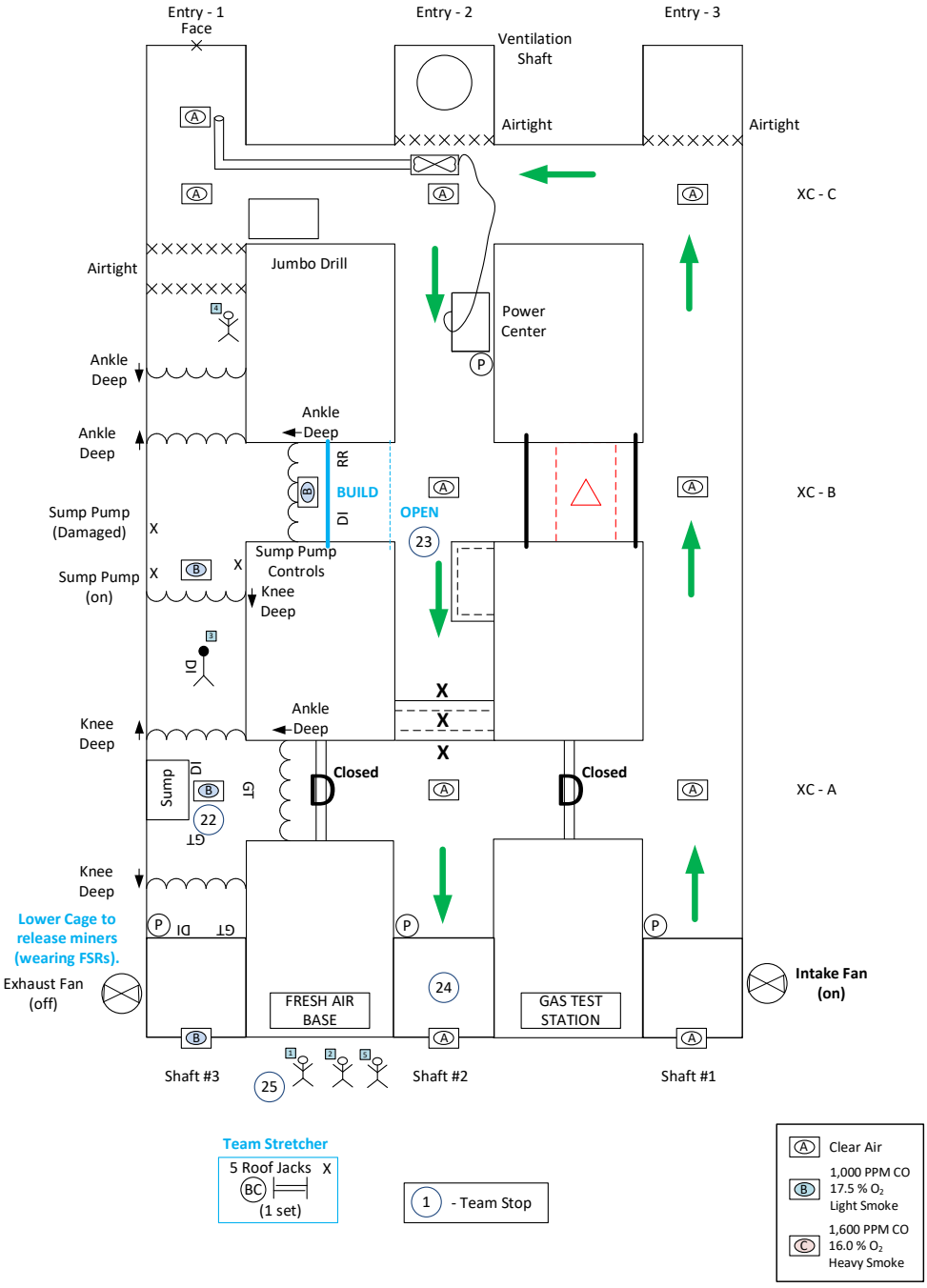
Note: Since the miners are already wearing their filter-self rescuers and the CO concentration along a portion of the exit route is 1,000 ppm, they should keep the FSRs on until the group exits the mine. The team can save their spare apparatus for use on another survivor.

Team Stop No. 23
The team and the two miners can advance northward in Entry 1 to XC-B. Then, they can travel eastward in the crosscut and rebuild the temporary stopping that they had previously tore down to access the area. Afterward, they can tear down the temporary stopping that they had previously erected as an airlock and proceed to Entry 2.

If the captain doesn't check the roof and rib prior to building a temporary stopping, assess 5 discounts per Judge 1- UG Rule #8(b)(3). If the captain does not D&I the build, assess discounts per Judge 1 – UG Rule #9 (2x each place - 10 max).

Missing Miners:
- 1 - Miner #1 (ID – 6771)
- 2 - Miner #2 (ID – 2941)
- 3 - Miner #3 (ID – 1333)
- 4 - Miner #4 (ID – 4235)
- 5 - Miner #5 (ID – 9361)

Solution Map 8 (Rescue 2)



Team Stop No. 24
Now, the team can advance southward in Entry 2 toward Shaft #2. When they reach the Shaft #2 Station, the team and the miners can enter the conveyance, close the shaft gate, signal the hoist engineer and start their ascent to the surface.

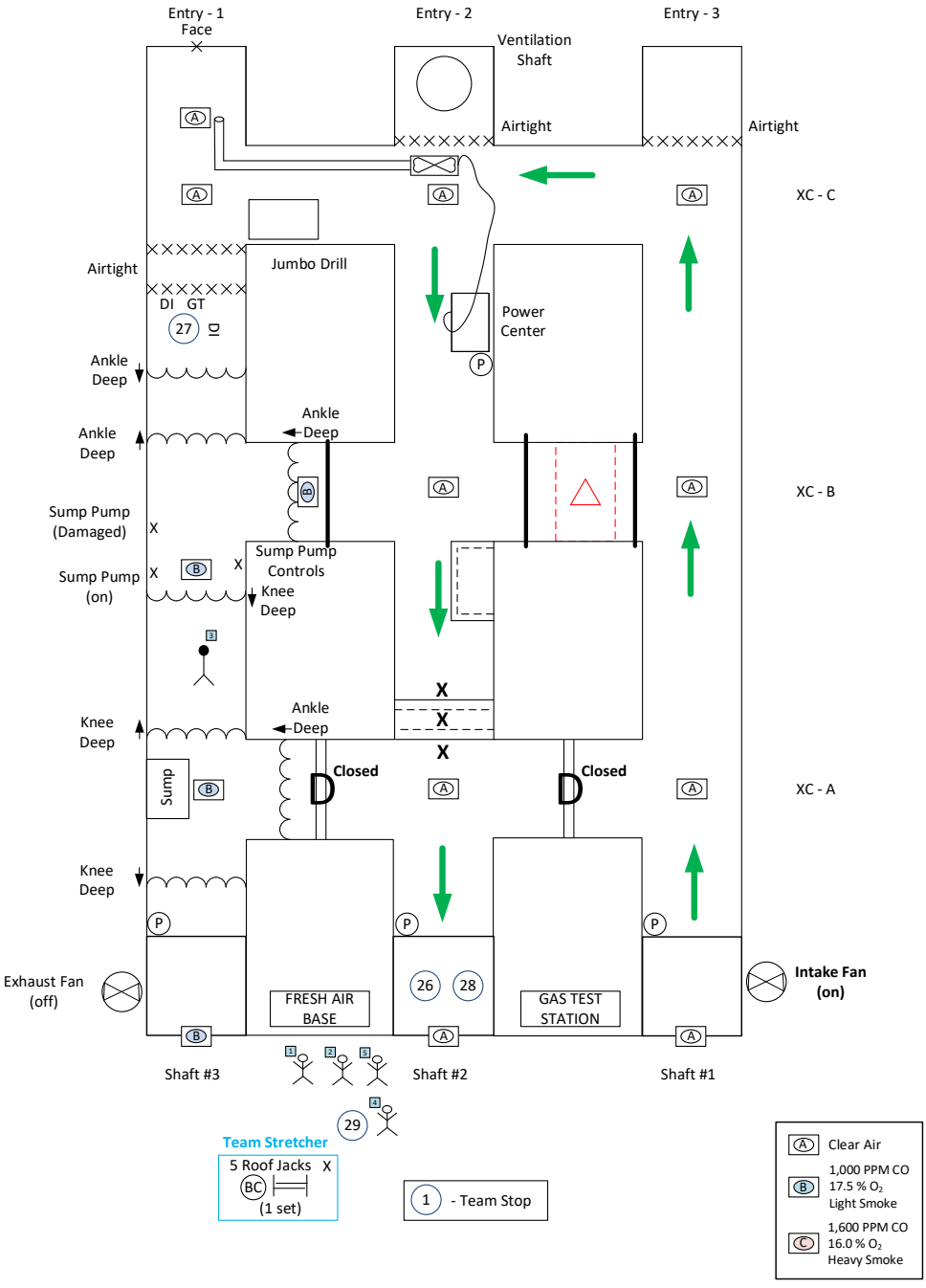
Team Stop No. 25
After ascending in the cage to the surface landing, the team can exit and close the shaft gate behind them to release the cage. Then, they can escort Miner #1 and Miner #2 to the fresh air base. At that time, the team can arrange for any follow-up medical treatment.

2018 National Contest – Day 2

Missing Miners:
1 - Miner #1 (ID – 6771)
2 - Miner #2 (ID – 2941)
3 - Miner #3 (ID – 1333)
4 - Miner #4 (ID – 4235)
5 - Miner #5 (ID – 9361)

Solution Map 9 (Rescue 3)

N



Note: Team Stop Nos. 26 - 29 (see Solution Map 9 – Rescue 3)

Team Stop No. 26
In order to explore the remaining area (north of XC-B in Entry 1) to find the last missing miner, the team can re-enter the mine through Shaft No. 2. After entering the cage, they must close the shaft gate and signal the hoist engineer. Afterward, the team will descend to the 1,650-foot Level.

Team Stop No. 27
Once at Shaft #2 Station, the team can exit the cage and close the shaft gate behind them to release the cage. Then, the team will advance westward in XC-A to Entry 1 and proceed northward in the entry to XC-B. They will find that the placard north of the intersection (originally indicating "water over knee deep") had changed to "water ankle deep." Five feet past the intersection, the team will find the extent of the "water ankle deep" and reach dry floor. Traveling further, the team will find the last missing miner (Miner #4, ID – 4235) lying near the eastern rib and unresponsive. The team captain must perform necessary roof or back checks over the miner. After a primary assessment, the miner will awaken and speak to the team. The miner is O.K. but disoriented. At this time, the team can continue with their secondary survey to find that the miner is uninjured. **Because the concentration of CO along their exit route is 1,000 ppm, the miner must be fitted with proper respiratory protection.** If the team does not provide proper respiratory protection for the survivor, assess discounts (50 x each person) per Judge 1 – UG Rule 18(d). Additionally, if the captain does not assess roof conditions directly over the miner, assess discounts (5 x each infraction) per Judge 1 – UG Rule #8(c).

