2016 National Metal and Nonmetal Mine Rescue Contest

JUDGES' PACKET
Field Competition
Day 1

July 26, 2016
Reno, Nevada

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Introduction

Welcome to the 2016 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.

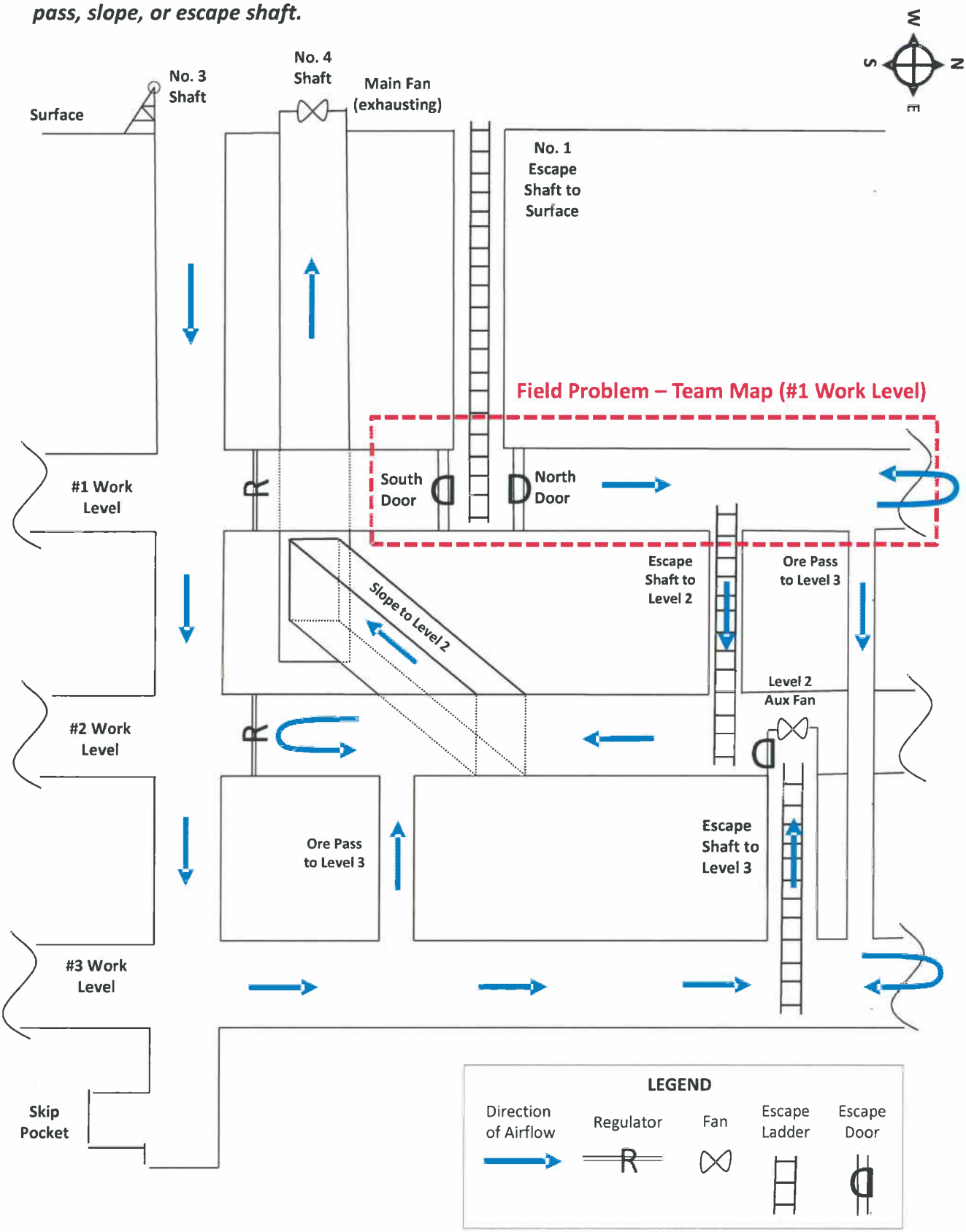
Your team's final placement will be based on your combined cumulative discounts for both day's field problems plus your written test discounts. Those teams with the least amount of total discounts will vie for the trophies.

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.

2016 Day 1 – North Block Ventilation Map

DISCLAIMER: ***This schematic should be used for ventilation purposes only. It shows how airflow travels throughout the multiple levels of the North Block portion of the mine. The schematic is not to scale and does not depict the specific locations of any air shaft, ore pass, slope, or escape shaft.***



Mine Information Sheet
Sparks Mining Co. – Late Night Mine

Mine Design and Openings:
The Sparks Mining Co.'s Late Night Mine is a multi-level underground development opened by six shafts. Air lock fire doors separate the mine into two portions known as the North Block and South Block, each portion has three shafts and its own ventilation system.

In the North Block, the downcast No. 3 Shaft (intake air) is equipped with the production skips, as well as an escape compartment which can be used to hoist six persons to the surface. There is access to the No. 3 Shaft on all three work levels. The upcast No. 4 Shaft (return air) is equipped with a hoist used to transport people and to convey supplies. The North Block is ventilated by an exhausting Main Fan located on the surface at this shaft. The No. 1 Escape Shaft extends from the surface to the #1 Work Level and has no conveyances. A ladder way is maintained in the shaft to provide escape from the #1 Work Level. Doors located at the bottom of this shaft keep it isolated from the North Block ventilation system.

Ventilation:
The Main Fan for the North Block is located on the surface at the upcast No. 4 Shaft. The Main Fan pulls approximately 250,000 cfm of fresh air into the mine through the downcast No. 3 Shaft. Intake air circulates through the work levels as shown on the 2016 Day 1 North Block Ventilation Map. Return air exhausts from the mine through the upcast No. 4 Shaft. The Main Fan operates in the stable portion of its performance curve and cannot be reversed. Currently, the electrical power to the fan is on and the fan is operating.

Ventilation on each level of the mine is achieved utilizing concrete block stoppings and brattice curtains. Air is directed to the faces using these permanent and temporary ventilation controls. On the #2 Work Level, a 20,000 cfm auxiliary fan is located at the top of the Escape Shaft to Level 3 to assist primary airflow from the lowest level.

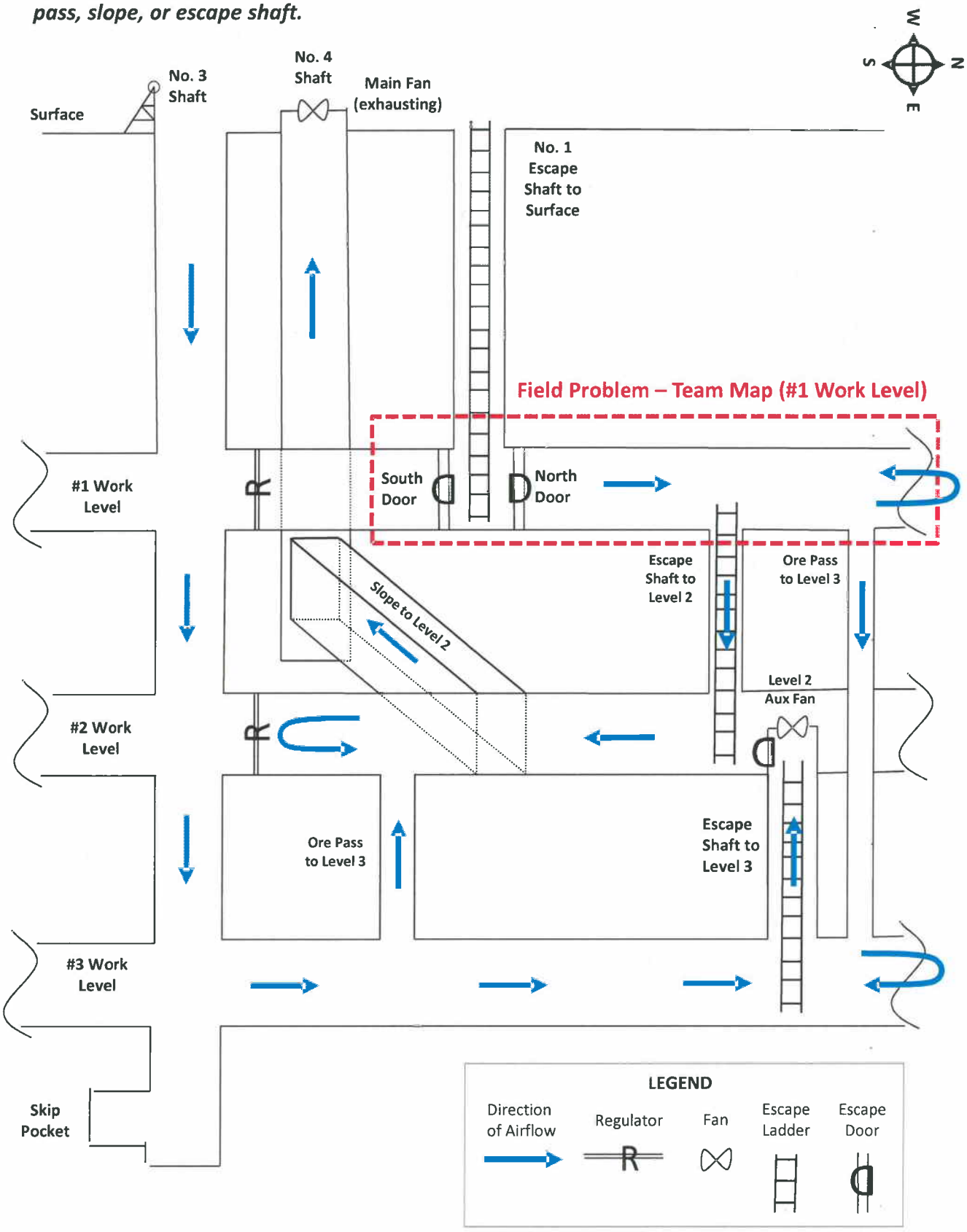
Mine Classification & Other Mines:
In accordance with Title 30 CFR 57.22003, the mine is classified as Category VI. That is, the presence of methane has not been established in this mine and there is no history of methane gas in any other mine in the area. At this time, the Late Night Mine is not connected to any of these mines.

Electric Power:
The electrical power to the shafts, the surface pumping station, and the Main Fan has been restored; however, all power to the underground has been de-energized, locked out, and guarded.

Mine Map:
The onsite Engineering Department updated the mine map on July 15, 2016.

2016 Day 1 – North Block Ventilation Map

DISCLAIMER: ***This schematic should be used for ventilation purposes only. It shows how airflow travels throughout the multiple levels of the North Block portion of the mine. The schematic is not to scale and does not depict the specific locations of any air shaft, ore pass, slope, or escape shaft.***



Mine Information Sheet (continued)
Sparks Mining Co. – Late Night Mine

Mining & Equipment:
The mine operates three shifts per day, six days per week. Routine maintenance is performed on all shifts and major maintenance projects are scheduled "as needed" on Sundays. High grade ore is mined using a conventional "room and pillar" method on all three work levels. Typical pillar dimensions are 15 feet by 20 feet (W x L). The entries were initially driven approximately eight feet high and ten feet wide. Each level is connected to the lower level by an ore pass and a ladder way. On the #1 Work Level, the broken ore is loaded into rock trucks by front-end loaders and then transported to the ore pass where it is dropped to the #3 Work Level below. Front-end loaders and haul trucks operating on the #3 Work Level load and transport the ore to a main ore pass leading to the No. 3 Shaft skip pocket. The ore is then hoisted to the surface via the production skips. All underground mobile equipment (including the front-end loaders, rock trucks, face drills, roof bolting machines, and transport jeeps) is diesel-powered.

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 wooden posts or stacked crib blocks.

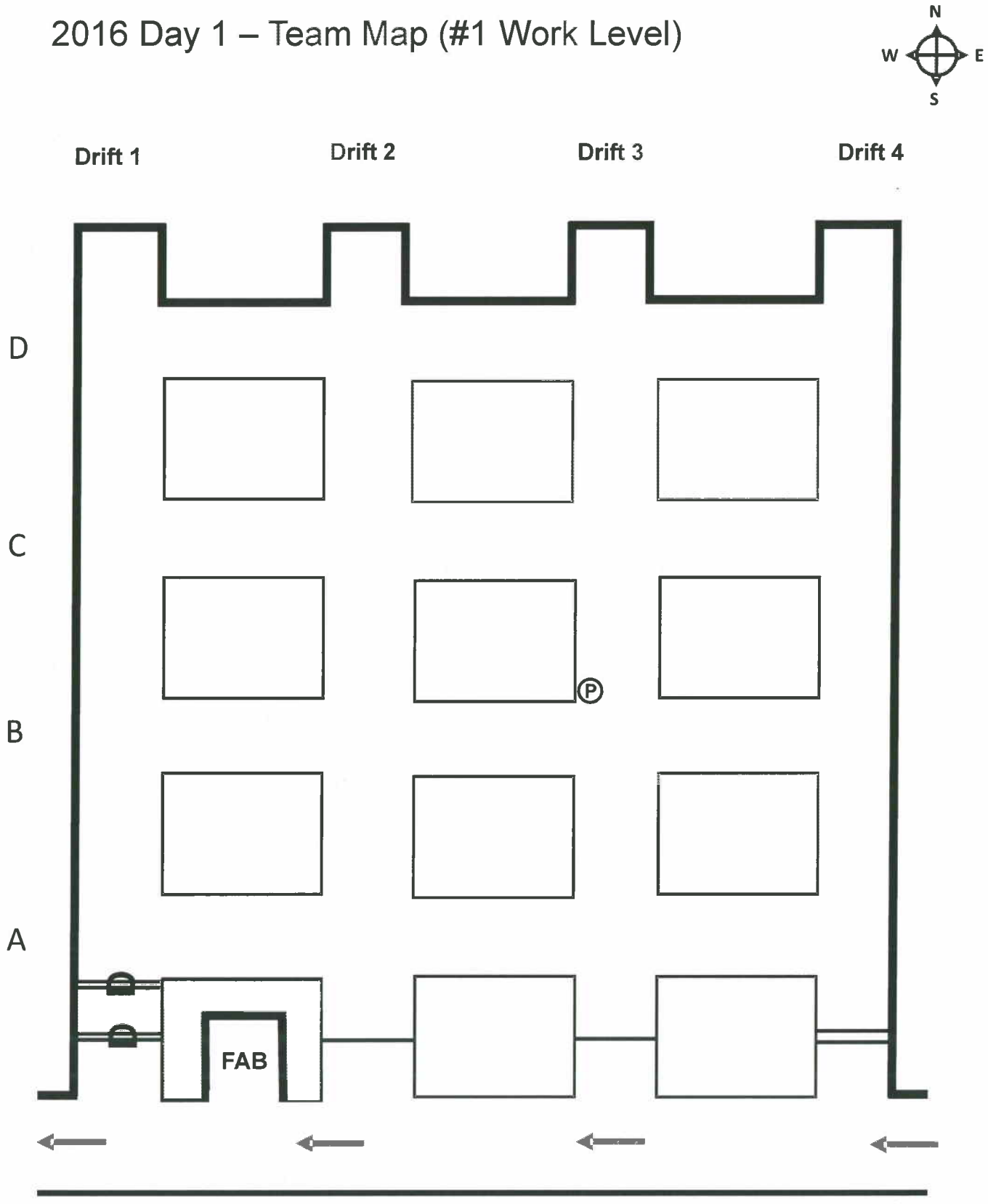
Water, Pumps, and Waterlines:
The mine has a history of water problems in the active workings. The ore body dips toward the East. Culverts are used to divert water from the active areas. Submersible pumps and waterlines have been installed to minimize water levels in the travel ways. Each shaft is equipped with a ten-foot deep sump. The main water pump, located on the surface, can easily handle the volume of water produced in the mine and the shafts. The main water pump has been activated along with the power to the shafts.