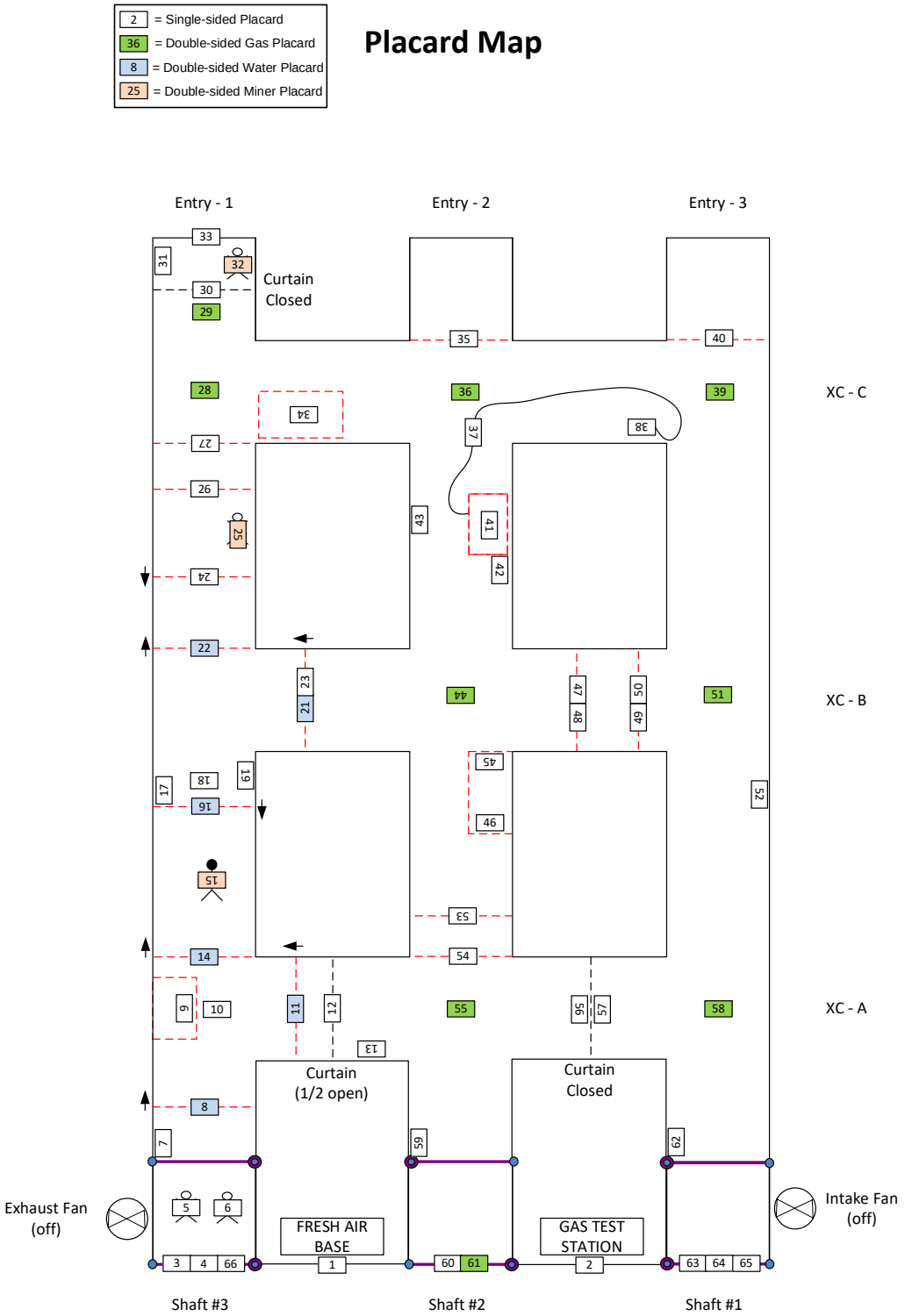
The captain can continue to explore while team members prepare Miner #4 for travel. Stretching northward, the captain will find the southern extent of the airtight cave stretching rib-to-rib. After performing roof or back checks and taking necessary gas tests, the captain will D&I the cave as their furthest point of advance (FPA) in this direction. The team and Miner #4 can then travel to the Shaft #2 Station.

Team Stop No. 28
Once at the Shaft No. 2 station, the team and Miner #4 can enter the conveyance, close the shaft gate, signal the hoist engineer and start their ascent to the surface.

Team Stop No. 29
After ascending in the cage to the surface, they can exit and close the shaft gate behind them. The team must count off as they exit the mine for this final time. They can escort Miner #4 to the fresh air base. At that time, the team can arrange for any follow-up medical treatment. The captain can report to the Mine Manager that the team has completed their mission. That is, they have explored all accessible areas of the mine, sealed the fire, re-ventilated as needed, pumped the water, located all five missing miners, and brought four of them out alive.

***** THE END ****

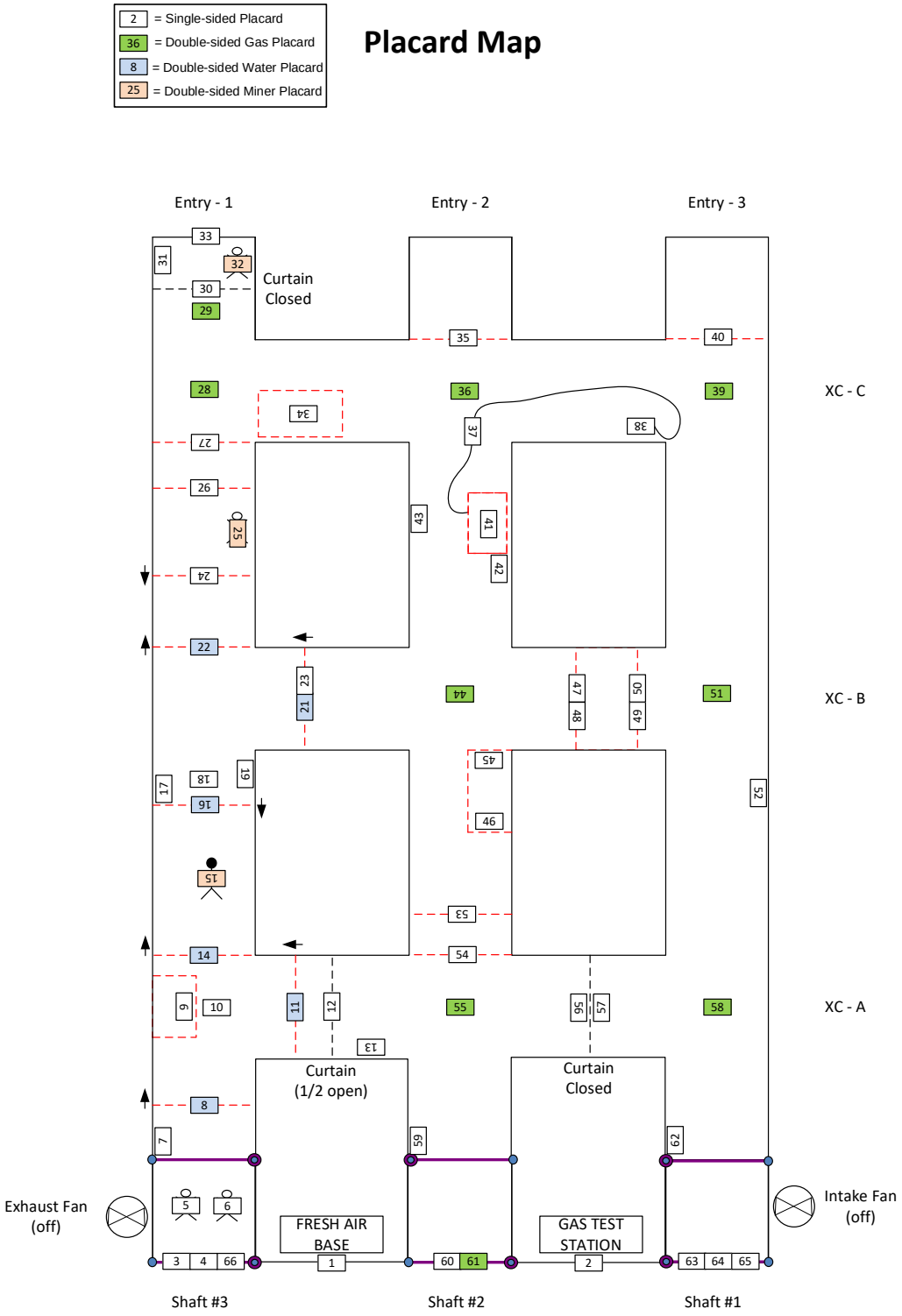
Placard Map


2 = Single-sided Placard
36 = Double-sided Gas Placard
8 = Double-sided Water Placard
25 = Double-sided Miner Placard
Entry - 1
Entry - 2
Entry - 3
Curtain Closed
XC - C
XC - B
XC - A
Curtain (1/2 open)
Curtain Closed
Exhaust Fan (off)
Intake Fan (off)
FRESH AIR BASE
GAS TEST STATION
Shaft #3
Shaft #2
Shaft #1

Placard Key:

1. Fresh Air Base
2. Gas Test Station
3. Shaft #3
4. 1,000 ppm CO
   17.5 % O_2
   Light Smoke
5. Miner #1 (ID – 6771)
6. Miner #2 (ID – 2941)
7. Mine Phone (operable)
8. Water Chest Deep ▲
9. Sump
10. 1,000 ppm CO
    17.5 % O_2
    Light Smoke
11. Water Over Knee Deep ▲
12. Permanent Stopping
    with Door (open)
13. Brattice Material & Frames (2 sets)
14. Water Chest Deep ▲
15. Person / Miner #3 (ID - 1333)
16. Water Chest Deep ▲
17. Sump Pump (damaged)
18. 1,000 ppm CO
    17.5 % O_2
    Light Smoke
19. Sump Pump Controls
21. Water Knee Deep ▲
22. Water Over Knee Deep ▲
23. 1,000 ppm CO
    17.5 % O_2
    Light Smoke
24. Water Ankle Deep ▲
25. Person / Miner #4 (ID – 4235)
26. Caved Airtight (Rib-to-Rib)
27. Caved Airtight (Rib-to-Rib)
28. 1,600 ppm CO
    16.0 % O_2
    Heavy Smoke
29. 1,600 ppm CO
    16.0 % O_2
    Heavy Smoke
30. Barricade (8’ x 10’)
31. Sump Pump
32. Person / Miner #5 (ID – 9361)
33. Face – Entry-1
34. Jumbo Drill
35. Caved Airtight (Rib-to-Rib)
36. 1,600 ppm CO
    16.0 % O_2
    Heavy Smoke
37. Power Cable
38. Auxiliary Fan with 25’ Tubing
39. 1,000 ppm CO
    17.5 % O_2
    Light Smoke

Placard Map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Entry - 1
Entry - 2
Entry - 3
Curtain Closed
XC - C
XC - B
XC - A
Curtain (1/2 open)
Curtain Closed
Exhaust Fan (off)
Intake Fan (off)
FRESH AIR BASE
GAS TEST STATION
Shaft #3
Shaft #2
Shaft #1

Placard Key (continued):

40. Caved Airtight (Rib-to-Rib)
41. Power Center
42. Mine Phone (operable)
43. 8 Roof Jacks
44. 1,600 ppm CO
    16.0 % O_2
    Heavy Smoke
45. Unsafe Roof
46. Unsafe Roof
47. Lube Truck on Fire
48. Fire Out of Control
49. Lube Truck on Fire
50. Fire Out of Control
51. 1,600 ppm CO
    16.0 % O_2
    Heavy Smoke
52. Brattice Material & Frames (2 sets)
53. Unsafe Roof (Rib-to-Rib)
54. Unsafe Roof (Rib-to-Rib)
55. 1,000 ppm CO
    17.5 % O_2
    Light Smoke
56. Permanent Stopping
    with Door (closed)
57. Permanent Stopping
    with Door (closed)
58. 1,000 ppm CO
    17.5 % O_2
    Light Smoke
59. Mine Phone (operable)
60. Shaft #2
61. 1,000 ppm CO
    17.5 % O_2
    Light Smoke
62. Mine Phone (operable)
63. Shaft #1
64. Clear Air
65. Intake Fan (off)
66. Exhaust Fan (off, cannot be restarted)

Note: Double-sided Placards
Seven gas placards (36, 39, 44, 51, 55, 58 and 61) can be flipped when changes are made by the team to successfully ventilate Entry 2 and Entry 3 while exhausting from the Shaft #2 (see Solution Map 4 – Vent 1).