Explosives:
Explosives are 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 truck.

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 at any given time.**

Communications:
Pager phones are available in the mine for contact with the surface. The current phone locations are marked on the mine map. However, there has been no contact with the missing miners.

2016 Day 1 – Team Map (#1 Work Level)



Team Briefing Statement

You are located underground at the fresh air base that has been established at the #1 Work Level of the Sparks Mining Co.'s Late Night Mine. The mine is a multi-level underground development opened by six shafts. Air lock fire doors separate the mine into two portions known as the North Block and South Block; each portion has three shafts and its own ventilation system. The #1 Work Level is part of the North Block.

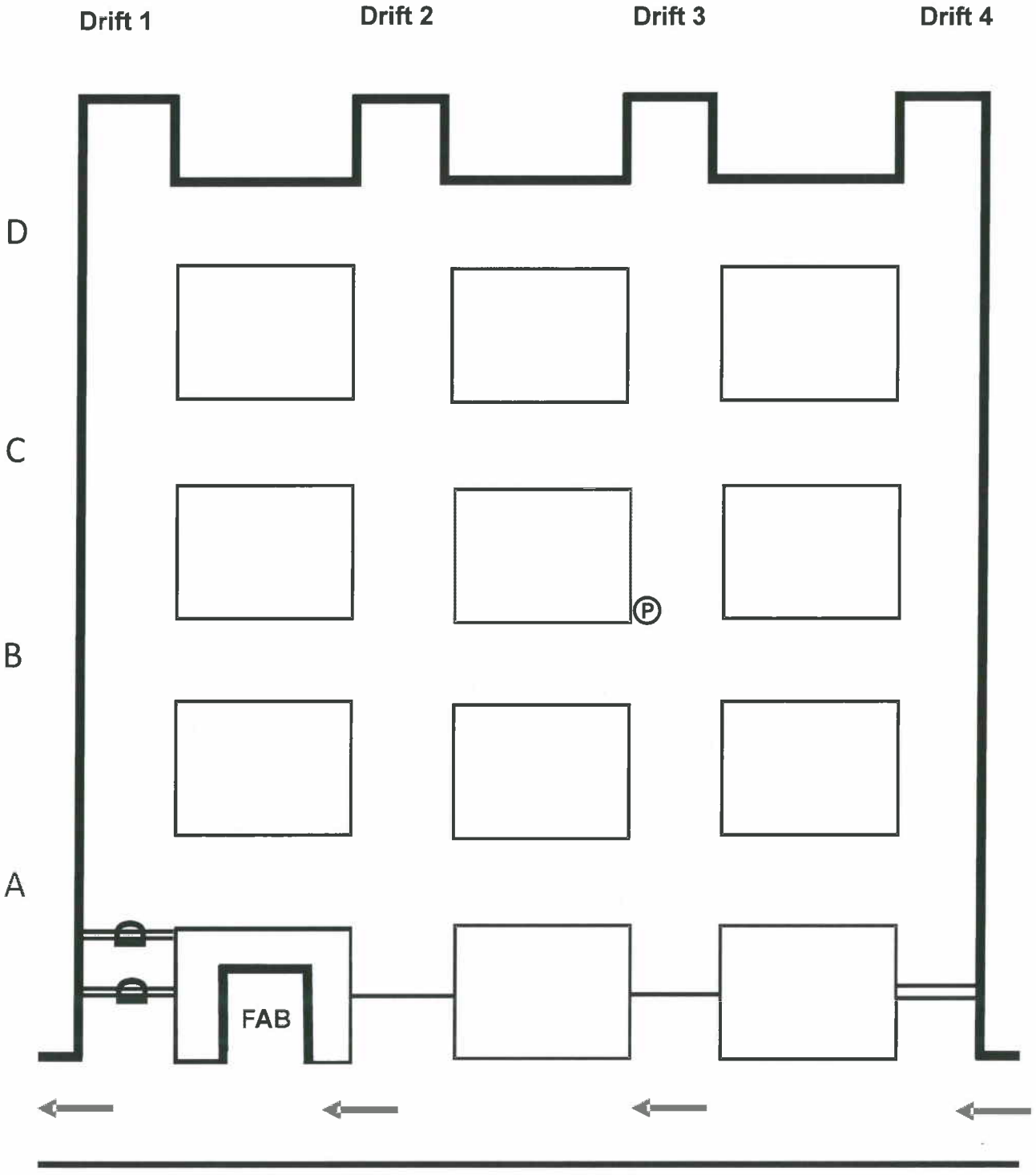
In the North Block, the downcast No. 3 Shaft (intake air) is equipped with the production skips, as well as an escape compartment which can be used to hoist six persons to the surface. There is access to the No. 3 Shaft on all three work levels. The upcast No. 4 Shaft (return air) is equipped with a hoist used to transport people and to convey supplies. The North Block is ventilated by a Main Fan located on the surface at this shaft. The Main Fan exhausts 250,000 cfm from the mine and cannot be reversed. The No. 1 Escape Shaft extends from the #1 Work level to the surface and has no conveyances. A ladder way is maintained in the shaft to provide escape from the #1 Work Level.

High grade ore is mined using a conventional "room and pillar" method on all three work levels. The entries were initially driven approximately eight feet high and ten feet wide. Each level is connected to the lower level by an ore pass and a ladder way. 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 no history of water problems in the active workings. The mine is classified as Category VI, since the presence of methane has not been established and there is no history of methane gas in any other mine in the area. At this time, the Late Night Mine is not connected to any of these mines.

Last night at 11:00 p.m., the production crews assembled on the surface to start their shift. By 11:30 p.m., a total of 54 persons went underground. An eight-person crew traveled to the #1 Work Level. At about 3:15 a.m., a mechanic called out from the Maintenance Shop on the #1 Work Level and informed the hoist engineer that there was an apparent fire underground and dark black smoke was filling the level. At that time, communication was lost. The engineer called the mine foreman who immediately gave the order to activate the warning system to evacuate the mine. By 4:00 a.m., a total of 46 persons exited the mine.

A short time later, two miners exited the #1 Work Level through the No. 1 Escape Shaft. They reported that they had difficulty getting to shaft due to smoke in the face areas and Drift 1. Once they found their way, they climbed to the surface. The two miners had worn their MSA W-65 filter self-rescuers while escaping to the surface. They had no specific information as to what had happened nor were they aware of the condition or location of the rest of their crew. We do not know the status of the communication system, because there has been no further contact with the missing miners.

2016 Day 1 – Team Map (#1 Work Level)



At 5:30 a.m., the Company's mine rescue teams entered the mine and explored the entire North Block from the #3 Work Level up to the #1 Work Level and established a Fresh Air Base (FAB). The FAB location has been marked on the Day 1 - Team and Fresh Air Base Maps (Work Level #1).

All power to the underground has been de-energized, locked out, and guarded. Both hoists are operational and the Main Fan and surface pump are operating. Continuous gas monitoring has been established at the three shafts. The latest readings show "clear air" at each location.

We have called all of the government agencies for help. Guards have been posted at the shafts and at the main fan. There is a fully equipped mine rescue team located on the surface and they are 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 #1 Work Level. **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. The materials are stored in several areas underground and can be readily located if needed. If there is something else deemed necessary by the team, upon request, it can be delivered in a reasonable amount of time.

When you reach the mine rescue course you will be located at the fresh air base on the #1 Work Level. 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 not answer any additional questions concerning the team briefing statement. However, if you do not understand a term, it will be defined. The 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 wire 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 on the #1 Work Level (problem field) and any changes made by the team;
- Extinguish or seal any fires;
- Account for the six 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

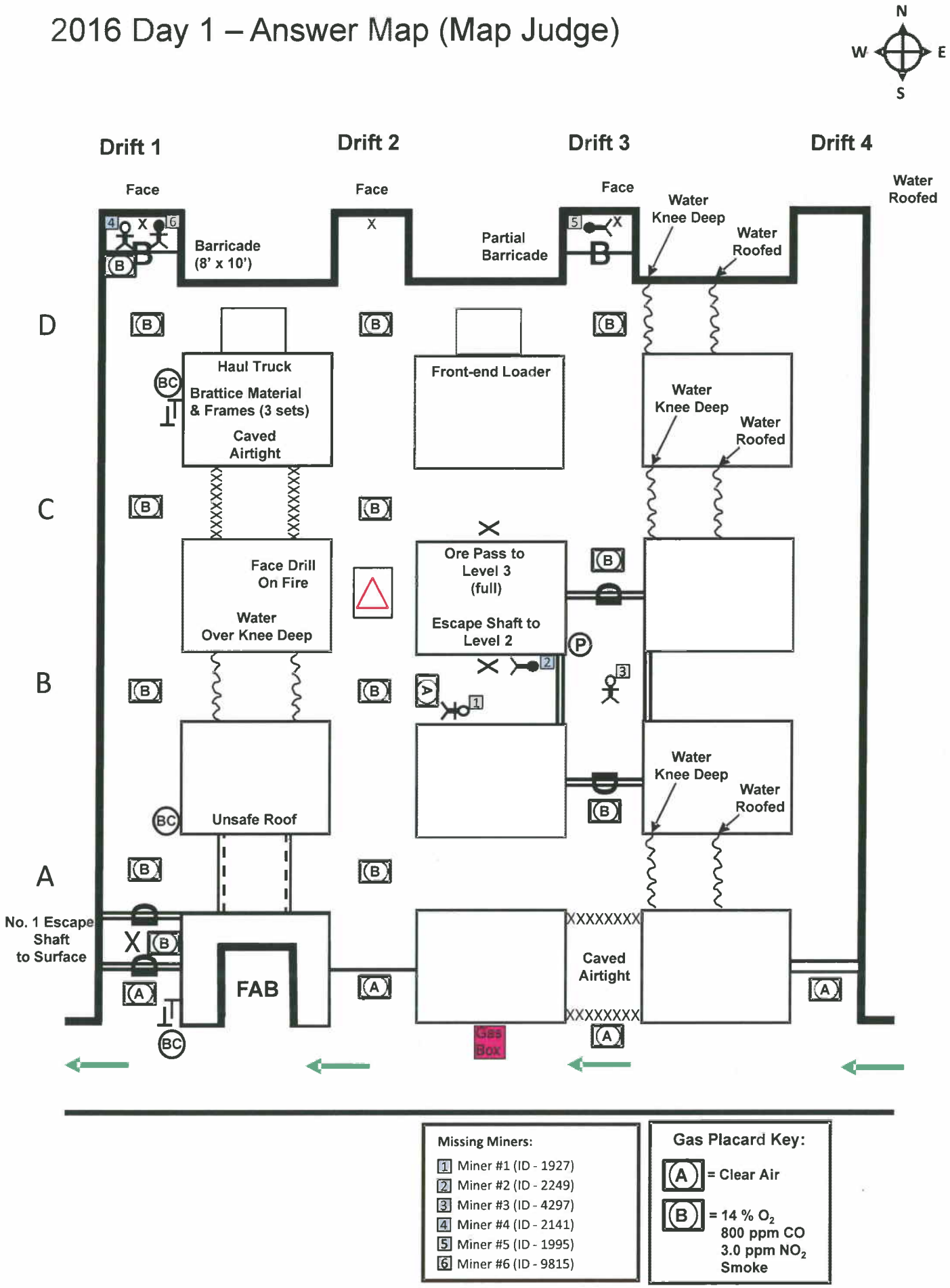
Introduce yourself to the team as the "Mine Manager." Then, introduce the #1, and #2 Judges. The team has been briefed on the problem and the mine information, and been provided with the mine maps in isolation. Read the following instructions to the team:

> **At this time, I have no new information for your team. 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!"**

2016 Day 1 – Answer Map (Map Judge)



Missing Miners:

1. Miner #1 (ID - 1927)
2. Miner #2 (ID - 2249)
3. Miner #3 (ID - 4297)
4. Miner #4 (ID - 2141)
5. Miner #5 (ID - 1995)
6. Miner #6 (ID - 9815)

Gas Placard Key:

- (A) = Clear Air
- (B) = 14 % O_2, 800 ppm CO, 3.0 ppm NO_2, 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.

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.

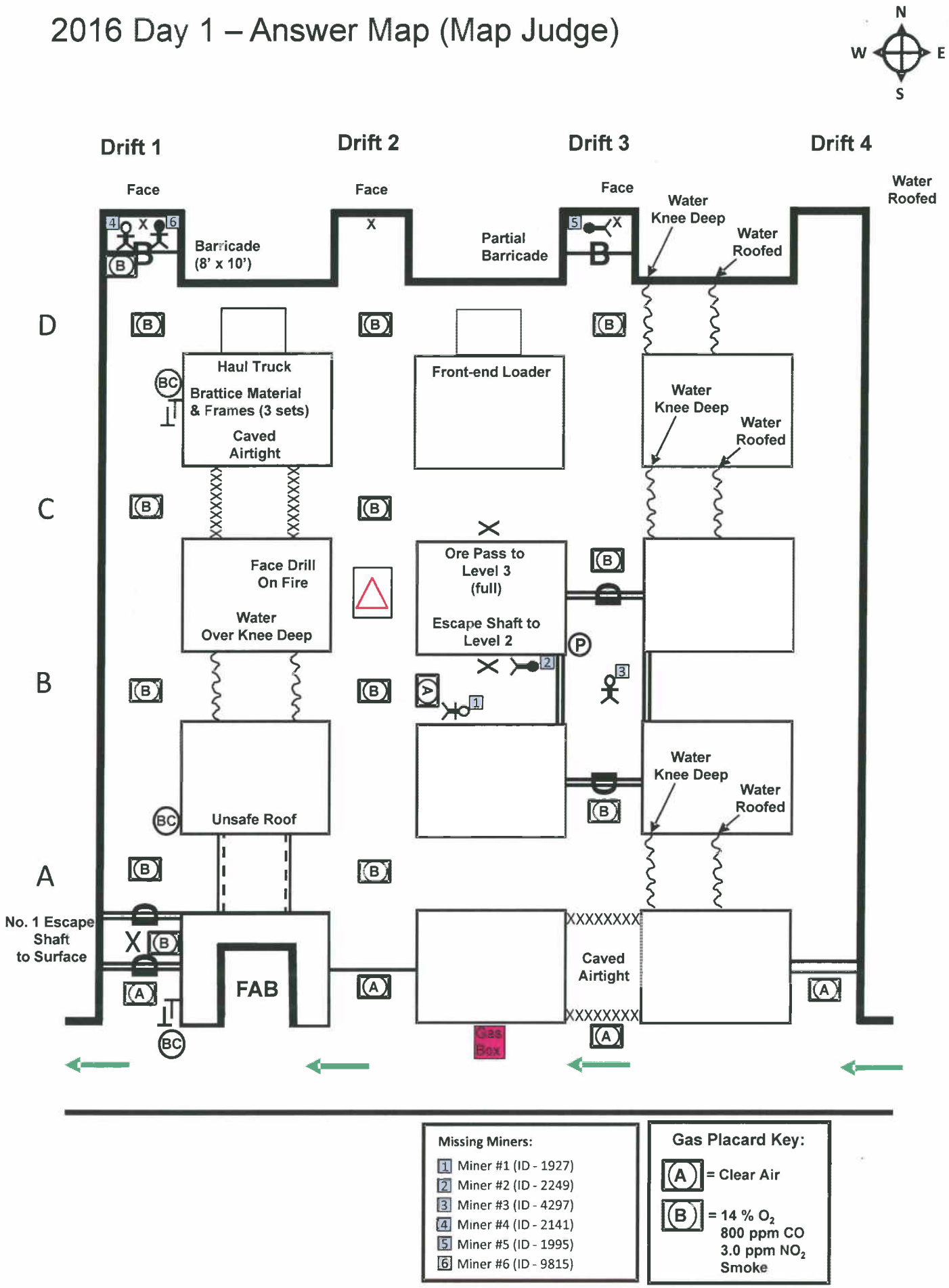
Since the mine is a Category VI, the team does not need to use non-sparking tools to work the problem. However, if the team does not have non-sparking tools and requests them from the official in charge, the tools that they brought with them will be deemed non-sparking.