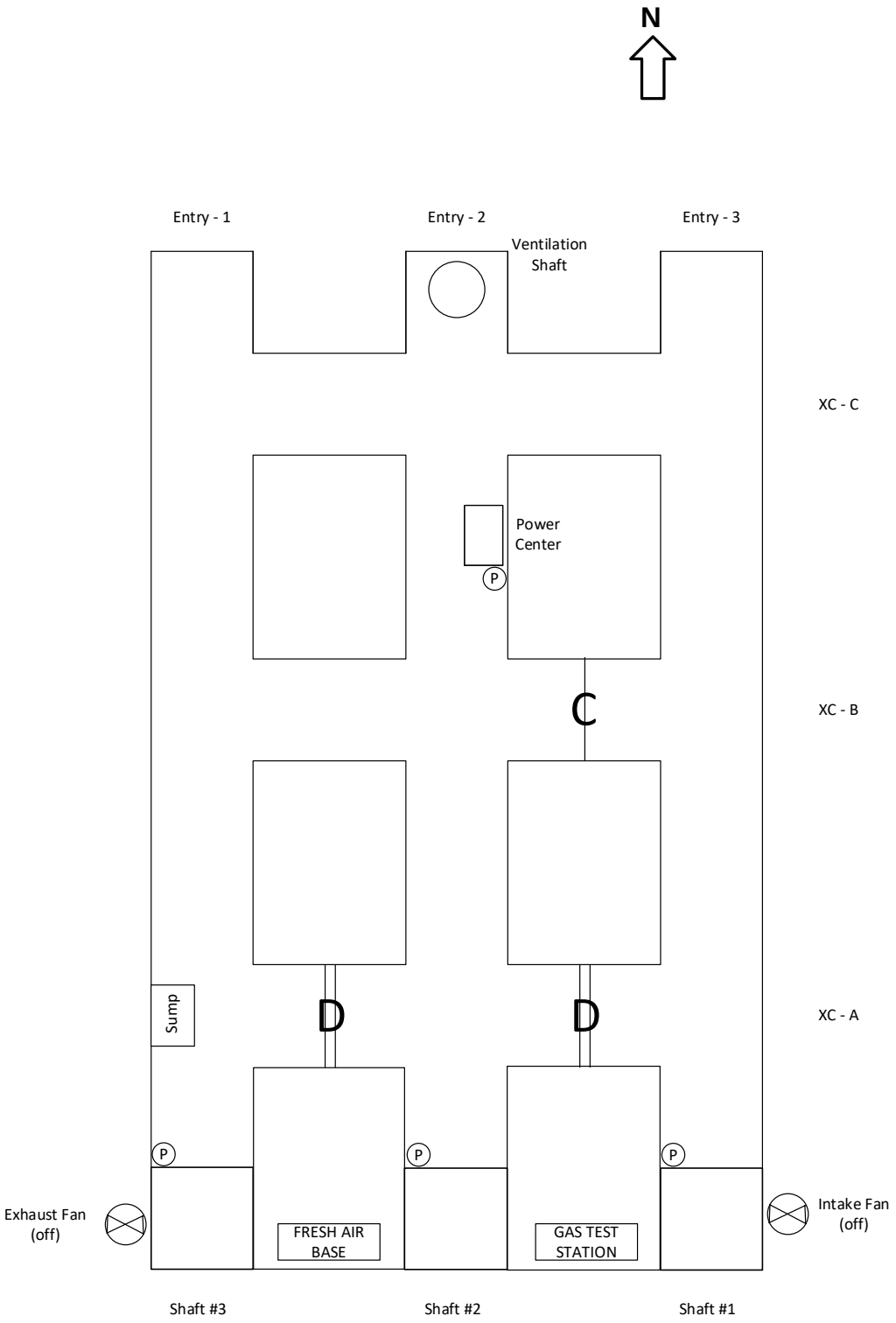
Two gas placards (28 and 29) can be flipped when the team utilizes the auxiliary fan and 30-ft tubing to successfully ventilate the areas in Crosscut C and Entry 1 near the barricade (see Solution Map 5 – Vent 2).

Six water placards (8, 11, 14, 16, 21 and 22) can be flipped when the team replaces the damaged sump pump in Entry 1 near Crosscut B and activates the new pump.

Three placards (15, 25, and 32), one for each missing miner, can be flipped to show their respective identification number.

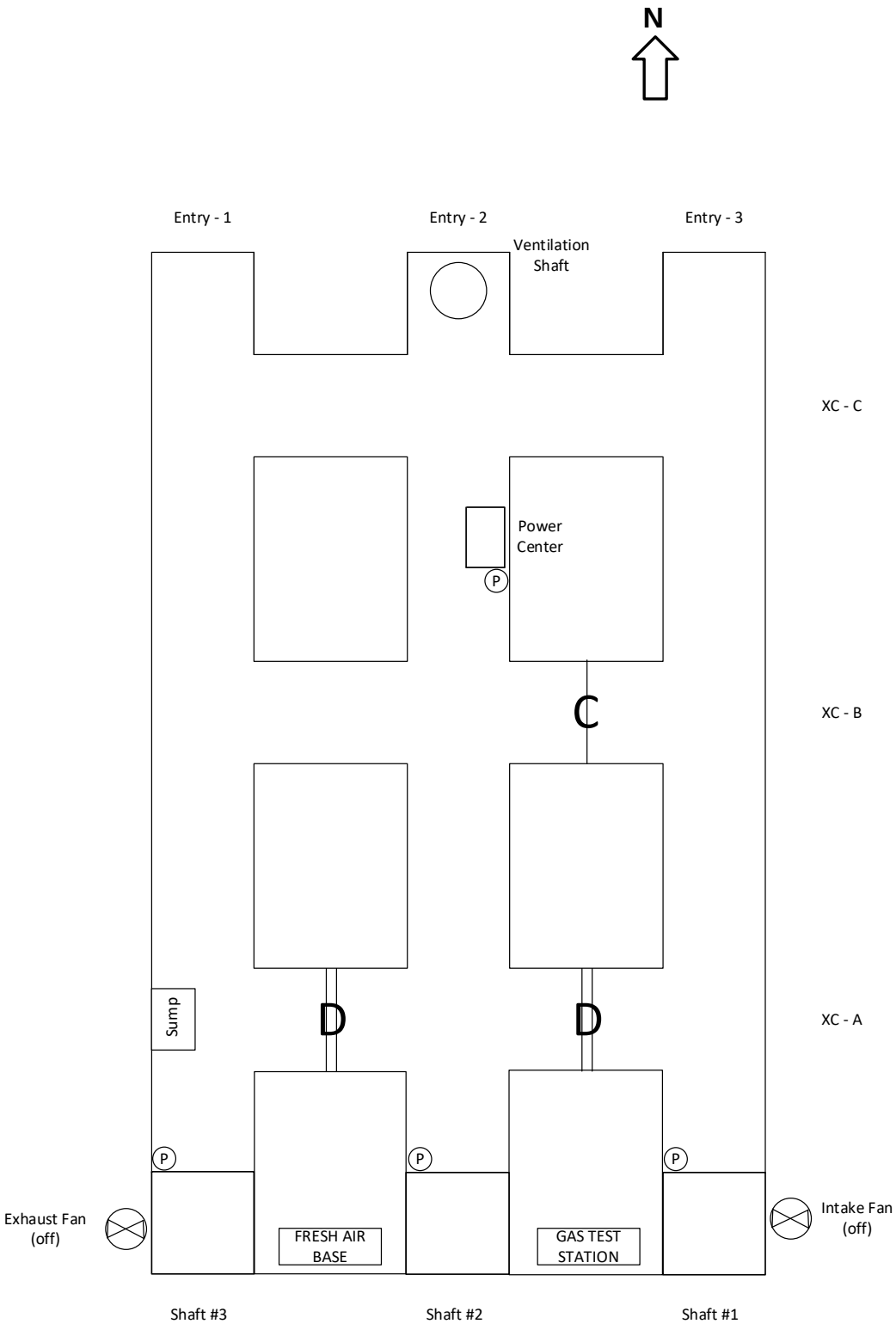
Team Working Order # _____

Team Map (1,650-foot Level)



Team Working Order # _____

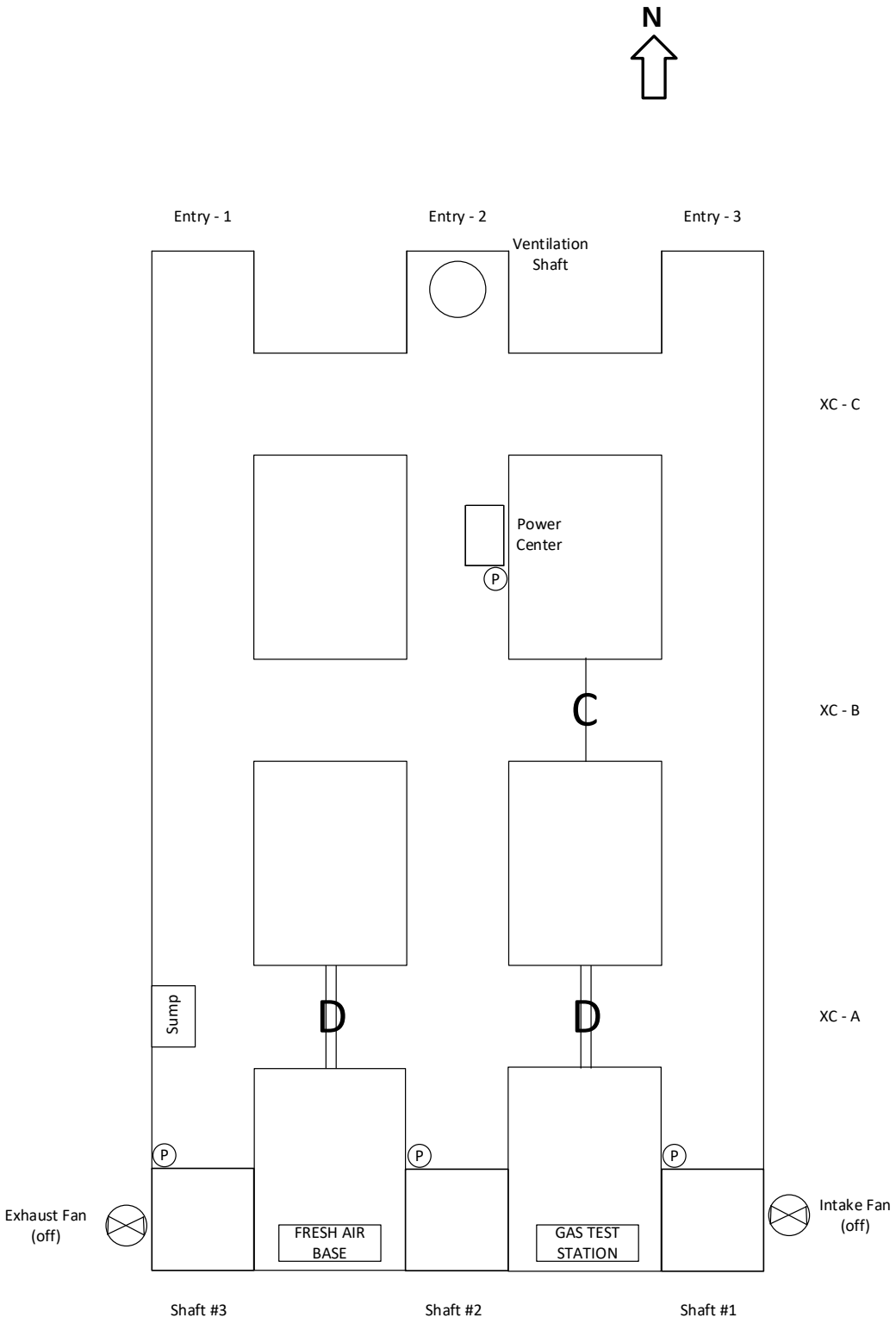
Fresh Air Base Map (1,650-foot Level)



2018 National Contest – Day 2

Team Working Order # _____

Fresh Air Base Alternate Map (Do Not Score)



2018 National Contest – Day 2

Missing Miners:
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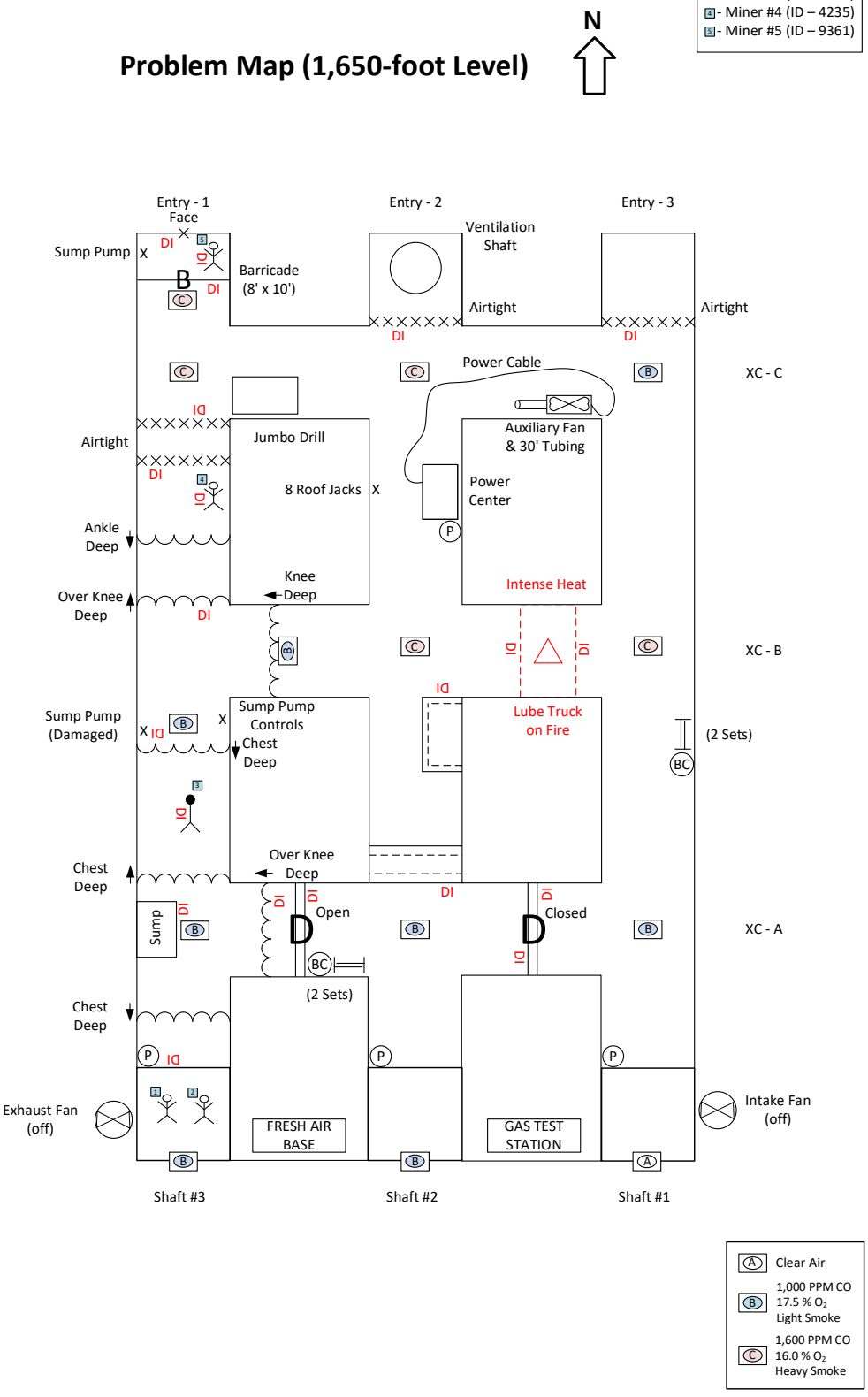
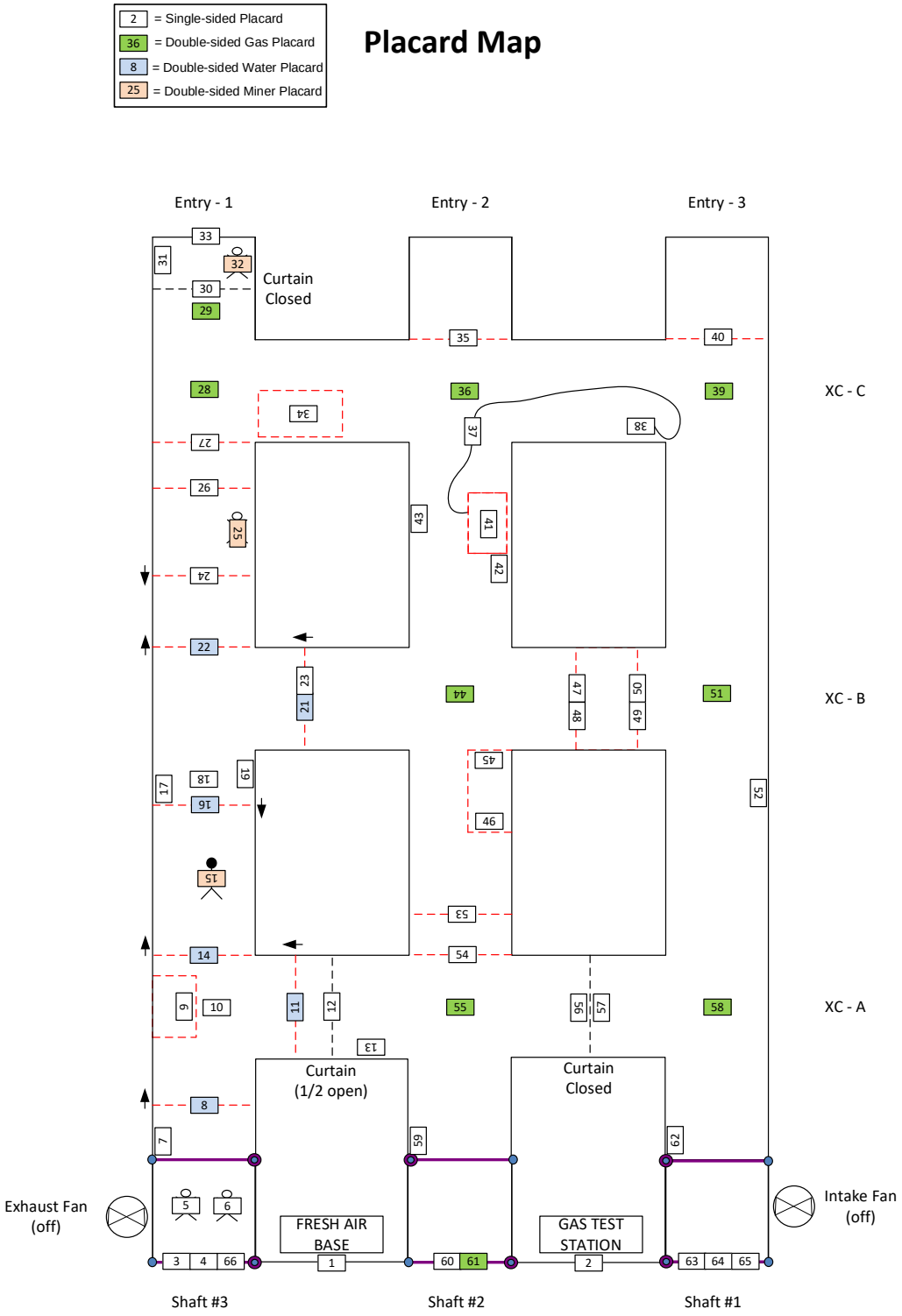
5 - Miner #5 (ID – 9361)

Problem Map (1,650-foot Level)



Placard Map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Entry - 3
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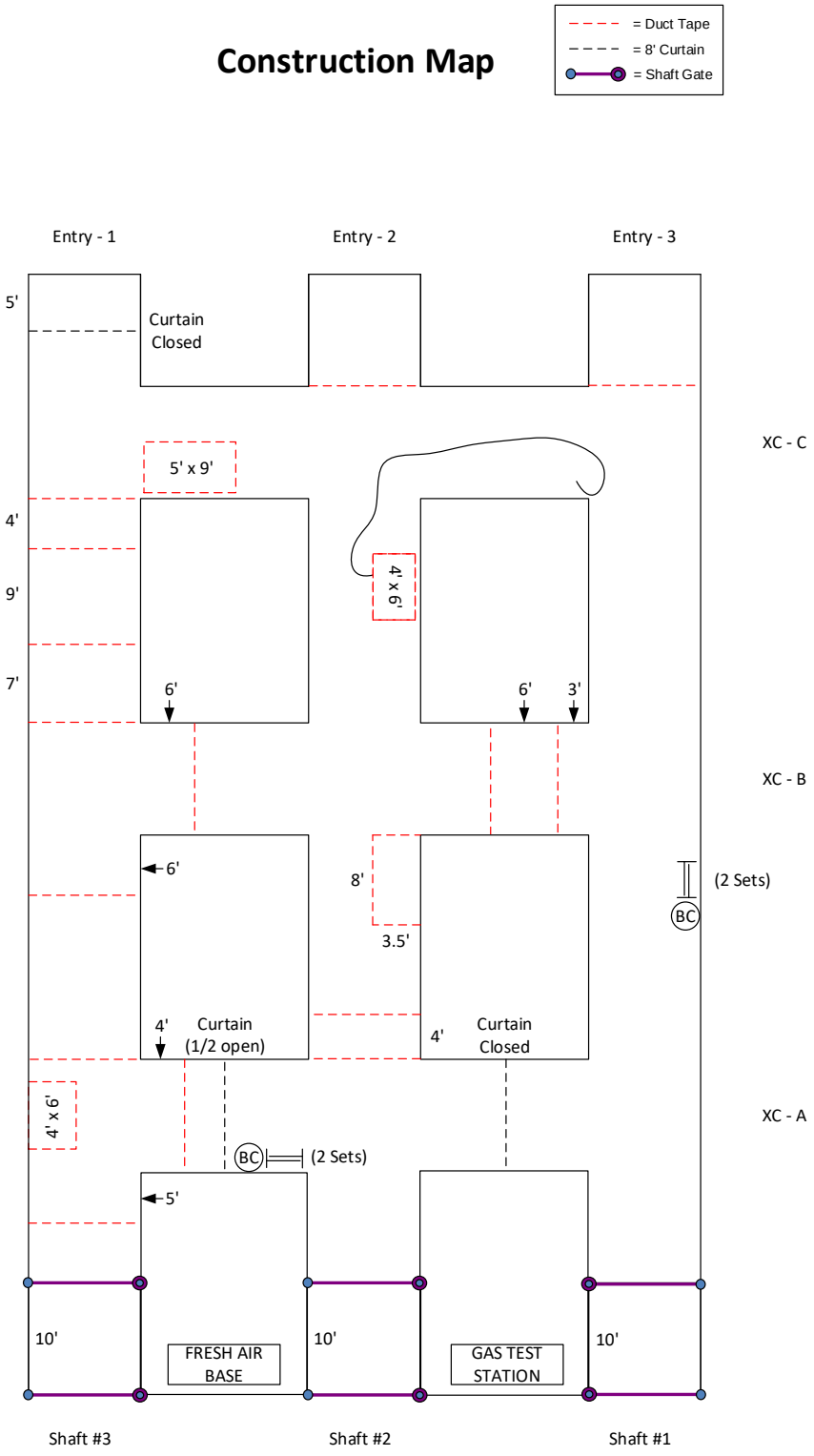
XC - B
XC - A
Curtain (1/2 open)
Curtain Closed
Exhaust Fan (off)
Intake Fan (off)
FRESH AIR BASE
GAS TEST STATION
Shaft #3
Shaft #2
Shaft #1