When ready, the team must examine all openings along the prior mine rescue team's furthest point of advance. The four 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. This examination should not cover more than 25 feet.

Drift 1 checks reveal: As the captain performs roof or back checks and the team conducts necessary gas tests, a placard at the drift shows Clear Air. The captain will date & initial (D&I) the South Door (closed). The team will also find one set of brattice material which they may take for future use during exploration of the level.

Drift 2 checks reveal: The team will find that the drift to the north is blocked by a temporary stopping which had been erected by the previous mine rescue team. As the captain performs roof or back checks and the team conducts necessary gas tests, a placard at the drift shows Clear Air.

2016 Day 1 – Answer Map (Map Judge)



Drift 3 checks reveal: The team will find that the drift to the north is blocked by an area that is Caved Airtight stretching rib-to-rib. As the captain performs roof or back checks and the team conducts necessary gas tests, a placard at the drift shows Clear Air. The captain will D&I the Caved Airtight as their furthest point of advance (FPA) in this direction.

Drift 4 checks reveal: The team will find that the drift to the north is blocked by a Permanent Stopping. As the captain performs roof or back checks and the team conducts necessary gas tests, a placard at the drift shows Clear Air. The captain will D&I the stopping as their FPA in this direction. The team can now travel beyond the fresh air base.

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

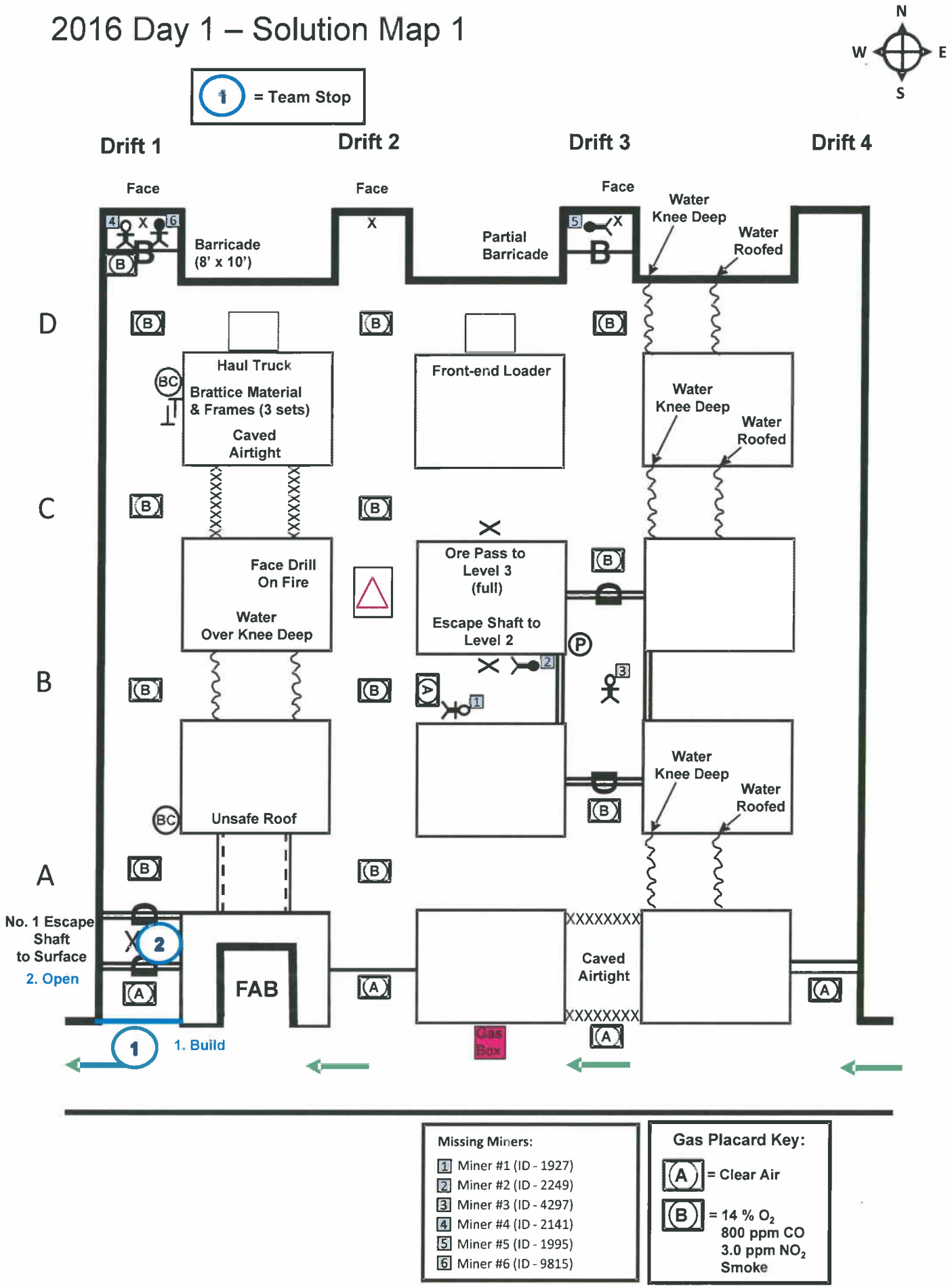
Note: The brattice material available for use by the team is relatively lightweight and compact (10-foot strips of brattice cloth with clips on each end). Therefore, for the sake of realism, the team will only be allowed to carry two sets of material at any given time. This information was provided to the team on the Mine Information Sheet.

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 Day 1 - Judge's Map (with Team Stops) 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 Day 1 - Judge's Map (with Team Stops) 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.

2016 Day 1 – Solution Map 1



Note: Team Stop Nos. 1 - 2 (see Solution Map 1)

Team Stop No. 1
Note: The team can "airlock" into the South Door (closed) in Drift 1 or the Temporary Stopping in Drift 2 by erecting a temporary stopping.

For this scenario, the team will airlock into Drift 1 and open the South Door. If the team does not build an airlock, assess 10 discounts under Judge 2 - UG Rule #10 for failure to erect temporary stopping when necessary. Also, if they open the South Door, assess 15 discounts under Judge 2 – UG Rule #12 for changing ventilation before the effects of such changes are known.

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: 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.

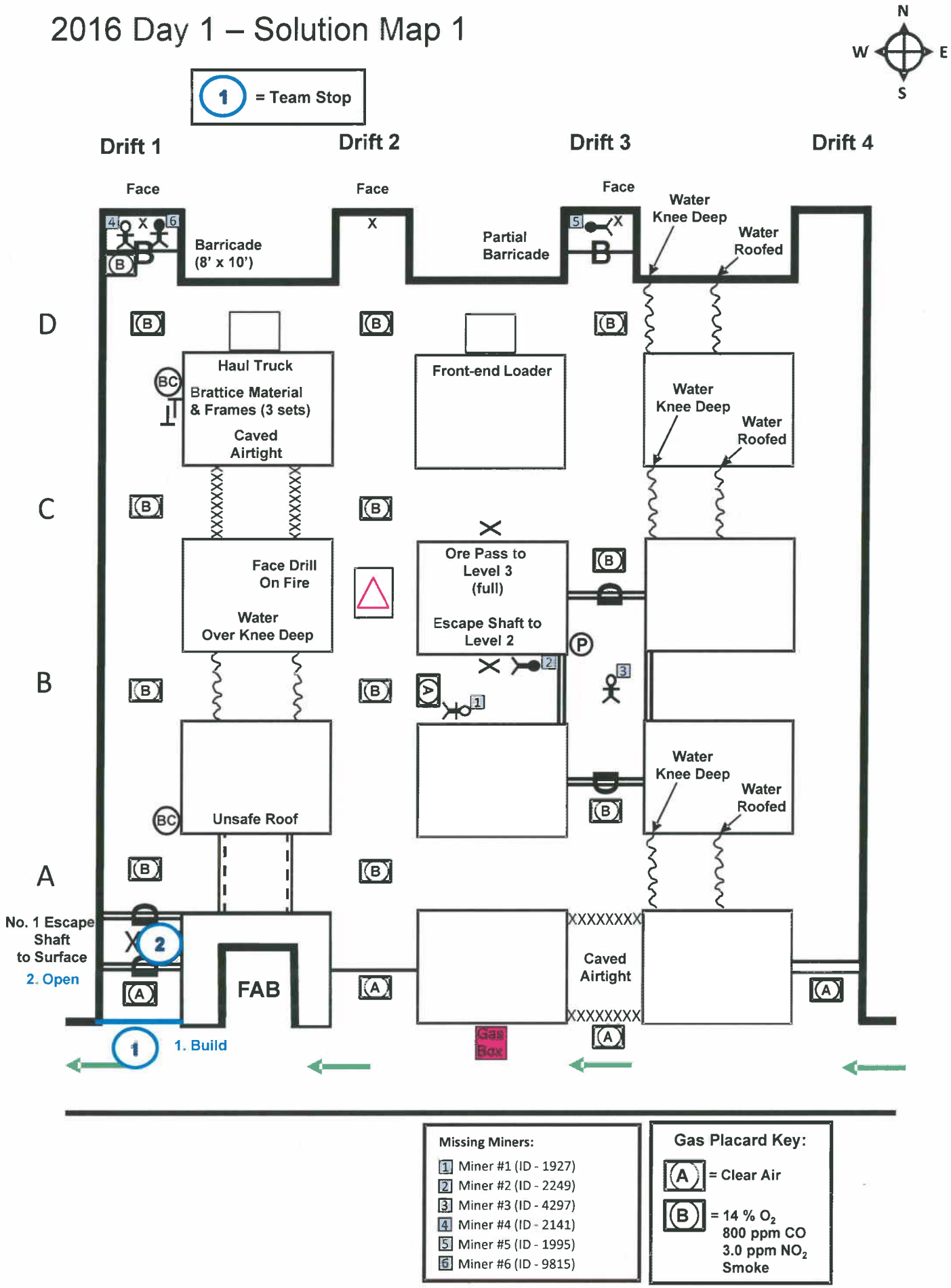
Team Stop No. 2
When the team opens the South Door, the captain performs roof or back checks and the team will conduct necessary gas checks. The team will find: 14% oxygen (O_2), 800 ppm carbon monoxide (CO), and 3 ppm nitrogen dioxide (NO_2) with Smoke. The team must perform an apparatus and personnel check before entering "smoke" at this location. They must also be attached to their lifeline.

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).

If the captain does not 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, assess discounts (5x each occurrence) per Judge 1 - UG Rule #8(b)(4).

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).

2016 Day 1 – Solution Map 1



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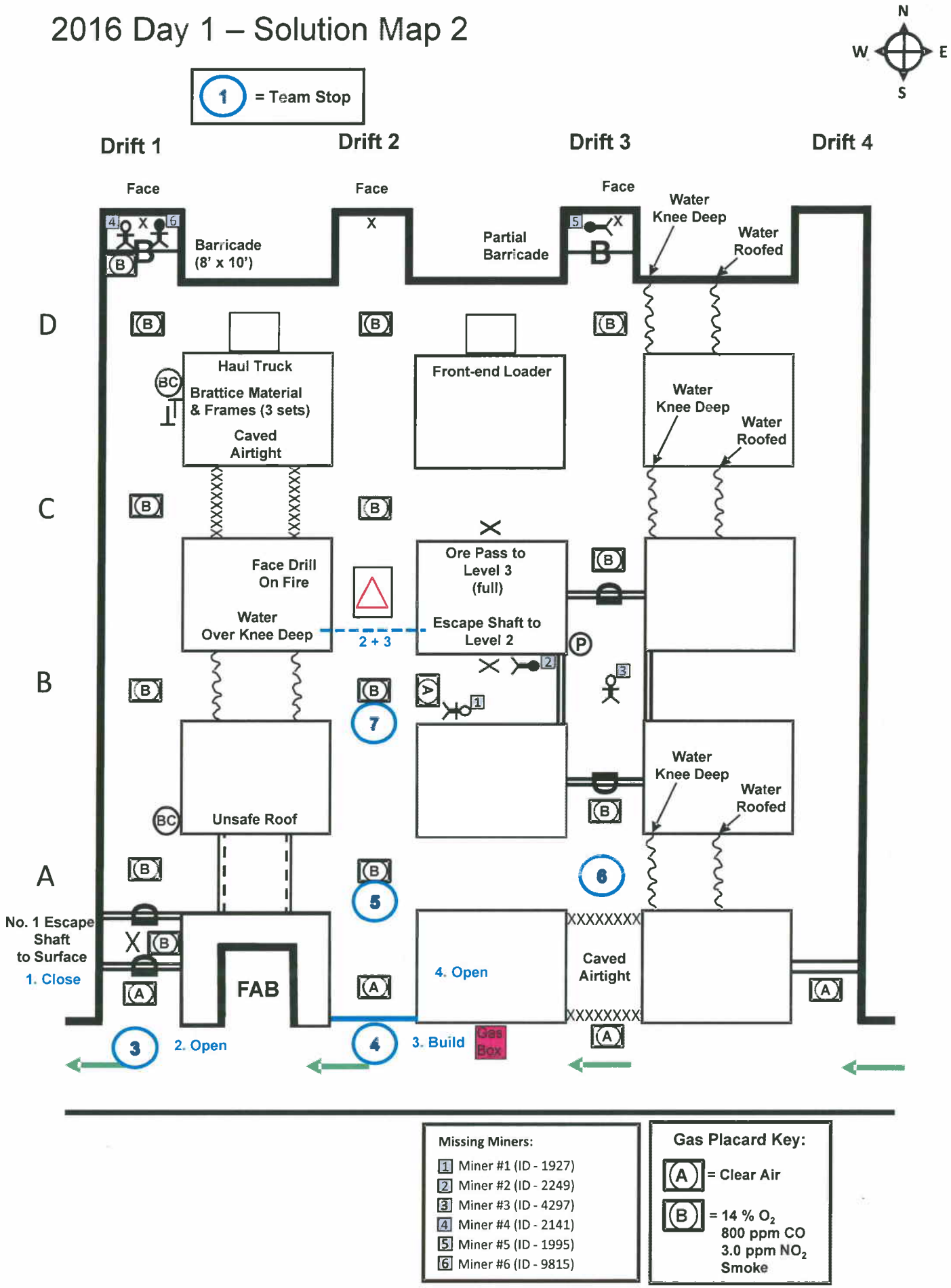
Gas Placard Key:

- (A) = Clear Air
- (B) = 14 % O_2, 800 ppm CO, 3.0 ppm NO_2, Smoke

The captain will find a placard showing "No. 1 Escape Shaft to Surface". The team captain should warn the other team members to avoid the fall of material hazard from above. The team cannot open the North Door (closed) and advance inby in Drift 1, because the conditions behind the door are unknown and there is no physical way to build a temporary stopping or airlock (due to limited space between the two doors).