Construction Map



2018 Metal/Nonmetal National Mine Rescue Contest

Technician Team Competition – Written Test (Drager BG4)

ANSWER KEY

	Answer	Page	Publication
1	B	3	4057781 PSS BG Service Manual
2	B	3	4057781 PSS BG Service Manual
3	D	17	4057781 PSS BG Service Manual
4	C	35	4057781 PSS BG Service Manual
5	A	39	4057781 PSS BG Service Manual
6	D	39	4057781 PSS BG Service Manual
7	C	42	4057781 PSS BG Service Manual
8	D	43	4057781 PSS BG Service Manual
9	B	44	4057781 PSS BG Service Manual
10	A	53	4057781 PSS BG Service Manual
11	A	33	MX 6 Manual Revision 9
12	B	3	MX 6 Manual Revision 9
13	B	6	MX 6 Manual Revision 9
14	A	11	MX 6 Manual Revision 9
15	B	32	MX 6 Manual Revision 9
16	D	7	MX 6 Manual Revision 9
17	D	3	MX 6 Manual Revision 9
18	C	39	MX 6 Manual Revision 9
19	C	7	MX 6 Manual Revision 9
20	A	6	MX 6 Manual Revision 9
21	D	7	MSHA 3027 Module 3
22	C	21	MSHA 3027 Module 3
23	D	47	MSHA 3027 Module 2
24	B	47	MSHA 3027 Module 2
25	B	3	MSHA 3027 Module 2
26	B	4	MSHA 3027 Module 2
27	A	7	MSHA 3027 Module 2
28	B	5	MSHA 3027 Module 3
29	A	23	MSHA 3027 Module 3
30	B	53	MSHA 3027 Module 3

2018 Metal/Nonmetal National Mine Rescue Contest

Technician Team Competition – Written Test (BioPak 240R)

ANSWER KEY

	Answer	Page	Publication
1	A	6	User Manual Revision K
2	C	6	User Manual Revision K
3	B	17	User Manual Revision K
4	B	7	User Manual Revision K
5	C	12	User Manual Revision K
6	C	19	User Manual Revision K
7	A	19	User Manual Revision K
8	C	9	Benchman Manual Revision M
9	C	15-16	Benchman Manual Revision M
10	C	18	User Manual Revision K
11	A	33	MX 6 Manual Revision 9
12	B	3	MX 6 Manual Revision 9
13	B	6	MX 6 Manual Revision 9
14	A	11	MX 6 Manual Revision 9
15	B	32	MX 6 Manual Revision 9
16	D	7	MX 6 Manual Revision 9
17	D	3	MX 6 Manual Revision 9
18	C	39	MX 6 Manual Revision 9
19	C	7	MX 6 Manual Revision 9
20	A	6	MX 6 Manual Revision 9
21	D	7	MSHA 3027 Module 3
22	C	21	MSHA 3027 Module 3
23	D	47	MSHA 3027 Module 2
24	B	47	MSHA 3027 Module 2
25	B	3	MSHA 3027 Module 2
26	B	4	MSHA 3027 Module 2
27	A	7	MSHA 3027 Module 2
28	B	5	MSHA 3027 Module 3
29	A	23	MSHA 3027 Module 3
30	B	53	MSHA 3027 Module 3

2018 Metal/Nonmetal National Mine Rescue Contest

Technician Team Competition – Written Test (BioPak 240S)

ANSWER KEY

	Answer	Page	Publication
1	A	4	User Manual Revision F
2	C	4	User Manual Revision F
3	B	7	User Manual Revision F
4	B	5	User Manual Revision F
5	C	8	User Manual Revision F
6	C	9	User Manual Revision F
7	A	7	Benchman Manual Revision L
8	C	8	Benchman Manual Revision L
9	C	10	Benchman Manual Revision L
10	C	10	Benchman Manual Revision L
11	A	33	MX 6 Manual Revision 9
12	B	3	MX 6 Manual Revision 9
13	B	6	MX 6 Manual Revision 9
14	A	11	MX 6 Manual Revision 9
15	B	32	MX 6 Manual Revision 9
16	D	7	MX 6 Manual Revision 9
17	D	3	MX 6 Manual Revision 9
18	C	39	MX 6 Manual Revision 9
19	C	7	MX 6 Manual Revision 9
20	A	6	MX 6 Manual Revision 9
21	D	7	MSHA 3027 Module 3
22	C	21	MSHA 3027 Module 3
23	D	47	MSHA 3027 Module 2
24	B	47	MSHA 3027 Module 2
25	B	3	MSHA 3027 Module 2
26	B	4	MSHA 3027 Module 2
27	A	7	MSHA 3027 Module 2
28	B	5	MSHA 3027 Module 3
29	A	23	MSHA 3027 Module 3
30	B	53	MSHA 3027 Module 3

2018 Metal/Nonmetal National Mine Rescue Contest

First Aid Competition – Written Test

ANSWER KEY - Reference tenth Edition of Brady "First Responder"

1. B
2. C
3. A
4. B
5. A
6. D
7. A
8. D
9. B
10. C
11. B
12. D
13. B
14. A
15. A
16. D
17. A
18. D
19. C
20. B
21. A
22. D
23. B
24. A
25. D
26. C
27. D
28. B
29. A
30. A

2018 Metal/Nonmetal National Mine Rescue Contest
First Aid Competition – Written Test

Answers and Rationales

1. b) Become immunized from pathogens typically found in EMS. *Vaccines are available for common infectious diseases. Most people receive them as a part of childhood checkups but additional vaccines are available for those with high risk exposure to pathogens. OSHA requires that employees who have a risk of becoming exposed to blood or other potentially infectious material (OPIM) must be offered hepatitis B vaccinations free of charge. EMR 10th, Ch.3, Page 35.*

2. c) Help minimize exposure to a patient's blood and body fluids–*BSI precautions are specific steps to minimize exposure. Examples of BSI are wearing protective gloves, masks, gowns and eyewear. EMR 10th, Ch. 3, Page 36.*

3. a) Oxygen and carbon dioxide– *air enters the lungs through the right and left bronchi. From there air passes though smaller passages called bronchioles when it eventually ends up in the alveoli. It is deep within the alveoli that the exchange of oxygen and carbon dioxide occurs. Good perfusion can be adversely affected by disease if the patient is not able to take in adequate oxygen and eliminate carbon dioxide. EMR 10th, Ch. 4, Page 64.*

4. b) Power lift– *The power lift is used to move a patient from a stretcher or cot; while trying not to bend at the waist any more than you absolutely have to. EMR 10th, Ch. 6, Page 99.*

5. a) True– *The autonomic nervous system controls most involuntary processes. EMR 10th, Ch. 4, Page 71.*

6. d) Oxygen source; *a cylinder. Cylinders come in a variety of sizes, each identified by a specific letter which indicates the liter of oxygen in the cylinder. EMR 10th, Ch. 10 Page 179*

7. a) After each set of 30 compressions, open the airway and check for evidence of a foreign object- *In an unresponsive adult with a FBO, CPR with chest compressions are given and after 30 compressions, checking for an object, and two rescue breaths are given. If the breaths do not go in, the cycle continues; 30 compressions, looking for an object, and two rescue breaths. EMR 10th , Ch. 10, Page 156.*

8. d) All of the above– *Cardiopulmonary resuscitation (CPR) is an emergency procedure that involves the application of both external chest compressions and ventilations to someone in cardiac arrest. EMR 10th , Ch.11, Page 191.*

9. b) An abnormal breathing pattern– *characterized by slow, shallow, gasping breaths that typically occur following cardiac arrest. CPR. EMR 10th , Ch. 11 Page 193.*

10. c) 100 to 120 per minute–*Current AHA Guidelines recommend 100 to 120 compressions per minute; however, without a mask, the rescuer should simply push hard and push fast. EMR 10th Ch.11, Page 195-196.*

11. b) False. *Limiting necessary interruptions to 10 seconds or less is one element that ensures effective CPR. 20 seconds is too long. EMR 10th, Ch. 11, Page 205.*

12. d) In cardiac arrest- *Only patients in cardiac arrest should have an AED placed on them. Ensure the patient is unresponsive, has no carotid pulse and has no normal respirations EMR 10th, Ch. 11 Page 208*

13. b) Last oral intake– *it's important to know when obtaining a history what that patient has taken in, when and approximate quantity. This may alert you to any connection like a food allergy and care for contents of the stomach. EMR 10th, Ch. 12, Page 218-219*

14. a) Rate, depth, sound and ease–. *Each characteristic should be assessed. Rate is classified as normal, rapid or slow. Depth- normal, shallow or deep; Sound- snoring, gurgling, gasping or wheezing; Ease- effortless, labored or difficult. EMR 10th, Ch. 12, Page 223*

15. a) True – *The average pulse rate for an adult is 60 to 100 beats per minute. EMR 10th, Ch. 12, Page 226.*

16. d) Carotid pulse; *The pulse point is in the neck on either side (commonly referred to as the jugular) using two fingers and should be checked on an unresponsive patient. EMR 10th, Ch. 12, Page 227*

17. a) True: *Blood pressure by palpitation is used when the ambient noise makes it difficult to hear with a stethoscope yet feeling the radial pulse is not a very accurate method because it will only provide one reading, an approximate systolic pressure. EMR 10th, Ch. 12,Page 229-230*

18. d) All of the above; *Perform a scene size-up and primary assessment; Care for immediate life threats first; Perform a secondary assessment including vital signs are all elements of the patient assessment for a trauma patient with a significant mechanism of injury. EMR 10th Ch. 13, Page 245*

19. c) Scene size-up– *every patient assessment begins with scene size-up which includes; taking BSI precautions, determining if the scene is safe, identifying MOI, number of patients, additional resources needed and need for spinal precautions. EMR 10th, Ch. 13 Page 246.*

20. b) A fall of less than 10 feet– *a fall of less than 10 feet is considered nonsignificant; however, a fall greater than 15 feet is significant. Ejection, rollover crashes and penetration*

to the head, neck, chest or abdomen are significant mechanisms of injury. EMR 10th, Ch. 13, Page 260

21. a) True – *A MedicAlert bracelet or necklace can provide medical history, including allergies and a phone number for additional information. EMR 10th, Ch. 13, Page 263.*

22. d) All of the above- *signs are objective indications of illness or injury that can be seen, heard, felt, and smelled by another person such as sweating and abnormal pulse. Symptoms are subjective and cannot be observed by another person but are felt and reported by the patient such as the feeling of impending doom. EMR 10th, Ch. 14, Pgs 277*

23. b) Angina Pectoris– *literally translated it means pain in the chest. Though it's similar to a heart attack, the difference is that with angina, the coronary blood flow is not completely cut off. EMR 10th, Ch. 14, Page 278.*