Note: If the team opens the North Door, they will cause an air change without knowing the effects of such changes. Air will be pulled down the No. 1 Escape Shaft and travel toward the Escape Shaft Down to Level 2 (located in crosscut B between Drift 2 and Drift 3). This air change will endanger the survivor near the Escape Shaft. **If the team opens the North Door, three gas placards in crosscut A and the B2 intersection (Numbers 10, 34, and 41) will be flipped to show Clear Air.** The team will be assessed 15 discounts per Judge 2 - UG Rule #12 for changing ventilation before the effects of such changes are known and 50 discounts per Judge 1 - UG Rule #18(d) for improperly protecting survivor from toxic gasses. **Total for these infractions: 15 + 50 = 65 discounts.**

2016 Day 1 – Solution Map 2



Note: Team Stop Nos. 3 - 7 (see Solution Map 2)

Team Stop No. 3
The team will retreat through the South Door and close it. Then, they can tear down the temporary stopping that they had erected and return to the fresh air base.

Team Stop No. 4
The team will then airlock into Drift 2. The captain must check the roof and rib prior to building the temporary stopping. After the build, the captain must D&I the temporary stopping. Again, if the team does not build an airlock, assess discounts under Judge 2 – UG Rule #10 and Rule #12. When the team opens the Temporary Stopping and passes through, the captain performs roof or back checks and the team will conduct necessary gas checks.

Team Stop No. 5
The team will advance north to the intersection A2 where the captain performs roof or back checks and the team will conduct necessary gas checks. The team will find: 14% oxygen (O_2), 800 ppm carbon monoxide (CO), and 3 ppm nitrogen dioxide (NO_2) with Smoke. The team must perform an apparatus and personnel check before entering "smoke" at this location. They must also be attached to their lifeline.

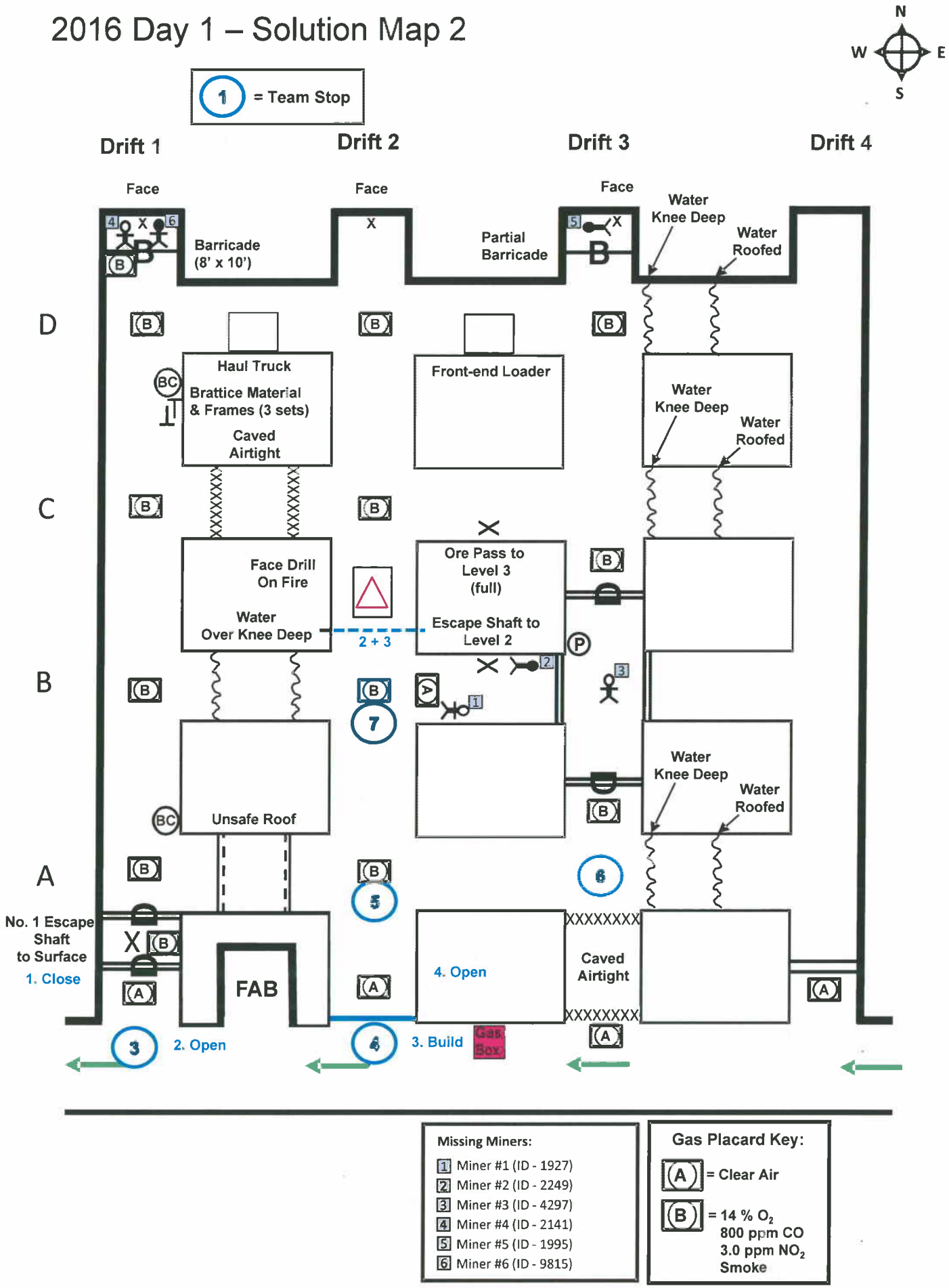
Stretching westward in crosscut A, the captain will find an area of Unsafe Roof stretching rib-to-rib. The captain must warn the rest of the team members to avoid this hazard. At this point, the team has not located any posts or cribbing materials to support it. **If the team asks the mine manager for posts to access the area of unsafe roof, they will be told that "All materials needed to work the problem can be found on the field. Additional posts can be delivered to the fresh air base in one (1) hour."**

Therefore, the team must move on.

Team Stop No. 6
The team will advance eastward to the intersection A3 where the captain performs roof or back checks and the team will conduct necessary gas checks. To the south, they will find that the drift is blocked by an area that is Caved Airtight stretching rib-to-rib. After performing necessary roof or back checks, the captain will D&I the Caved Airtight as their FPA in this direction. To the east in crosscut A, they will find a placard indicating Water Knee Deep. The team can stretch ten feet into the crosscut to find another placard indicating Water Roofed stretching rib-to-rib. After performing necessary roof or back checks, the captain will D&I the Water Roofed as their FPA in this direction. Any team member passing the Water Roofed placard will result in individual endangerment discounts (15 x each person) per Judge 1 – UG Rule #10(a)(2).

Stretching northward, the team will find a Permanent Stopping with Door (closed) which is the southern extent of the Maintenance Shop. The captain performs roof or back checks and the team will conduct necessary gas checks. They will find a placard showing 14% O_2, 800 ppm CO, and 3 ppm NO_2 with Smoke. If the team captain knocks on the door and calls out to anyone inside, there is a response.

2016 Day 1 – Solution Map 2



The No. 1 judge will hand the team a placard with the following statement:

> *"I am Miner #3. When I saw the smoke outside the shop, I called for help but the mine phone stopped working. I am alone in here but O.K. The air is good. All of the walls and doors are intact. Please get me out of here."*

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

Team Stop No. 7

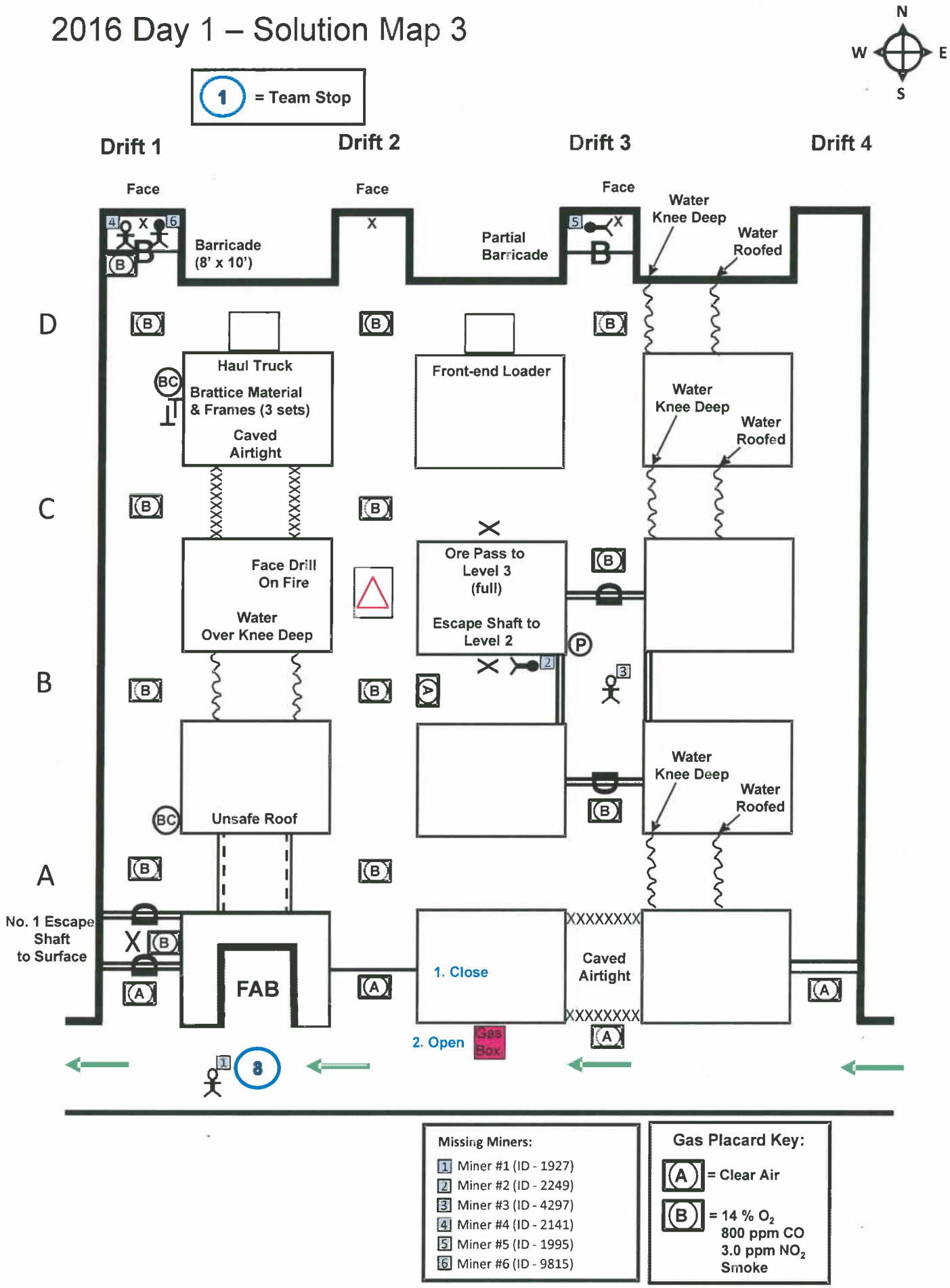
The team must continue systematic exploration of the mine. Therefore, they can retreat to the A2 intersection and advance northward in Drift 2. At the B2 intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find that the gas concentrations in the area are the same as those at A2. Stretching westward in crosscut B, the team will find an area of Water Over Knee Deep and there are no pumps in the vicinity. The captain must D&I the water as their FPA in this direction.

Note: the team cannot advance beyond 3 feet past crosscut B, because they have not tied-in the entries behind them.

Stretching eastward in crosscut B, they will find a Clear Air placard. Along the southern rib, they will find the second missing miner (Miner #1, I.D. 1927) who is 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 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 9th Edition on pages 402 – 403).** At this time, the team can continue with their secondary survey and then secure the miner to the stretcher. **The unconscious miner must also be fitted with proper respiratory protection.**

The captain can continue to explore while team members are preparing Miner #1 for transport. Along the northern rib, the captain will find the Escape Shaft to Level 2 and must warn the rest of the team members to avoid this fall of person hazard. The captain will also find the third missing miner (Miner #2, I.D. 2249) who is 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 exhibits no vital signs. The miner is dead."** The captain must D&I the location of the body. Stretching eastward, the captain will find a Permanent Stopping. After the captain performs roof or back checks and the team conducts necessary gas tests, the captain will D&I the stopping as their FPA in this direction.

2016 Day 1 – Solution Map 3

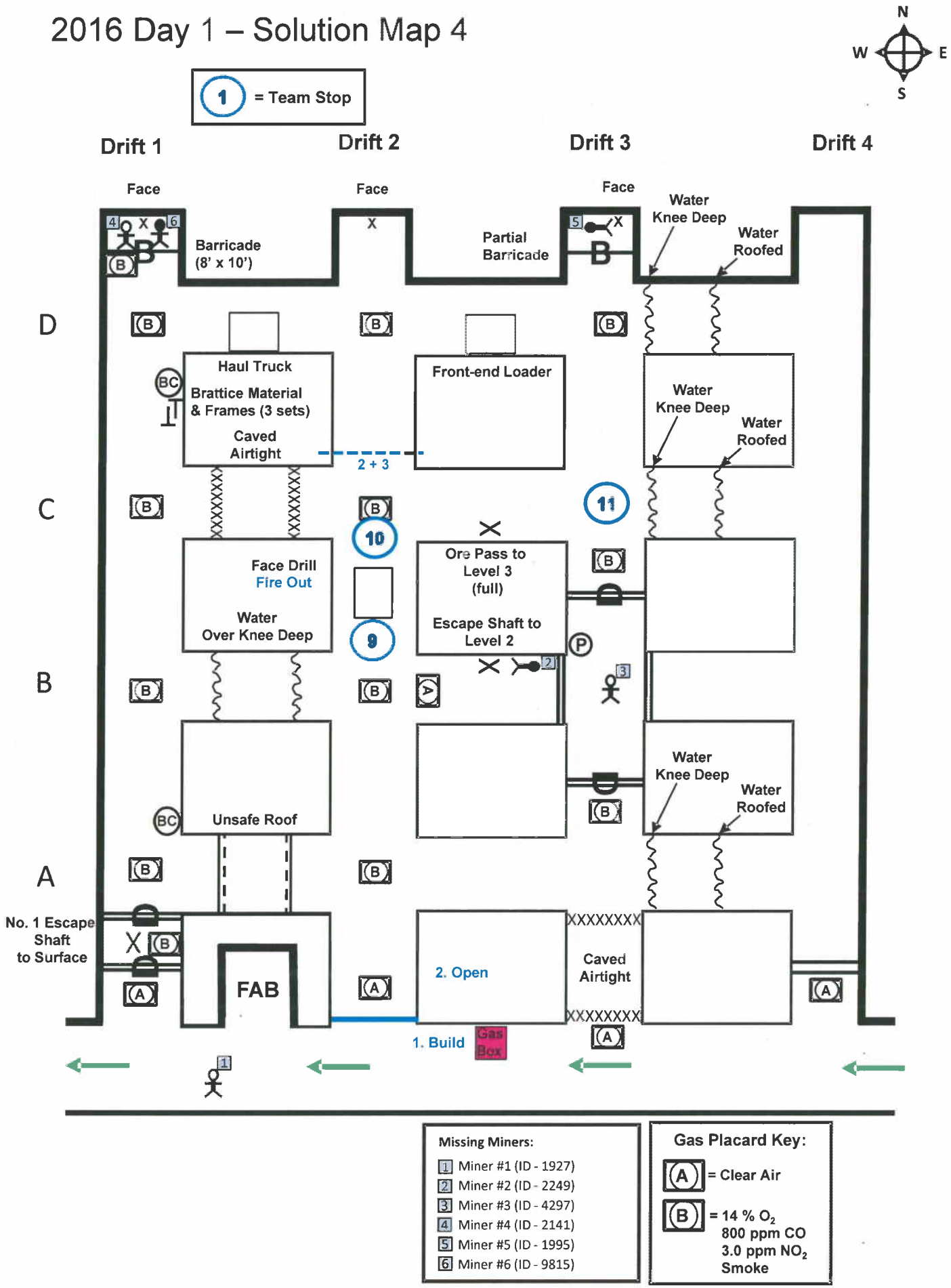


Note: Team Stop No. 8 (see Solution Map 3)

Team Stop No. 8

The team can now travel to the fresh air base. They will travel southward in Drift 2 carrying the unconscious survivor. Before exiting the drift, they must close the Temporary Stopping that they had previously opened. Then, they can tear down the temporary stopping that they had erected and return to the fresh air base. The fresh air base attendant can arrange for follow-up medical treatment. Now, the team must continue systematic exploration of the mine.