24. a) 94%– *use of a pulse oximeter should be considered a part of obtaining vital signs. SpO2 less than 94% can be supplemented with the use of a nasal cannula. EMR 10th. Ch. 15, Page 283.*

25. d) Taking BLS precautions – *taking BLS precautions is always the first step in emergency care for any patient. EMR 10th, Ch. 15, Page 300.*

26. c) Carbon dioxide–*Hyperventilation is described a rapid, deep and difficult to control. Most cases of hyperventilation are caused by anxiety and are rarely a true emergency. However, it can be a sign of a more serious medical condition. EMR 10th, Ch. 15, Page 296.*

27. d) All of the above– *All of the conditions noted can be the cause of altered mental status, including poisoning or overdose, seizure, stroke, diabetic emergency, hypoxia and trauma EMR 10th, Ch. 16, Page 306-307.*

28. b) Lungs- *Inhaled poisons from fumes, gases, vapors and dust can all enter the circulatory system through the lungs. EMR 10th, Ch. 17, Page 319.*

29. a) Turn the patient on his side and allow excess water to exit the mouth *Once the water runs out, start CPR with 30 compressions to two breaths. Compression starts CPR, not breaths. AHA recommends not attempting to relieve water or air from the stomach unless immediate suction is available. EMR 10th , Ch. 17, Page 347.*

30. a) Direct pressure, the use of a pressure bandage, and the tourniquet – *Elevation can also be used but there is no longer recommendations to have rescuers put pressure on a pressure point. A tourniquet is now used when direct pressure and a pressure bandage fail to stop the bleeding. All three steps are essential for saving a bleeding patient's life. EMR 10th Ch. 18 Page 361*

2018 National Metal and Nonmetal Mine Rescue Contest

Mine Rescue Field Competition
Written Test

Directions:

1. **Find the correct answer to each of the questions.**
2. **Select only <u>one</u> answer per question.**
3. **Then, fill in the corresponding circle on the answer sheet for each numbered question.**

Good Luck!

July 23, 2018

2018 Metal/Nonmetal National Mine Rescue Contest

Mine Rescue Field Competition – Written Test

1. The Command Center is the hub of rescue and recovery operations and is typically staffed and controlled by a mine emergency “command group”.

   A. True
   B. False

2. The mines ventilation system is designed to bring in fresh air to _____ and _____ harmful gases and to supply oxygen.

   A. Increase and promote
   B. disperse and remove
   C. decrease and unify
   D. All of the above

3. MSHA requires mine rescue stations serving underground M/NM mines to have ____ gas detectors appropriate for each gas which may be encountered at the mines served.

   A. Two
   B. Three
   C. Four
   D. None of the above

4. The advantage to chemical analysis is that generally it is not a time-consuming process.

   A. True
   B. False

5. The rate of diffusion is how quickly the gas will mix or blend with one or more other gasses and how quickly it can be dispersed.

   A. True
   B. False

6. Atmospheric pressure is measured on a _____.

   A. Weigh Scale
   B. Dust Pump
   C. Barometer
   D. All of the above

7. Under no circumstances do you ever alter ventilation without orders to do so from the _____.

   A. President of the United States
   B. Secretary of Labor
   C. #1 Judge
   D. Command Center

8. In many cases, one main fan is used to ventilate the entire mine.

   A. True
   B. False

9. In some large multi-level mines, booster fans installed on certain levels are used along with the main fan to maintain the correct ventilation throughout the mine.

   A. False
   B. True

10. If shafts are used as the two main airways, the intake airway is called the upcast shaft, and the exhaust airway is referred to as the downcast shaft.

    A. True
    B. False

11. If pressure difference exists naturally between the two airways, then the mine has _____ ventilation.

    A. Mechanical
    B. Accurate
    C. Natural
    D. None of the above

12. “Exploration” is a term we use to describe the process of assessing conditions underground and locating miners (or clues to their whereabouts) during a rescue and recovery operation.

    A. True
    B. False

13. Before anyone goes underground, it’s important to examine the _____ to determine the safest route for entering the mine.

    A. Mine Map Legend
    B. Mine Rescue Team
    C. Mine Act
    D. Mine Openings

14. During barefaced exploration, the crew uses the mines communication system to report their progress and findings to the surface.

    A. True
    B. False

15. The fresh air base should be located as close as possible to the affected are of the mine, but situated where its assured a supply of good _____.

    A. Food
    B. Supplies
    C. Drinking Water
    D. Air

16. According to law, the team must also have a portable or sound-powered communication system. The systems wire or cable must be at least ___ feet long.

    A. 500
    B. 800
    C. 10,000
    D. 1,000

17. Before the team goes underground, they will attend a _____ session.

    A. Health Counseling
    B. Eye Exam
    C. Briefing
    D. All of the above

18. Sealing off the fire area is another way of removing _____.

    A. Fuel
    B. Oxygen
    C. Heat
    D. None of the above

19. Class ___ fires involve combustible metals such as magnesium, titanium, zirconium, sodium, and potassium.

    A. “A”
    B. “B”
    C. “C”
    D. “D”

20. Dry chemical extinguishers put out fires by stopping the chemical reaction between the fuel and oxygen (which produces the flame).

    A. True
    B. False

21. Hand-held extinguishers range in size from about ____ to ____ pounds.

    A. 5 to 50
    B. 10 to 50
    C. 2 to 55
    D. 2 to 50

22. A 30-pound extinguisher will normally last ___ to ___ seconds.

    A. 16 to 25
    B. 18 to 30
    C. 18 to 25
    D. None of the above

23. Low expansion foam can only be used when you're close enough to a fire to force the foam directly on to the fire.

    A. True
    B. False

24. If the fire begins to back up against the intake air in search of oxygen, you can put up a "traverse" brattice (or hurdle brattice) from side to side and seal it completely.

    A. True
    B. False

25. Severe head injuries, airway or breathing problems, and unconsciousness are examples of a _____ priority condition.

    A. Low or third
    B. Secondary
    C. First
    D. None of the above

26. Specific gravity is the weight of a gas compared to an equal volume of normal air under the same temperature and pressure.

    A. True
    B. False

27. Sulfur monoxide has a specific gravity of 2.2638.

    A. True
    B. False

28. Since your self-contained breathing apparatus supplies you with oxygen, it will protect you against asphyxiating gases.

    A. True
    B. False

29. The specific gravity for Carbon Dioxide (CO_2) is _____?

    A. 1.1925
    B. 1.2291
    C. 1.5299
    D. None of the above

30. Carbon Monoxide is explosive and flammable. Its explosive range in normal air is ____ to ____ percent.

    A. 12.0 to 74.0
    B. 12.5 to 74.2
    C. Carbon Monoxide is not explosive and flammable
    D. None of the above

2018 National Metal and Nonmetal Mine Rescue Contest

First Aid Competition
Written Test

Directions:

1. **Find the correct answer to each of the questions.**
2. **Select only one answer per question.**
3. **Then, fill in the corresponding circle on the answer sheet for each numbered question.**

Good Luck!

July 23, 2018

2018 Metal/Nonmetal National Mine Rescue Contest

First Aid Competition – Written Test

1. One way emergency medical responders can minimize the risk of acquiring an infectious disease is to:

    a. Hold their breath while treating patients suspected of communicable disease
    b. Become immunized from pathogens typically found in EMS
    c. Work closely with other, more experienced responders and practice your skills
    d. Get a measles vaccine

2. Body substance isolation precautions are specific steps to:

    a. Separate patients in triage to prevent exposure to air borne pathogens
    b. Help minimize exposure to a patient's body fluid and attitude
    c. Help minimize exposure to a patient's blood and body fluids
    d. Insure the patient is protected from coffee ground emesis

3. There are many diseases that can affect the respiratory system. Diseases can disrupt the circulation of the blood from picking up _____ and dropping off _____.

    a. Oxygen/carbon dioxide
    b. Alveoli/hydrocarbon
    c. Oxygen/carbon oxide
    d. Oxygen/neumocarbons

4. Many first responders are injured every year because they attempt to move a patient improperly. The technique of lifting with your legs, keeping your back as straight as possible and bending at your knees is known as:

    a. Extremity lift
    b. Power lift
    c. Shoulder drag
    d. Stair carry

5. The autonomic nervous system is the part of the peripheral nervous system that acts as the control system for most of the involuntary processes such as heart rate, respiratory rate, digestion, perspiration and salivation.

    a. True
    b. False

6. A typical oxygen-delivery system includes a _____, a regulator, and a delivery device. Occasionally a humidifier will be added to provide moisture to the oxygen if the patient will be on the system for an extended time:

    a. Pressure regulator
    b. humidifier
    c. Pulse oximeter
    d. Oxygen source

7. When clearing a foreign body airway obstruction on an unresponsive adult, you should _____:

    a. After each set of 30 compressions, open the airway and check for evidence of a foreign object
    b. Place the patient face down (prone) on a firm surface and tap and shout
    c. Attempt five chest thrusts and five back blows
    d. Make a fist and give up to five abdominal thrusts

8. During CPR you must:

    a. Ensure and maintain an open airway
    b. Breathe for (ventilate) the patient
    c. Perform rapid, deep chest compressions to circulate the blood
    d. All of the above

9. Agonal breathing is:

    a. Apparent with patients of a heart rate of 60 BPM
    b. An abnormal breathing pattern
    c. A normal breathing pattern in adults
    d. Characterized by fast, deep breaths which typically occur after exercise

10. Effective CPR depends on the correct rate and ratio of compressions to ventilations. If no barrier is available, deliver compressions at a rate of _____:

    a. 30 compressions five times per minute
    b. 30 compressions over the span of 30 seconds
    c. 100 to 120 per minute
    d. 30 compressions with 10 second breaks between sets

11. For effective CPR, limit necessary interruptions such as pulse and breathing checks to no more than 20 seconds.

    a. True
    b. False

12. Automatic External Defibrillators (AED) save lives. However, there are some basic warnings for use. Place the AED only on a patient who is_____.

    a. Choking
    b. Semi-conscious and complaining of chest pain
    c. Seated
    d. In cardiac arrest

13. Obtaining a medical history can be achieved with the SAMPLE history tool. The L in the acronym means_____:

    a. Last oral excretion
    b. Last oral intake
    c. Leading event to the injury
    d. Level of pain

14. Respiration or ventilation is the act or process of breathing. You will evaluate several characteristics when assessing a patient's respirations;

    a. Rate, depth, sound and ease
    b. Rate, perspiration, height, and cycle
    c. Breaths per minute, skin color, verbal responses
    d. Breaths per minute, responsiveness, labor

15. The average pulse rate for an adult is 60 to 100:

    a. True
    b. False

16. When caring for a responsive patient, you can check the radial pulse at the patient's wrist. For an unresponsive patient, the _____ in the neck should be used:

    a. Brachial pulse
    b. Cardiogenic pulse
    c. Cardiac pulse
    d. Carotid pulse

17. Determining blood pressure by palpation (feeling the radial pulse) is not a very accurate method:

    a. True
    b. False

18. When conducting patient assessment for the trauma patient with a significant mechanism of injury you should:

    a. Perform a scene size-up and primary assessment
    b. Care for immediate life threats first
    c. Perform a rapid secondary assessment including baseline vital signs
    d. All of the above

19. Every patient assessment begins with _____:

    a. Determining type of BSI needed
    b. Identifying the mechanism of injury
    c. Scene size-up
    d. Identifying resources needed

20. To differentiate between a significant mechanism of injury and nonsignificant; here is an example of a nonsignificant mechanism of injury:

    a. Rollover vehicle crash
    b. A fall of less than 10 feet
    c. Penetrations to the head, neck, chest or abdomen
    d. Ejection from a vehicle

21. Medical identification jewelry can provide important information if the patient is unresponsive and a history cannot be obtained by family or bystanders:

    a. True
    b. False

22. The term “cardiac compromise” is used to describe specific signs and symptoms that indicate some type of emergency relating to the heart. A sign or symptom of a heart attack is:

    a. Diaphoresis (sudden onset of sweating)
    b. Abnormal pulse
    c. Feeling of impending doom
    d. All of the above

23. The medical term for what is commonly known as pain in the chest caused by a lack of sufficient blood and oxygen to the heart muscle is:

    a. Myocordial infraction
    b. Angina Pectoris
    c. Myocardial infarction
    d. Myocardial interference

24. To determine oxygen saturation for patients with the signs and symptoms of cardiac compromise, the American Heart Association recommends the use of a pulse oximeter to monitor peripheral oxygen saturation. Any patient with an oxygen saturation of (SpO2) of less than _____ should receive supplemental oxygen.

    a. 94%
    b. 96%
    c. 98%
    d. 99%

25. Emergency care for a patient with respiratory compromise starts with:

    a. Allowing the patient to remain in a position of comfort
    b. Obtaining baseline vitals
    c. Arranging for ALS response if available
    d. Taking BLS precautions

26. Hyperventilation occurs when the person breathes out and eliminates an excess amount of _____:

    a. Oxygen
    b. Mucus
    c. Carbon dioxide
    d. Carbon monoxide

27. An altered mental status can be caused by _____:

    a. Kidney failure
    b. Psychiatric condition
    c. Infection
    d. All of the above

28. Poisons that are inhaled can reach the circulatory system directly through the _____:

    a. Blood stream
    b. Lungs
    c. Nervous system
    d. None of the above

29. You may encounter water in the airway of a patient who was pulled from a body of water. To treat this patient you should:

    a. Turn the patient on his side and allow excess water to exit the mouth
    b. Place the patient in a supine position and give 2 breaths
    c. Lift the patient's arms above his head so water more easily flows out of the lungs
    d. Gently press on the abdomen to ensure water exits the stomach

30. There are three steps to controlling external bleeding of an extremity. They are;

    a) Direct pressure, the use of a pressure bandage, and the tourniquet
    b) Direct pressure, elevation, pressure point
    c) Direct pressure, elevation, roller bandage
    d) Direct Exposure, the use of a pressure bandage, tourniquet

2018 National Metal and Nonmetal Mine Rescue Contest

Team Trainer Competition
Written Test

Directions:

1. **Find the correct answer to each of the questions.**
2. **Select only <u>one</u> answer per question.**
3. **Then, fill in the corresponding circle on the answer sheet for each numbered question.**

Good Luck!

July 23, 2018

2018 Metal/Nonmetal National Mine Rescue Contest

Team Trainer Competition – Written Test

1. Sulfur dioxide may be produced by blasting in sulfide ores and by fires containing iron pyrite.

   A. True
   B. False

2. The specific gravity of butane is 1.5625.

   A. True
   B. False

3. Acetylene is colorless and tasteless. It has a slight _____ odor.

   A. Onion
   B. Sour Cream and Onion
   C. Garlic
   D. None of the above

4. Smoke may irritate your lungs when you inhale it, it is normally considered to be an asphyxiant.

   A. True
   B. False

5. If the weight of a gas you're testing for is _____ then normal air, you'll know to test for it near the back of the mine.

   A. Heavier
   B. Lighter
   C. None of the above

6. If the fan goes down while you're underground, and hazardous conditions ensue, you may be recalled from the mine.

   A. True
   B. False

7. The basic principle underlying mine ventilation is that air always moves from ____ pressure regions to ____ pressure regions.

   A. Low to High
   B. High to Low
   C. East to West

8. The teams map person is responsible for marking down information on the map as the team explores and assesses ventilation.

    A. True
    B. False

9. Porous stoppings such as concrete block stoppings are usually plastered on the ___ pressure side to reduce air leakage.

    A. Low
    B. Surface
    C. High
    D. None of the above

10. Check curtains are designed to close manually after you have passed through them so that they continue to direct air to the working place.

    A. True
    B. False

11. According to the 2017-2018 Metal and Nonmetal Mine Rescue Contest Rules, If placards have not been changed after ____ seconds, teams must assume that their actions were not successful.

    A. 10
    B. 20
    C. 30
    D. 15

12. According to the 2017-2018 Metal and Nonmetal Mine Rescue Contest Rules, the team captain will only be required to start the timing device and write down the team position before receiving the problem and the maps.

    A. True
    B. False

13. According to the 2017-2018 Metal and Nonmetal Mine Rescue Contest Rules, regulating airflow to control a fire is also considered a ventilation change.

    A. True
    B. False

14. According to the 2017-2018 Metal and Nonmetal Mine Rescue Contest Rules, once a post has been set to correct and support an unsafe roof condition, it can only be removed by the team captain.

    A. True
    B. False

15. According to the 2017-2018 Metal and Nonmetal Mine Rescue Contest Rules, “Caved Tight” means ground caved in to prevent access and allows very little ventilation flow.

    A. True
    B. False

16. According to Title 30 CFR Part 49.2, every operator of an underground mine shall establish at least ___ mine rescue teams which are available at all times when miners are underground or enter into an arrangement for these services.

    A. Four
    B. Three
    C. Two
    D. One

17. According to Title 30 CFR Part 49.6 (a) (5), each mine rescue station shall be provided with at least six self-contained breathing apparatus, each with a minimum of 4 hour capacity.

    A. True
    B. False

18. According to Title 30 CFR Part 49.6 (a) (6), gas detectors must measure concentrations of Carbon Monoxide from 0.0 parts per million to at least _____ parts per million.

    A. 900
    B. 999
    C. 9,000
    D. 9,999

19. According to Title 30 CFR Part 49.8 (c), a mine rescue team member will be ineligible to serve on a team if more than ____ hours of training is missed during one year, unless additional training is received to make up for the time missed.

    A. 4
    B. 8
    C. 16
    D. None of the above

20. According to Title 30 CFR Part 49.8 (g), a record of training of each team member shall be on file at the mine rescue station for a period of two years.

    A. True
    B. False

21. Body substance isolation (BSI) precautions are specific steps that help to minimize exposure to a patient’s blood and body fluids.

    A. True

B. False

22. The _____ is an imaginary vertical line that divides the body into right and left halves.

    A. Proximal
    B. Inferior
    C. Midline
    D. Superior

23. The role of EMR (Emergency Medical Responders) during a MCI (Multiple-Casualty Incident) depends on:

    A. When they arrive at the scene
    B. The type of agency for whom they are working
    C. Their specific level of training
    D. All of the above

24. When using the lift-and-slide technique, this maneuver requires a minimum of five and often six rescuers.

    A. True
    B. False

25. The left ovary (female) can be found in the _____quadrant.

    A. Left Upper
    B. Right Upper
    C. Right Lower
    D. Left Lower

26. Wheeled extinguishers can weigh from ____ to ____ pounds.

    A. 75 to 400
    B. 2 to 55
    C. 75 to 350
    D. 2 to 50

27. To effectively and quickly put out the fire, you should direct the stream of dry chemical to about 6 inches ahead of the flame edge.

    A. True
    B. False

28. All foam generators are water driven.

    A. True
    B. False

29. If heat, smoke, and ventilating air currents permit, water is the most desirable and efficient means of fighting a fire, even if it’s an electrical fire.

    A. True
    B. False

30. Electric shock and electrocution are hazards to firefighters using water, foam, or other conductive agent to fight a fire.

    A. True
    B. False

2018 National Metal and Nonmetal Mine Rescue Contest

Technician Team Competition
Written Test (BioPak 240R)

Directions:

1. **Find the correct answer to each of the questions.**
2. **Select only one answer per question.**
3. **Then, fill in the corresponding circle on the answer sheet for each numbered question.**

Good Luck!

July 23, 2018

2018 Metal/Nonmetal National Mine Rescue Contest

Technician Team Competition – BioPak 240R – Written Test

10 Questions for BioPak 240R:

1. As stated in the BioPak 240 R Cautions and Limitations, which of the following is TRUE:
   A. Never substitute, modify, and, or omit parts
   B. All users of the SCBA must be trained by Biomarine qualified instructors
   C. All repairs beyond the scope of this manual must be performed by Biomarine or qualified Biomarine representative

2. Relating to the use of high pressure Oxygen, which of the following is TRUE:
   A. Do not open the cylinder valve in the presence of Nitrogen
   B. The oxygen cylinder shall meet DOT specifications and shall be marked BREATHING GAS
   C. Oxygen will not cause materials to ignite without the presence of an ignition source

3. Regarding the proper donning of the facemask, which of the following is TRUE:
   A. Tighten the facepiece as tight as you can
   B. Adjust the facemask top strap so that the mask is at the correct level with the face and the head-harness pad is in the center of the back of the head
   C. Emphysema is a potential disqualifying factor for wearing a BioPak 240 R

4. The SCBA (BioPak 240 R) is approved only when:
   A. Filled to 3000 psi with breathing gas
   B. Fully charged with compressed medical or aviation grade oxygen
   C. Fully charged with compressed medical or aviation grade breathing air

5. Which of the following is TRUE as it relates to the Oxygen Cylinder?
   A. The Oxygen cylinder is polypropylene-wrapped aluminum
   B. The Oxygen cylinder has a volume of 3000 psig
   C. The Oxygen cylinder has a volume of 440 liters

6. Which of the following will NOT assist the USER in cooling the breathing gas or clearing the mask of fog?
   A. Breathe normally through the nose and use the Magnetic wiper
   B. Ensure Ice has been installed
   C. Depress the Emergency By-Pass for up to 2-seconds

7. Should the LED flash RED and/or the horn sounds, the USER shall:
   A. Retire to a safe location as quickly as possible
   B. Exit and change your battery
   C. Exit and reboot your RMS

8. The use of Orbsorb carbon dioxide chemical scrubbers must always include:
    A. Shake test and O-ring lubrication
    B. Two scrubber cartridges and three wet sponges
    C. Two scrubber cartridges and the Moisture Pad provided with the scrubber

9. As prescribed in the BENCHMAN manual which is the most correct regarding Long Term Maintenance:
    A. Perform Turn-Around Maintenance and Maintenance Tag Validation
    B. Visually inspect the O-rings and perform a Low-Pressure Leak Test
    C. Visually inspect. Perform the Demand Valve, Constant flow, Vent Valve, Low pressure, high pressure, emergency bypass and alarm tests as well as Maintenance Tag Validation

10. If after 5-10 minutes under oxygen your LED changes from a flashing GREEN to a FLASHING BLUE. You should:
    A. Immediately leave the area and replace your battery
    B. Immediately leave the area and check for low-pressure leaks
    C. Check that the coolant canisters have been installed

10 Questions for MX6 iBrid:

1. The battery icon at >100% charge remaining is the color blue.
    A. True
    B. False
2. The operating temperature range for the instrument is -25° Celsius to 55° Celsius.
    A. True
    B. False

3. There are three levels of audio gas alarms based on the frequency of beeps and the length of delay between beeps.
    A. True
    B. False

4. The bump test process does not allow qualified personnel to review and adjust a unit's settings
    A. True
    B. False

5. The configuration mode display screens time out after 90 seconds. When activated, the main configuration screen remains on for 10 minutes.
    A. True
    B. False

6. An optical media interface is located on the bottom of the instrument and is used for infrared data transmissions at speeds of _____ bytes/second.
    A. 100,000
    B. 105,000
    C. 115,000
    D. None of the above

7. The alkaline battery pack is only approved for use with _____ or _____ batteries in the instrument.
    A. Duracell MM 2500, Rayovac LR10
    B. Duracell MM 1500, Rayovac LR6
    C. Duracell MM 2000, Rayovac LR8
    D. None of the above

8. The measurement range for Hydrogen Sulfide (H_2S) electrochemical sensor is zero to ____ ppm.
    A. 50
    B. 100
    C. 500
    D. None of the above

9. The LCD backlight flashes as part of all alarm sequences, except for the battery low condition. The visual alarm is also used as the confidence indicator which, when enabled, blinks the LEDs once every ___ seconds.
    A. 5
    B. 10
    C. 30
    D. None of the above

10. For a Carbon Dioxide (CO_2) infrared sensor range of 0% to 5% volume, the measurement resolution is _____% volume.
    A. 0.01
    B. 0.02
    C. 0.05
    D. None of the above

10 Questions from MSHA Publication 3027 (Module 2 and Module 3):

21. The map symbol ⊠ indicates:
    A. An undercast.
    B. An overcast
    C. An axillary fan.
    D. The main fan.

22. Mine Rescue teams should not alter ventilation without authorization from the command center because:
    A. Altering the ventilation could force explosive gases into areas where survivors might be located.
    B. It could force deadly gases over fire areas or hot spots and cause an explosion.
    C. It could supply additional oxygen to a fire area and “feed” the fire.
    D. It could also result in ventilation changes that would alter the air at the command center.