2016 Day 1 – Solution Map 4



Missing Miners:

- 1 Miner #1 (ID - 1927)
- 2 Miner #2 (ID - 2249)
- 3 Miner #3 (ID - 4297)
- 4 Miner #4 (ID - 2141)
- 5 Miner #5 (ID - 1995)
- 6 Miner #6 (ID - 9815)

Gas Placard Key:

- (A) = Clear Air
- (B) = 14 % O_2, 800 ppm CO, 3.0 ppm NO_2, Smoke

Note: Team Stop Nos. 9 - 11 (see Solution Map 4)

Team Stop No. 9
The team must airlock into Drift 2. The captain must check the roof and rib prior to building the temporary stopping. After the build, the captain must D&I the temporary stopping. Again, if the team does not build an airlock, assess discounts per Judge 2 – UG Rule #10 and Rule #12. Afterward, they can advance northward in the drift toward the C2 intersection. As they travel past crosscut B, the team will find a face drill parked in the middle of the drift and a placard indicating that it is "On Fire." The team can use their fire extinguishers to fight the fire. **When the team uses both fire extinguishers, the #1 Judge can flip the placard to show that the "Fire is Out."**

Team Stop No. 10
The team can now continue advancing northward in the drift. At the C2 intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find that the gas concentrations have not changed from their previous location. Stretching westward in crosscut C, they will find that the crosscut is blocked by an area that is Caved Airtight stretching rib-to-rib. After performing necessary roof or back checks, the captain will D&I the Caved Airtight as their FPA in this direction.

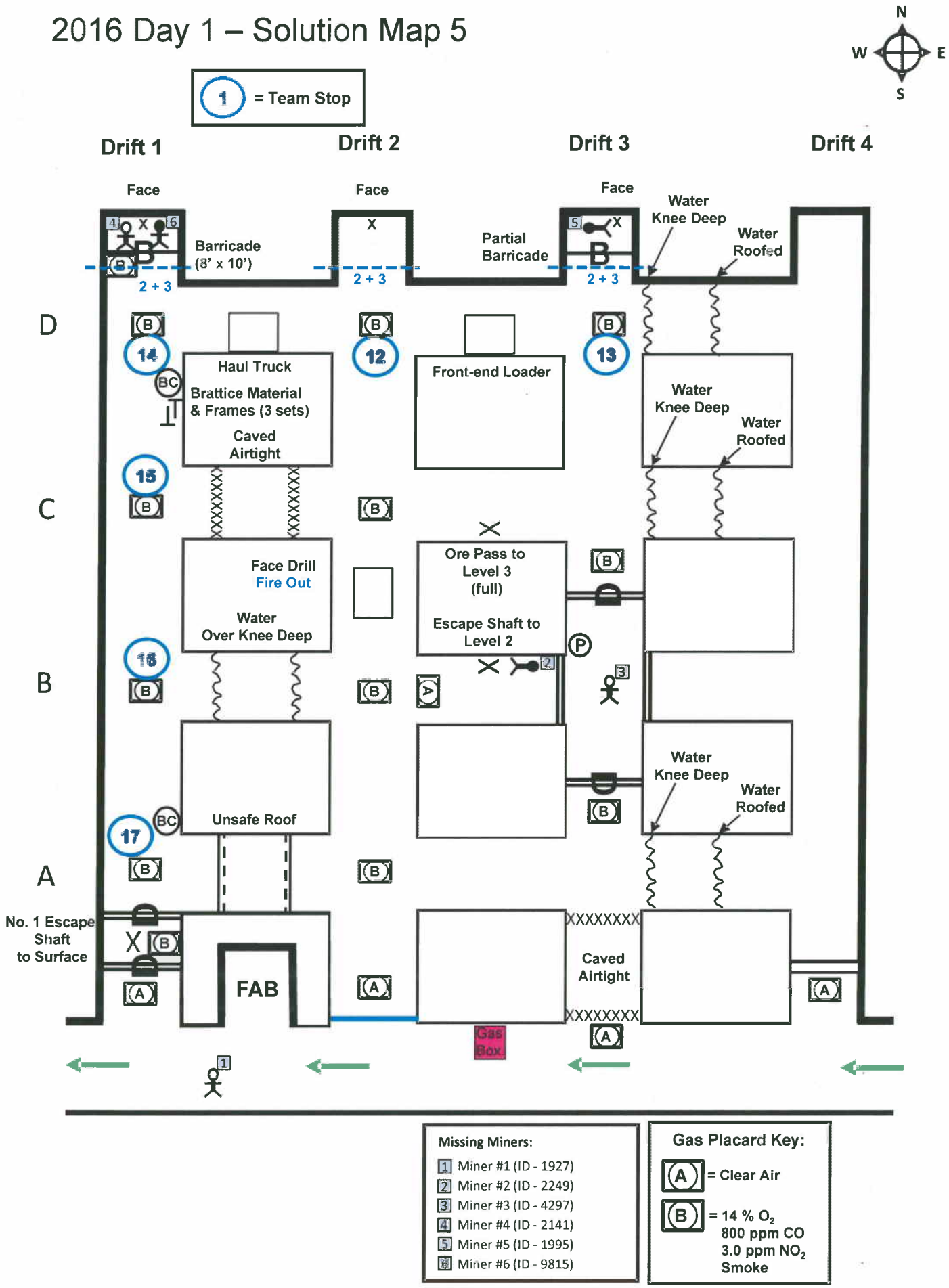
Note: the team cannot advance beyond 3 feet past crosscut C, because they have not tied-in the entries behind them.

Team Stop No. 11
The team can advance eastward in crosscut C. While they travel, they will find the Ore Pass to Level 3 along the southern rib. The placard indicates that the ore pass is "full." The captain must warn the other team members to stay clear of this fall of person hazard. At the C3 intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find that the drift is open to the north. To the east in crosscut C, they will find a placard indicating Water Knee Deep. The team can stretch ten feet into the crosscut to find another placard indicating Water Roofed stretching rib-to-rib. After performing necessary roof or back checks, the captain will D&I the Water Roofed as their FPA in this direction. Any team member passing the Water Roofed placard will result in individual endangerment discounts (15 x each person) per Judge 1 – UG Rule #10(a)(2).

Stretching southward in the drift, the team will find a Permanent Stopping with Door (closed) which is the northern extent of the Maintenance Shop. The captain performs roof or back checks and the team will conduct necessary gas checks. They will find a placard showing 14% O_2, 800 ppm CO, and 3 ppm NO_2 with Smoke.

Because of the oxygen-deficient atmosphere in the area, the team cannot open the shop door. The team can instruct the Miner #3 to stay inside the shop until the level has been cleared of toxic and poisonous gases for safe evacuation. The captain must D&I the Permanent Stopping with Door (closed) as their FPA in this direction.
Note: If the team chooses to open the shop door without ventilating first, assess 50 discounts per Judge 1 - UG Rule #18(a) for endangering the survivor by breaching a barricade (shop door) with toxic gasses outside.

2016 Day 1 – Solution Map 5



Missing Miners:

1. Miner #1 (ID - 1927)
2. Miner #2 (ID - 2249)
3. Miner #3 (ID - 4297)
4. Miner #4 (ID - 2141)
5. Miner #5 (ID - 1995)
6. Miner #6 (ID - 9815)

Gas Placard Key:

- (A) = Clear Air
- (B) = 14 % O_2, 800 ppm CO, 3.0 ppm NO_2, Smoke

Note: Team Stop Nos. 12 - 17 (see Solution Map 5)

Note: Team Stop No. 12 and Team Stop No. 13 can be performed in either order.

Team Stop No. 12
At this point, the team still cannot gain access to Drift 1 and must continue systematic exploration to the north. So, the team can retreat to the C2 intersection and then advance northward in Drift 2 toward crosscut D. At the D2 intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find a placard showing 14% O_2, 800 ppm CO, and 3 ppm NO_2 with Smoke. They will also find that the crosscut is open to the east and the west.

Note: the team cannot advance beyond 3 feet past crosscut D, because they have not tied-in the entries behind them.

Team Stop No. 13
The team can advance eastward in crosscut D. As they travel, they will find a front-end loader parked along the southern rib. At the D3 intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find that the gas concentrations have not changed from their previous location. To the east in crosscut D, they will find a placard indicating Water Knee Deep. The team can stretch ten feet into the crosscut to find another placard indicating Water Roofed stretching rib-to-rib. After performing necessary roof or back checks, the captain will D&I the Water Roofed as their FPA in this direction. Any team member passing the Water Roofed placard will result in individual endangerment discounts (15 x each person) per Judge 1 – UG Rule #10(a)(2). The team can then stretch southward in the drift to tie-in.

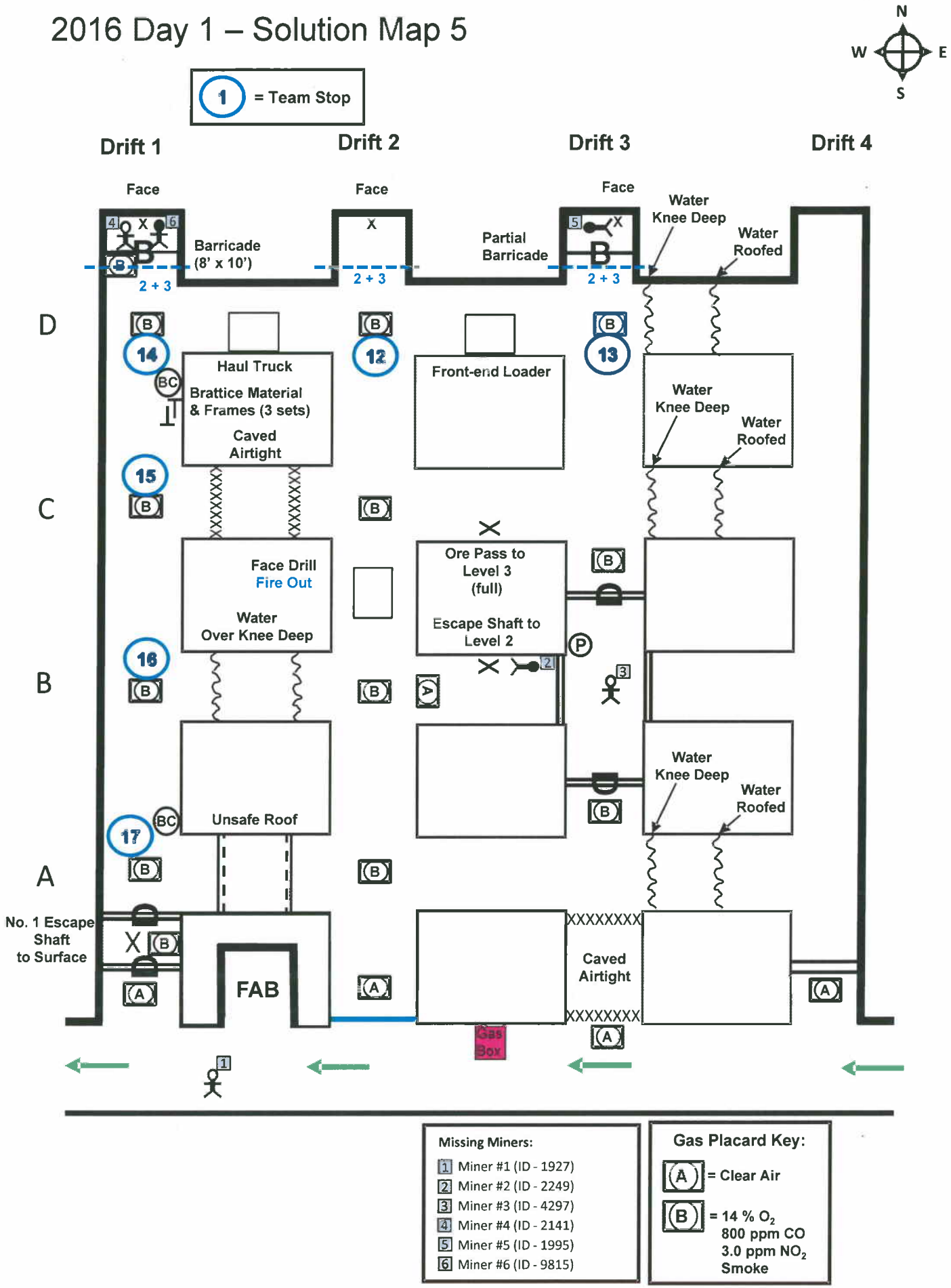
Note: the team cannot advance beyond 3 feet past crosscut D, because they have not tied-in the entries behind them.

Team Stop No. 14
The team can retreat to the D2 intersection and then advance westward in crosscut D toward Drift 1. As they travel, they will find a haul truck parked along the southern rib. At the D1 intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find that the gas concentrations have not changed from their previous location.

Note: the team cannot advance beyond 3 feet past crosscut D, because they have not tied-in the entries behind them.

Team Stop No. 15
The team can advance southward in Drift 1 toward crosscut C. As they travel, they will find three sets of Brattice Material & Frames positioned along the eastern rib. The team can take two sets with them for future use. Once at the C1 intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find that the gas concentrations have not changed from their previous location. Stretching eastward in crosscut C, they will find that the crosscut is blocked by an area that is Caved Airtight stretching rib-to-rib. After performing necessary roof or back

2016 Day 1 – Solution Map 5



checks, the captain will D&I the Caved Airtight as their FPA in this direction.