23. Which of the following gases have the largest explosive range?
    A. Carbon Monoxide
    B. Hydrogen
    C. Butane
    D. Acetylene

24. The specific gravity for Propane is _____.
    A. 1.5291
    B. 1.5625
    C. 1.5894
    D. 2.0100

25. MSHA requires mine rescue stations serving underground M/NM mines to have _____ gas detectors appropriate for each gas which may be encountered at the mines served.
    A. Three
    B. Four
    C. Five
    D. Enough

26. Chemical analysis is generally a more time-consuming process than testing with a portable device, but its advantage is timeliness. It tells exactly what gases the sample contains, and in precisely what amounts. A complete chemical analysis can also reveal the presence of gases that portable detectors are not designed to detect.
    A. True
    B. False

27. The range of concentrations within which a gas will explode is known as its “explosive range.” Figures representing the higher and lower limits of the explosive range are expressed in percentages.
    A. True
    B. False

28. With mechanical ventilation, mine fans are used to create the pressure differential by changing the air pressure at specified points in the mine. And the less pressure difference the fan creates, the faster the flow of air.
    A. True
    B. False

29. In many mines during a rescue and recovery operation, air locks are put up to establish a fresh air base and enable teams to move forward into questionable air without contaminating the air at the fresh air base.
    A. True
    B. False

30. **Anemometer** – Instrument used for measuring medium-velocity (120-2,000 cfm) and high-velocity (2,000-10,000 cfm) air currents in the mine.
    A. True
    B. False

2018 National Metal and Nonmetal Mine Rescue Contest

Technician Team Competition
Written Test (BioPak 240S)

Directions:

1. **Find the correct answer to each of the questions.**
2. **Select only one answer per question.**
3. **Then, fill in the corresponding circle on the answer sheet for each numbered question.**

Good Luck!

July 23, 2018

2018 Metal/Nonmetal National Mine Rescue Contest

Technician Team Competition – BioPak 240S – Written Test

10 Questions for BioPak 240S:

1. As stated in the BioPak 240 S Cautions and Limitations, which of the following is TRUE:
   A. Never substitute, modify, and or omit parts.
   B. All users of the SCBA must be trained by qualified instructors
   C. All repairs beyond the scope of this manual must be performed by Biomarine Incorporated

2. Relating to the use of high pressure Oxygen, which of the following is TRUE:
   A. Do not open the cylinder valve in the presence of Nitrogen
   B. The oxygen cylinder shall meet DOT specifications and shall be marked BREATHING GAS
   C. Oxygen enrichment will decrease the energy required for the ignition of materials

3. Regarding the proper donning of the facepiece, which of the following is TRUE:
   A. Tighten the facepiece as tight as you can
   B. Beards and eyeglasses that cause seal failure are in violation OSHA and MSHA regulations and will void your NIOSH approval
   C. Emphysema is a potential disqualifying factor for wearing a BioPak 240 S

4. The SCBA (BioPak 240S) is approved only when:
   A. Filled to 3000 psi with breathing gas
   B. Fully charged with compressed oxygen meeting U.S.P. specifications
   C. Fully charged with compressed medical or aviation Grade oxygen

5. It is normal for the pressure gauge on the harness to take up to _____ to come to a full reading.
   A. 1 Minute
   B. 120 Seconds
   C. 90 Seconds

6. In the event the USER feels that additional oxygen is required above that supplied by the normal operation of the BioPak, which valve will need to be depressed:

   A. Demand Valve
   B. Vent Valve
   C. Bypass Valve

7. An alarm whistle will provide a _____ sounding when remaining oxygen stores will provide one final hour of operation.
    A. 92 dB
    B. Electronic beep
    C. Flashing red light

8. As depicted on the BioPak 240 S Flow Diagram which of the following is NOT TRUE:
    A. The Diaphragm Spring is outside of the breathing loop
    B. The Exhalation Check valve is on the Right side of the Mask
    C. Exhaled gasses flow through the coolant canister before reaching the Scrubber canister

9. Carbon Dioxide + Calcium Hydroxide yields:
    A. Sodium Carbonate + Water
    B. Calcium Chloride + Water
    C. Calcium Carbonate + Water

10. The short flexible connection hose supplies:
    A. Warm, wet, and carbon-dioxide laden gas from the breathing chamber to the coolant canister
    B. Cool, wet, and carbon-dioxide laden gas from the breathing chamber to the coolant canister
    C. Warm, wet, and carbon dioxide-free gas from the breathing chamber to the coolant canister.

<u>10 Questions for MX6 iBrid</u>:

11. The battery icon at >100% charge remaining is the color blue.
    A. True
    B. False
12. The operating temperature range for the instrument is -25° Celsius to 55° Celsius.
    A. True
    B. False

13. There are three levels of audio gas alarms based on the frequency of beeps and the length of delay between beeps.
    A. True
    B. False

14. The bump test process does not allow qualified personnel to review and adjust a unit's settings
    A. True
    B. False

15. The configuration mode display screens time out after 90 seconds. When activated, the main configuration screen remains on for 10 minutes.
    A. True
    B. False

16. An optical media interface is located on the bottom of the instrument and is used for infrared data transmissions at speeds of _____ bytes/second.
    A. 100,000
    B. 105,000
    C. 115,000
    D. None of the above

17. The alkaline battery pack is only approved for use with _____ or _____ batteries in the instrument.
    A. Duracell MM 2500, Rayovac LR10
    B. Duracell MM 1500, Rayovac LR6
    C. Duracell MM 2000, Rayovac LR8
    D. None of the above

18. The measurement range for Hydrogen Sulfide (H_2S) electrochemical sensor is zero to ____ ppm.
    A. 50
    B. 100
    C. 500
    D. None of the above

19. The LCD backlight flashes as part of all alarm sequences, except for the battery low condition. The visual alarm is also used as the confidence indicator which, when enabled, blinks the LEDs once every ___ seconds.
    A. 5
    B. 10
    C. 30
    D. None of the above

20. For a Carbon Dioxide (CO_2) infrared sensor range of 0% to 5% volume, the measurement resolution is _____% volume.
    A. 0.01
    B. 0.02
    C. 0.05
    D. None of the above

10 Questions from MSHA Publication 3027 (Module 2 and Module 3):

21. The map symbol ⊠ indicates:
    A. An undercast.
    B. An overcast
    C. An axillary fan.
    D. The main fan.

22. Mine Rescue teams should not alter ventilation without authorization from the command center because:
    A. Altering the ventilation could force explosive gases into areas where survivors might be located.
    B. It could force deadly gases over fire areas or hot spots and cause an explosion.
    C. It could supply additional oxygen to a fire area and "feed" the fire.
    D. It could also result in ventilation changes that would alter the air at the command center.

23. Which of the following gases have the largest explosive range?
    A. Carbon Monoxide
    B. Hydrogen
    C. Butane
    D. Acetylene

24. The specific gravity for Propane is _____.
    A. 1.5291
    B. 1.5625
    C. 1.5894
    D. 2.0100

25. MSHA requires mine rescue stations serving underground M/NM mines to have _____ gas detectors appropriate for each gas which may be encountered at the mines served.
    A. Three
    B. Four
    C. Five
    D. Enough

26. Chemical analysis is generally a more time-consuming process than testing with a portable device, but its advantage is timeliness. It tells exactly what gases the sample contains, and in precisely what amounts. A complete chemical analysis can also reveal the presence of gases that portable detectors are not designed to detect.
    A. True
    B. False

27. The range of concentrations within which a gas will explode is known as its "explosive range." Figures representing the higher and lower limits of the explosive range are expressed in percentages.
    A. True
    B. False

28. With mechanical ventilation, mine fans are used to create the pressure differential by changing the air pressure at specified points in the mine. And the less pressure difference the fan creates, the faster the flow of air.
    A. True
    B. False

29. In many mines during a rescue and recovery operation, air locks are put up to establish a fresh air base and enable teams to move forward into questionable air without contaminating the air at the fresh air base.
    A. True
    B. False

30. **Anemometer** – Instrument used for measuring medium-velocity (120-2,000 cfm) and high-velocity (2,000-10,000 cfm) air currents in the mine.
    A. True
    B. False

2018 National Metal and Nonmetal Mine Rescue Contest

Technician Team Competition
Written Test (Dräger BG-4)

Directions:

1. **Find the correct answer to each of the questions.**
2. **Select only one answer per question.**
3. **Then, fill in the corresponding circle on the answer sheet for each numbered question.**

Good Luck!

July 23, 2018

2018 Metal/Nonmetal National Mine Rescue Contest

Technician Team Competition – Dräger BG-4 – Written Test

10 Questions for Dräger BG-4:

1. The breathing air is circulated in a open breathing cycle. The carbon dioxide contained in the exhaled air is absorbed in a regeneration cartridge (CO2 absorber). The breathing air is enriched with oxygen from the oxygen cylinder.
   A. True
   B. False

2. The Sentinel electronic monitoring system comprises a sensor unit, switch box, and display unit. It continuously measures the pressure in the oxygen cylinder and indicates this pressure on the sensor unit, tests and monitors the correct functioning of the BG 4, and generates a warning when the residual pressure is reached, as well as in the event of malfunctions.
   A. True
   B. False

3. The minimum charging pressure for an oxygen cylinder is _____ psi/200 bar.
   A. 3315
   B. 3135
   C. 3515
   D. None of the above

4. If the manual by-pass valve does not operate, the cause would be
   A. The cylinder pressure is incorrect
   B. The pressure indicator is defective
   C. The pressure reducer is defective
   D. The pressure indication (display) is defective

5. Disinfection: Place parts into disinfectant bath, only use approved disinfectants. Excessive disinfectant concentrations and over-long disinfecting times can damage the mask.
   A. True
   B. False

6. If necessary the harness should be washed separately in a washing machine with a max temperature of _____.
   A. 90 °F
   B. 90 °C
   C. 60 °F
   D. 60 °C

7. For temperatures of up to 104 °F the period of use for a PSS BG4 is up to _____ with ice in cooler.
   A. 40 minutes
   B. 120 minutes
   C. 240 minutes
   D. None of the above

8. Of the following groups, which is not a Major Component**?**
   A. Pneumatics
   B. Breathing Loop
   C. Sentinel System
   D. Case & Hardware

9. With regards to the Pressure Reducer, the relief valve activation is 1.5 to 1.9 L/min.
   A. True
   B. False

10. The Panorama Nova Mask reduces peripheral vision to 90%.
   A. True
   B. False

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