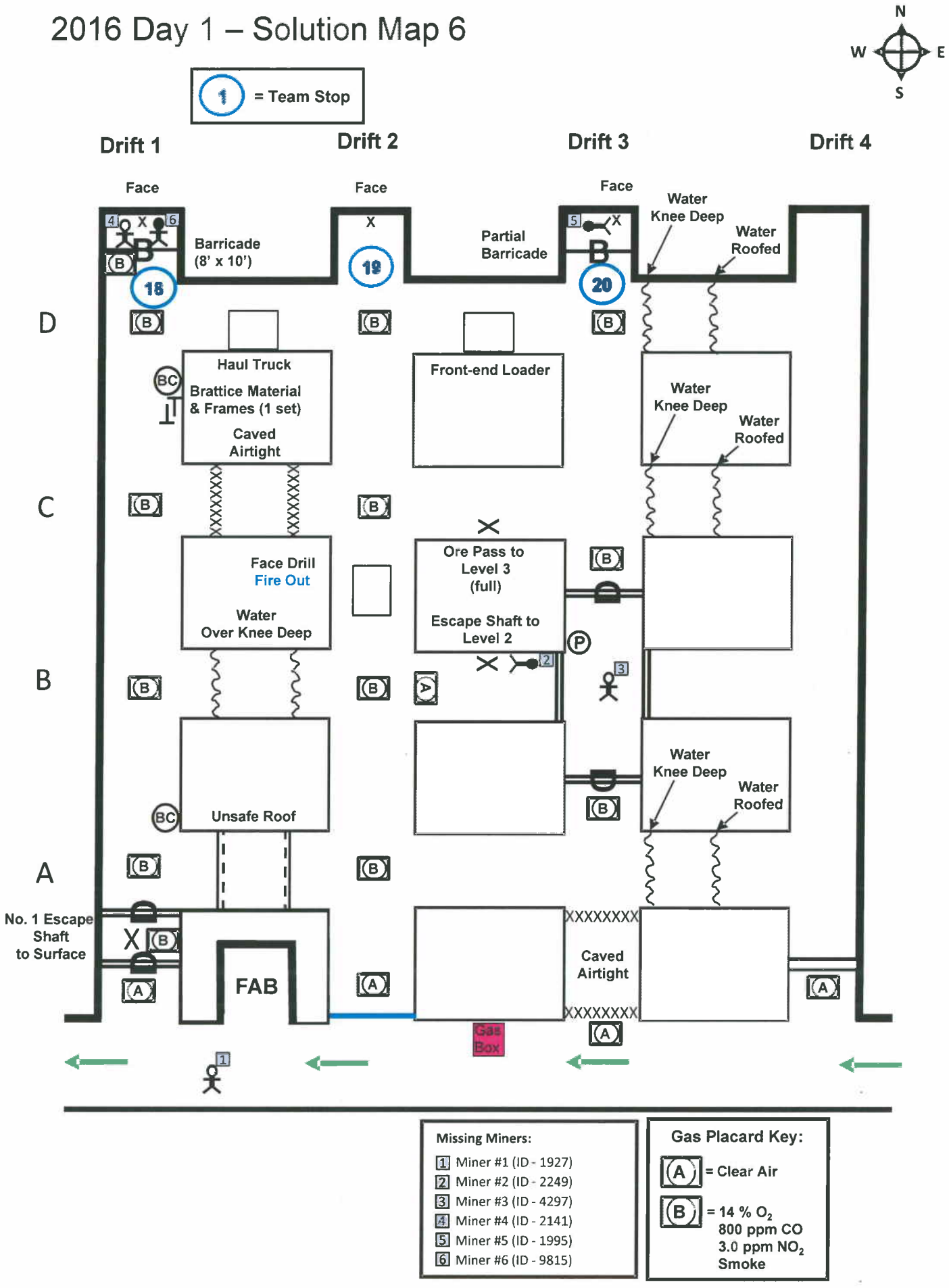
Team Stop No. 16
The team can advance southward in Drift 1 toward crosscut B. At the B1 intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find that the gas concentrations have not changed from their previous location. Stretching eastward in crosscut B, they will find an area of Water Over Knee Deep and there are no pumps in the vicinity. They must continue on. The captain must D&I the water as their FPA in this direction.

Team Stop No. 17
The team can advance southward in Drift 1 toward crosscut A. As the team travels, they will find Brattice Material (for use as a wing curtain) along the eastern rib. If they already have two sets of Brattice Material with Frames on their stretcher, they will need to leave the material in place. At the A1 intersection, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find that the gas concentrations have not changed from their previous location. Stretching southward, the team will find the backside of the North Door (closed). The captain must D&I the North Door (closed) as their FPA in this direction. Stretching eastward in crosscut A, they will find an area of Unsafe Roof stretching rib-to-rib. The captain must warn the rest of the team members to avoid this hazard. At this point, the team has not located any posts or cribbing materials to support it. **Again, if the team asks the mine manager for posts to access the area of unsafe roof, they will be told that "All materials needed to work the problem can be found on the field. Additional posts have not arrived at the fresh air base."** The captain must D&I the Unsafe Roof as their FPA in this direction.

Now, the team has tied-in all entries behind them, so they can explore the face area of each drift.

Note: To avoid an unintentional ventilation change, the team cannot open the North Door unless they construct an airlock by using two sets of brattice material as temporary stoppings in Drift 1 and crosscut A. If the team opens the door without constructing an airlock, assess 15 discounts per Judge 2 - UG Rule #12 for changing ventilation before the effects of such changes are known.

2016 Day 1 – Solution Map 6



Missing Miners:

1. Miner #1 (ID - 1927)
2. Miner #2 (ID - 2249)
3. Miner #3 (ID - 4297)
4. Miner #4 (ID - 2141)
5. Miner #5 (ID - 1995)
6. Miner #6 (ID - 9815)

Gas Placard Key:

- (A) = Clear Air
- (B) = 14 % O_2, 800 ppm CO, 3.0 ppm NO_2, Smoke

Note: Team Stop Nos. 18 - 20 (see Solution Map 6)

Team Stop No. 18
The team can advance northward in Drift 1 toward the face. The team will find an 8-feet by 10-feet brattice cloth barricade stretching from rib-to-rib across the drift about 5 feet inby the D1 intersection. The captain performs roof or back checks and the team will conduct necessary gas checks. They will find a placard showing 14% O_2, 800 ppm CO, and 3 ppm NO_2 with Smoke. If the team captain knocks on the barricade and calls out to anyone inside, there is no response.

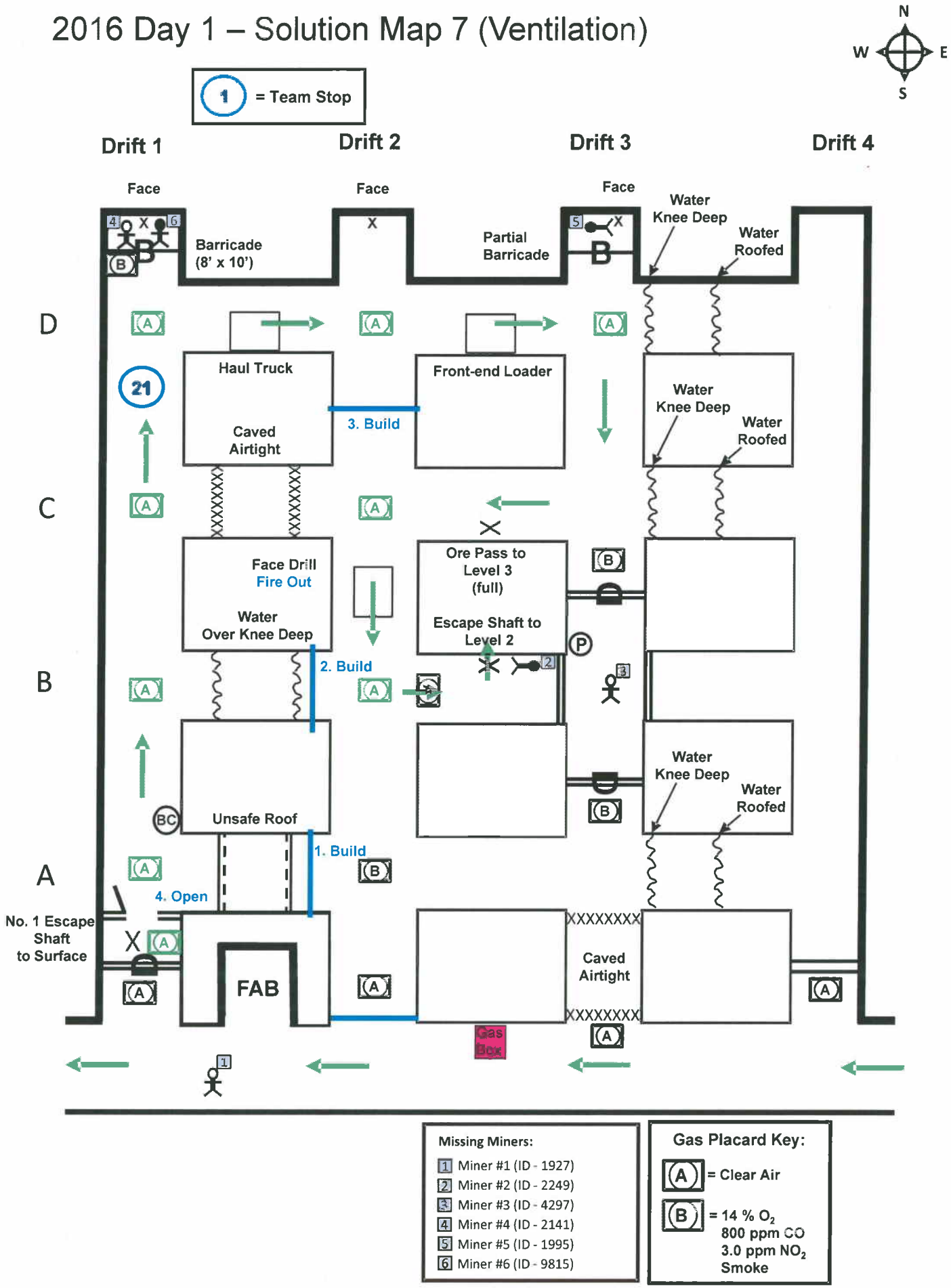
Because of the oxygen-deficient atmosphere in the area, the team cannot open the barricade. Before leaving, the captain must D&I the barricade.

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 toxic gasses outside.

Team Stop No. 19
The team can travel eastward in crosscut D and advance to the face area of Drift 2. At the face, the captain performs roof or back checks and the team will conduct necessary gas checks. They will find that the gas concentrations have not changed from their previous location. Before leaving, the captain must D&I the face.

Team Stop No. 20
The team can travel eastward in crosscut D and advance to the face area of Drift 3. The team will find a placard indicating a partial brattice cloth barricade stretching halfway across the drift about 5 feet inby the D1 intersection. Passing through the opening, the captain performs roof or back checks and the team will conduct necessary gas checks. At the face, they will find the fourth missing miner (Miner #5, I.D. 1995) who is 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 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.

2016 Day 1 – Solution Map 7 (Ventilation)



Missing Miners:

1. Miner #1 (ID - 1927)
2. Miner #2 (ID - 2249)
3. Miner #3 (ID - 4297)
4. Miner #4 (ID - 2141)
5. Miner #5 (ID - 1995)
6. Miner #6 (ID - 9815)

Gas Placard Key:

- (A) = Clear Air
- (B) = 14 % O_2, 800 ppm CO, 3.0 ppm NO_2, Smoke

Note: Team Stop No. 21 (see Solution Map 7 (Ventilation))

Team Stop No. 21
At this point, a ventilation change is necessary to clear the areas in front of the barricade in Drift 1 and the northern door of the Maintenance Shop. 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.

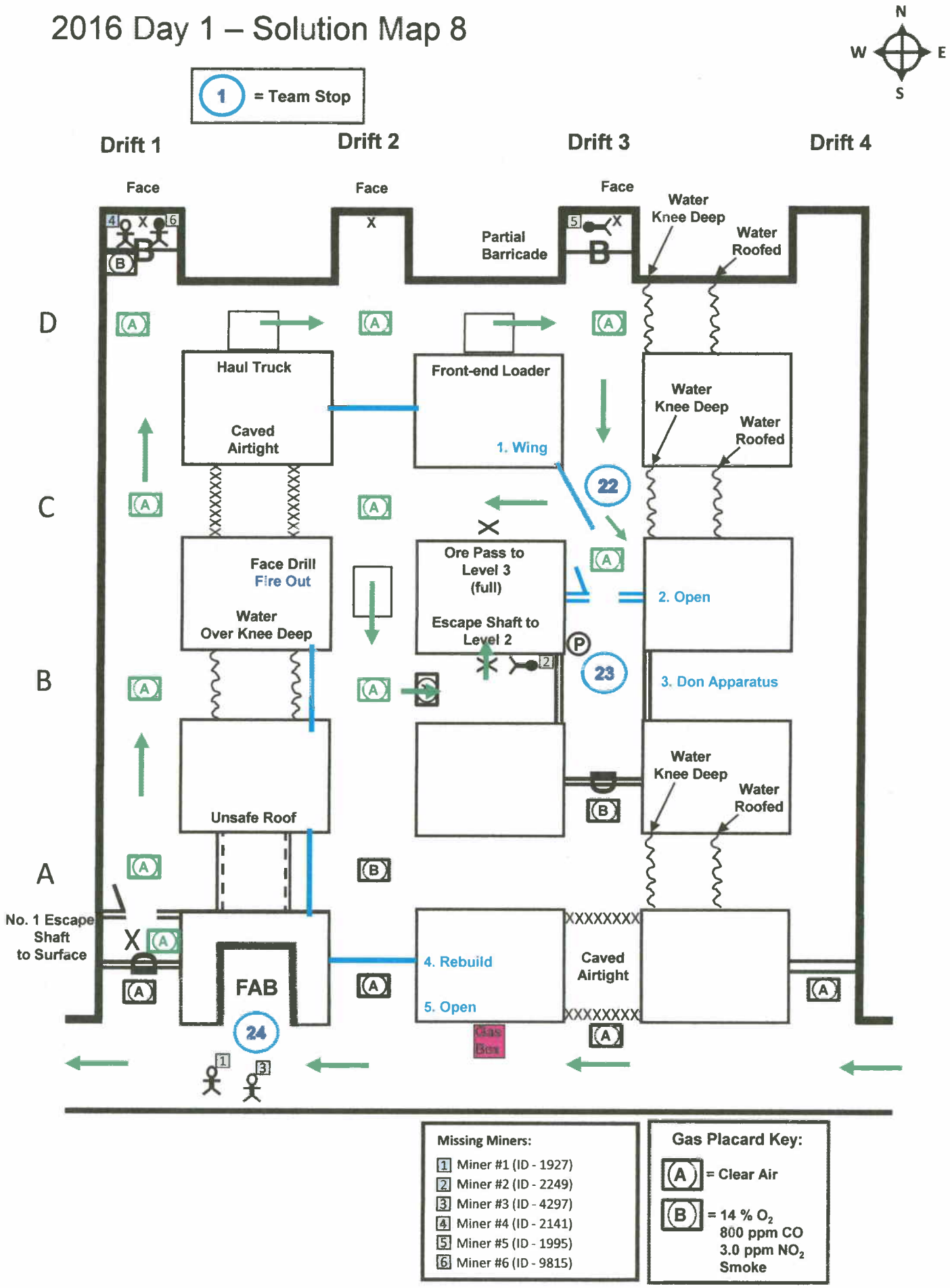
The team must explain the necessary ventilation changes prior to implementing them. For the purposes of this problem solution, the following steps will be discussed to accomplish re-ventilation:

1) Build a temporary stopping in crosscut A between Drift 1 and Drift 2;
2) Build a temporary stopping in crosscut B between Drift 1 and Drift 2;
3) Build a temporary stopping in Drift 2 between crosscut C and crosscut D;
4) Open the northern airlock door in Drift 1.

These four changes will allow the team to remain in the level while airflows from the No. 1 Escape Shaft to the Escape Shaft to Level 2 to flush away the contaminants and increase the oxygen content.

Note: If the team implements these changes, the gas placards will quickly revert to "clear air" in the drifts and crosscuts leading to the Escape Shaft to Level 2.

2016 Day 1 – Solution Map 8



Note: Team Stop Nos. 22 - 24 (see Solution Map 8)

Team Stop No. 22
Once the gas concentrations are swept from the drifts and crosscuts and the placards have been flipped to show "clear air," the team can reenter the level at Drift 1 or Drift 2 and advance to the C3 intersection. Then, they can travel southward to the northern door of the Maintenance Shop. They will find that the gas placard located immediately in front of shop door has not changed (14% O_2, 800 ppm CO, and 3 ppm NO_2 with Smoke). In order to flush this area, the team must erect a "wing" curtain in crosscut C to direct airflow from the drift toward the shop door **(as shown on Solution Map 8)**. Once they do this, the placard will change to show "clear air."

If the team does not utilize a "wing" curtain to flush the contaminants from in front of the shop door before opening it and endangers Miner #3, assess 50 discounts per Judge 1 – UG Rule #18(a).

Team Stop No. 23
Now, the team can open the shop door. Once inside they will find Miner #3. 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 Mine Phone (inoperable). Before leaving the area, the captain must D&I the two permanent stoppings in crosscut B and the Permanent Stopping with Door (closed) to the south as the team's FPA in these directions, as well as the location of the miner.

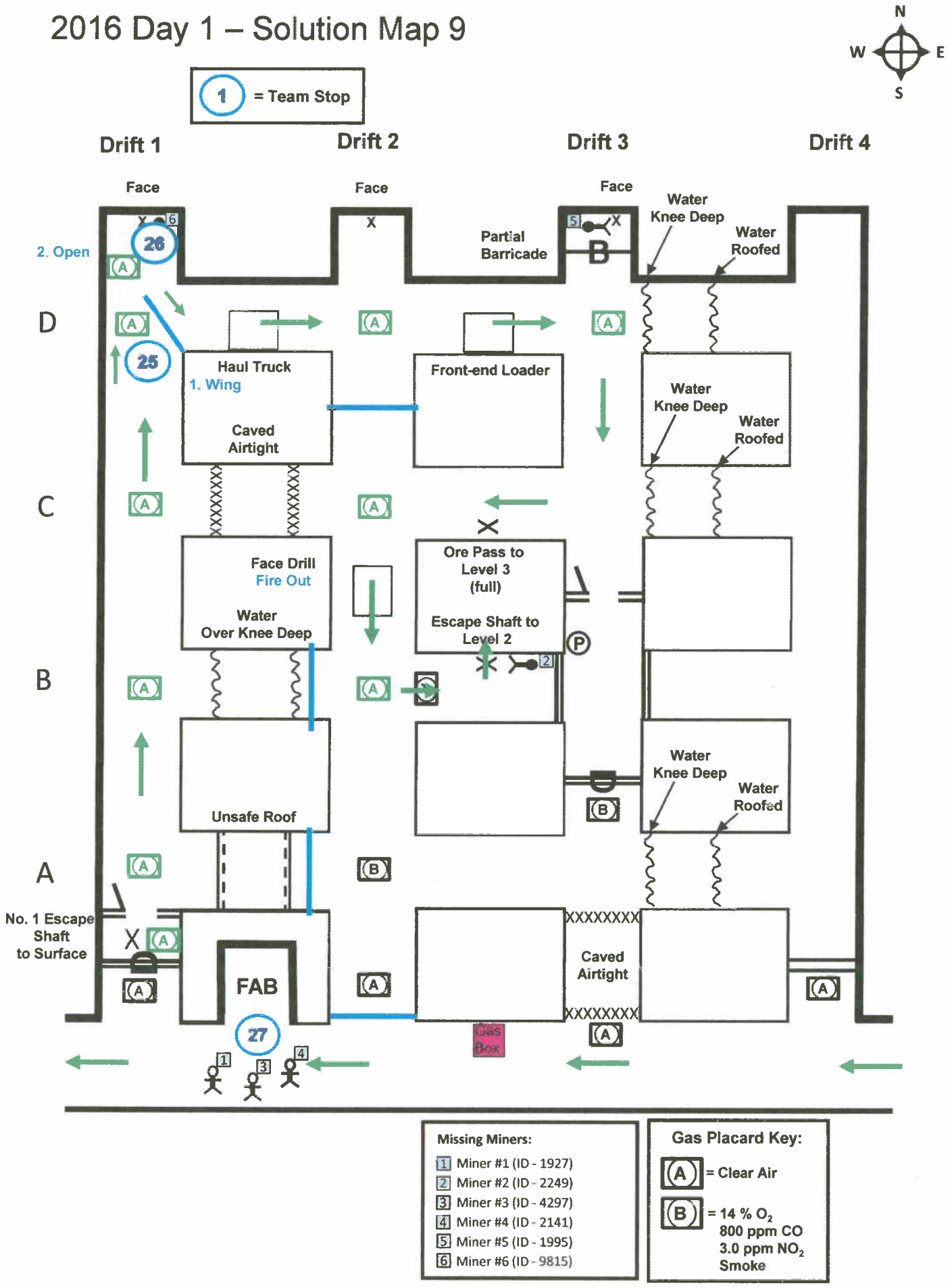
Team Stop No. 24
The team can escort Miner #3 to the fresh air base. At this point, the team must decide between two possible routes of travel:

1. If the team decides to travel southward in Drift 1 to the airlock, close the northern door behind them, open the southern door, and go to the fresh air base, then the miner will not need to wear respiratory protection since the drift has been cleared.

2. If the team decides to travel southward in Drift 2, rebuild the Temporary Stopping (built by the previous team), open the temporary stopping that they had erected, and go to the fresh air base, the miner will need to don and wear proper respiratory protection to pass through the drift south of crosscut B which has not been re-ventilated.

In either case, to ensure the safety of the survivor, all areas that had been cleared of smoke or toxic or dangerous gases must be gas tested from rib-to-rib along the route that they travel. Note: If the team chooses Option 2 (above) and fails to provide proper respiratory protection for Miner #4, assess 50 discounts for endangering the miner per Judge 1 – UG Rule #18(a).

2016 Day 1 – Solution Map 9



Missing Miners:

1. Miner #1 (ID - 1927)
2. Miner #2 (ID - 2249)
3. Miner #3 (ID - 4297)
4. Miner #4 (ID - 2141)
5. Miner #5 (ID - 1995)
6. Miner #6 (ID - 9815)

Gas Placard Key:

(A) = Clear Air

(B) = 14 % O_2
800 ppm CO
3.0 ppm NO_2
Smoke

Note: Team Stop Nos. 25 - 27 (see Solution Map 9)

Team Stop No. 25
Afterward, the team can reenter the level at Drift 1 or Drift 2 and return to the barricade in Drift 1. They will find that the gas placard located immediately in front of barricade has not changed (14% O_2, 800 ppm CO, and 3 ppm NO_2 with Smoke). In order to flush this area, the team must erect a "wing" curtain in crosscut D to direct airflow from the drift toward the barricade **(as shown on Solution Map 9)**. Once they do this, the placard will change to show "clear air."

If the team does not utilize a "wing" curtain to flush the contaminants from in front of the barricade before opening and endangers Miner #4, assess 50 discounts per Judge 1 – UG Rule #18(a).

Team Stop No. 26
Now, the team can open the barricade. As they pass through, the captain performs roof or back checks and the team will conduct necessary gas checks. Once inside they will find Miner #4 and Miner #6. The team captain must perform necessary roof or back checks over each miner. Then, the team members can assess each miner's condition. For Miner #4, the team will find that he/she is not injured and able to walk out with the team. For Miner #6, after a primary assessment, the #1 Judge will hand the team member a placard which reads: **"The miner exhibits no vital signs. The miner is dead."** Before leaving the area, the captain and another team member can perform roof or back checks and the team can conduct necessary gas tests. The captain must D&I the face as the team's FPA in this direction, as well as the location of each miner.

Team Stop No. 27
The team can escort Miner #4 to the fresh air base. Again, if the team decided to travel southward in Drift 1 to the airlock, close the northern door behind them, open the southern door, and go to the fresh air base, then the miner will not need to wear respiratory protection since the drift has been cleared.

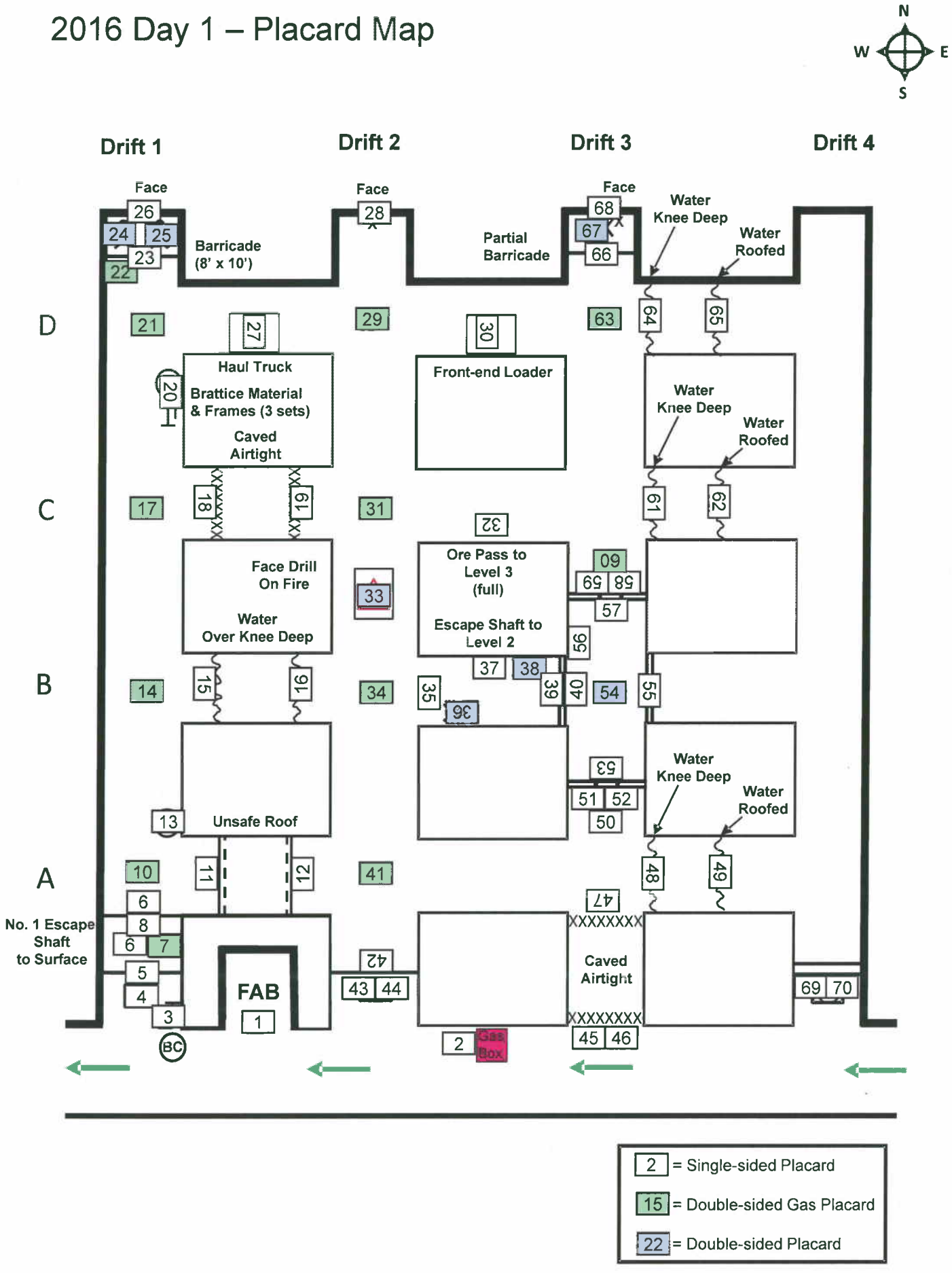
Again, if the team decided to travel southward in Drift 2, rebuild the Temporary Stopping, open the temporary stopping that they had erected, and go to the fresh air base, the miner will need to don and wear proper respiratory protection to pass through the drift south of crosscut B which has not been re-ventilated. If the team travels in Drift 2 and fails to provide proper respiratory protection for Miner #4, assess 50 discounts for endangering the miner per Judge 1 – UG Rule #18(a).

In either case, to ensure the safety of the survivor, all areas that had been cleared of smoke or toxic or dangerous gases must be gas tested from rib-to-rib along the route that they travel.

When the team returns to the fresh air base, the captain can state that the team has completed its mission. That is, they have explored all accessible areas of the level, extinguished the fire, located the six missing miners, and brought three out alive.

*** THE END ***

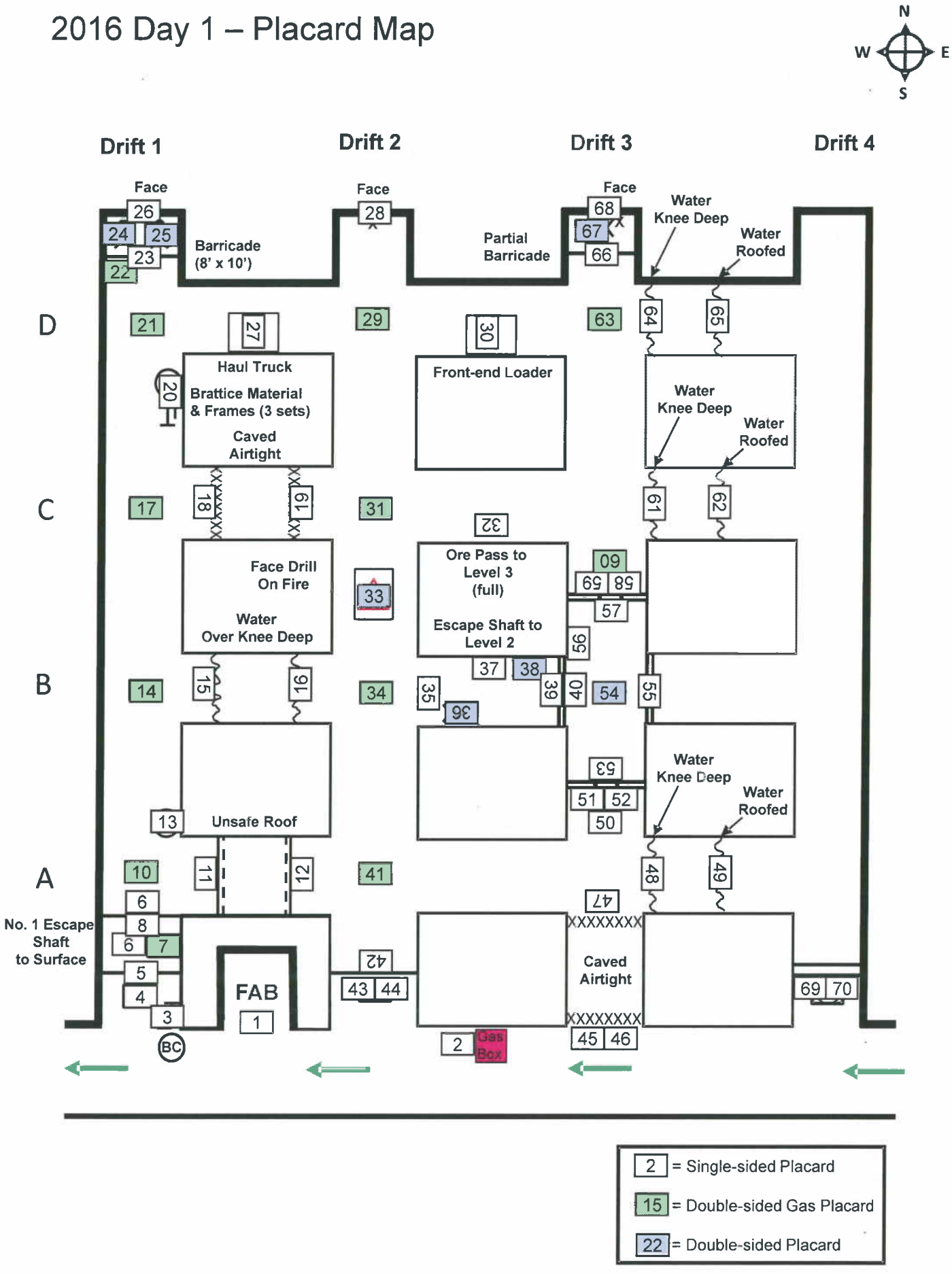
2016 Day 1 – Placard Map



Placard Key:

1. Fresh Air Base
2. Gas Box
3. Brattice Material & Frames
4. Clear Air
5. South Door Closed
6. #1 Escape Shaft to Surface
7. 14 % O_2
   800 ppm CO
   3.0 ppm NO_2
   Smoke
8. North Door Closed
9. North Door Closed
10. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
11. Unsafe Roof
12. Unsafe Roof
13. Brattice Material
14. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
15. Water Over Knee Deep
16. Water Over Knee Deep
17. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
18. Caved Airtight
19. Caved Airtight
20. Brattice Material & Frames (3 sets)
21. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
22. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
23. Barricade (8-feet by 10-feet)
24. Person / Miner #4 (ID – 2141)
25. Person / Miner #6 (ID – 9815)
26. Face
27. Haul Truck
28. Face
29. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
30. Front End Loader
31. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
32. Ore Pass to Level 3 (full)
33. Face Drill (on Fire)
34. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
35. Clear Air
36. Person / Miner #1 (ID – 1927)

2016 Day 1 – Placard Map



Placard Key (continued):

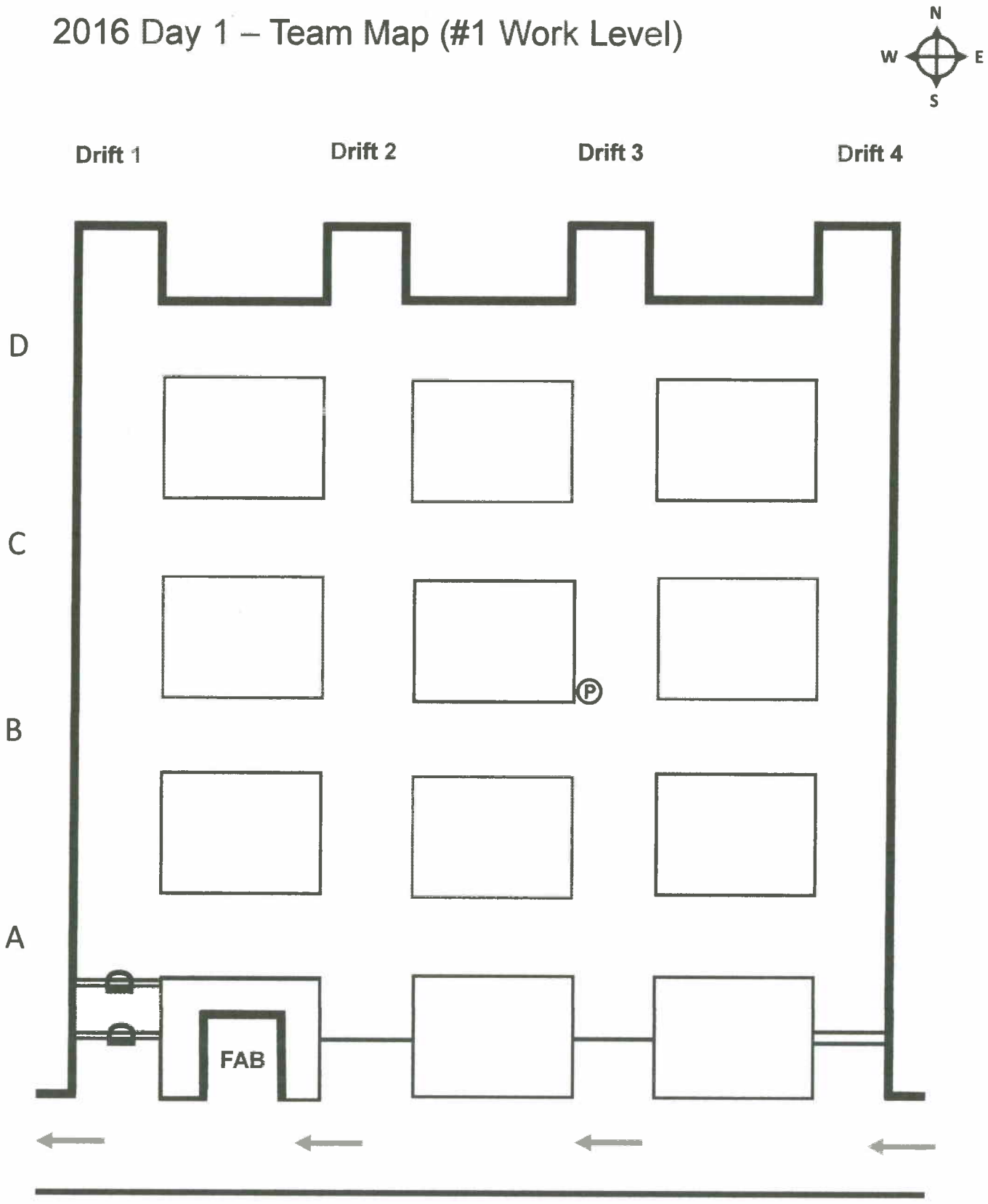
37. Escape Shaft Down to Level 2
38. Person / Miner #2 (ID – 2249)
39. Permanent Stopping
40. Permanent Stopping
41. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
42. Temporary Stopping
43. Temporary Stopping
44. Clear Air
45. Caved Airtight
46. Clear Air
47. Caved Airtight
48. Water Knee Deep
49. Water Roofed
50. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
51. Maintenance Shop
52. Permanent Stopping with Door (closed)
53. Permanent Stopping with Door (closed)
54. Person / Miner #3 (ID – 4297)
55. Permanent Stopping
56. Mine Phone (inoperable)
57. Permanent Stopping with Door (closed)
58. Maintenance Shop
59. Permanent Stopping with Door (closed)
60. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
61. Water Knee Deep
62. Water Roofed
63. 14 % O_2
    800 ppm CO
    3.0 ppm NO_2
    Smoke
64. Water Knee Deep
65. Water Roofed
66. Partial Barricade
67. Person / Miner #5 (ID – 1995)
68. Face
69. Permanent Stopping
70. Clear Air

Note: Double-sided Placards
Twelve gas placards (7, 10, 14, 17, 21, 22, 29, 31, 34, 41, 60 and 63) can be flipped when changes are made by the team to successfully ventilate these areas.

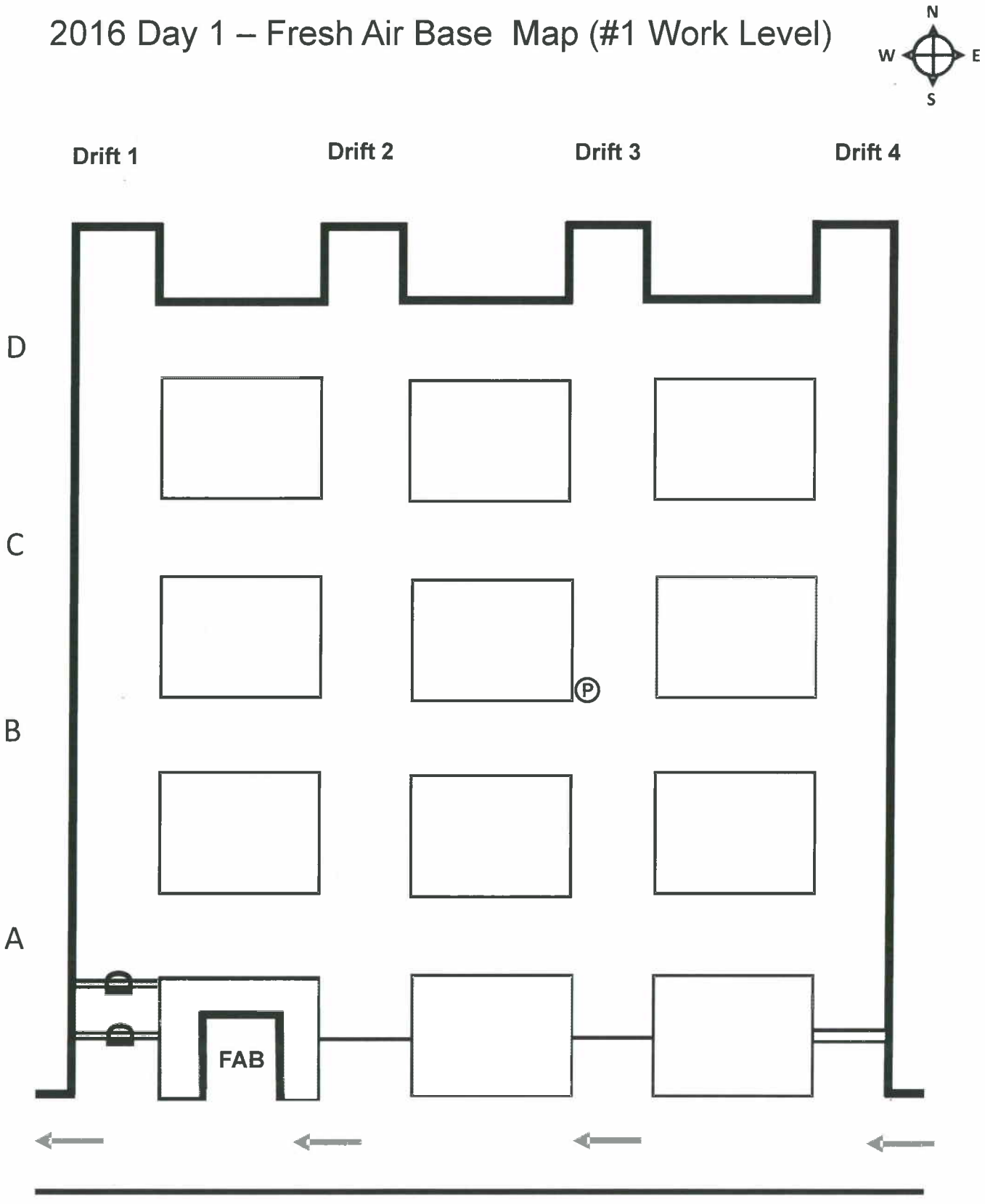
One placard (33) can be flipped when the fire on the face drill is extinguished.

Six placards (24, 25, 36, 38, 54 and 67), one for each missing miner, can be flipped to show their respective identification number.

2016 Day 1 – Team Map (#1 Work Level)

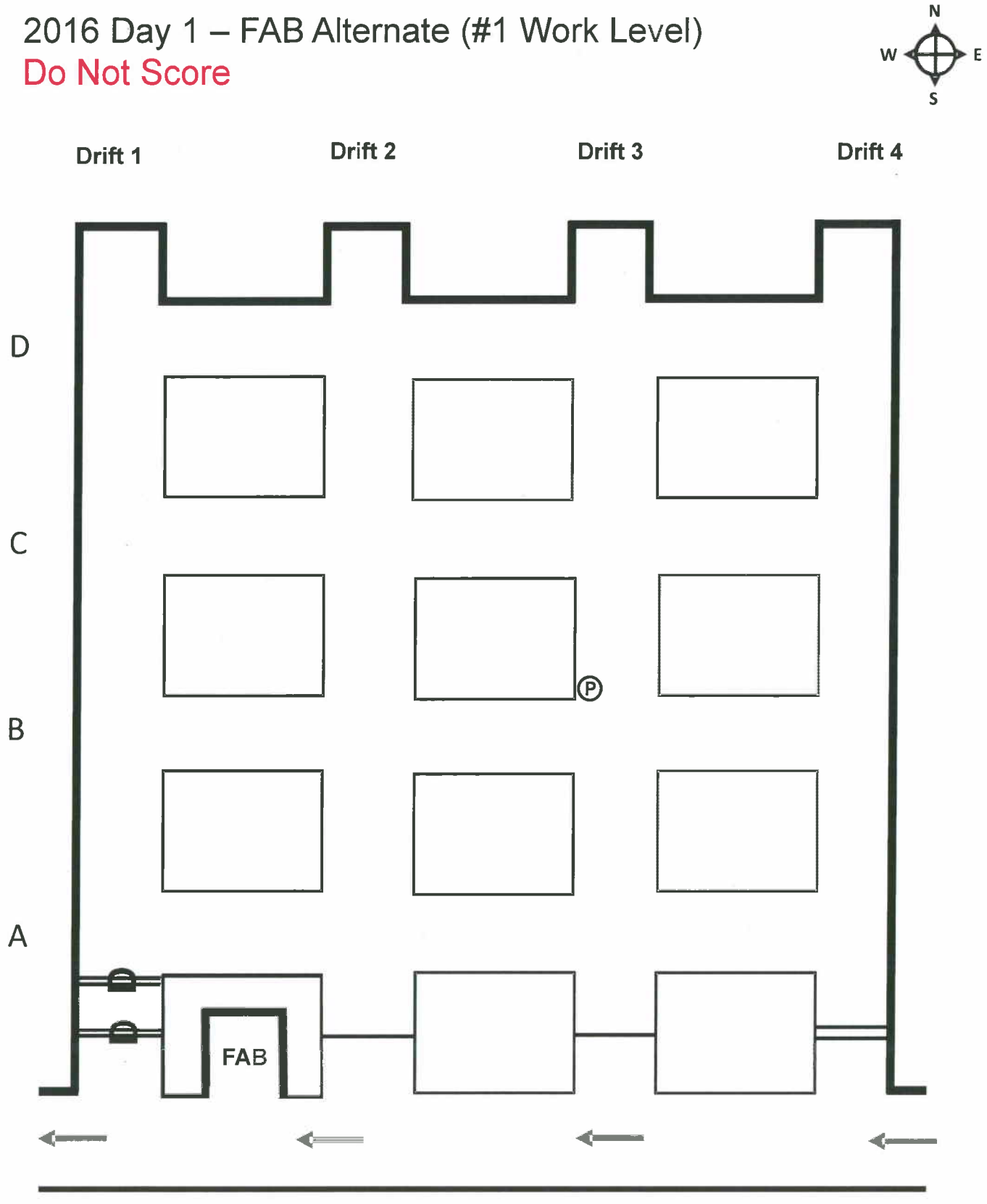


2016 Day 1 – Fresh Air Base Map (#1 Work Level)

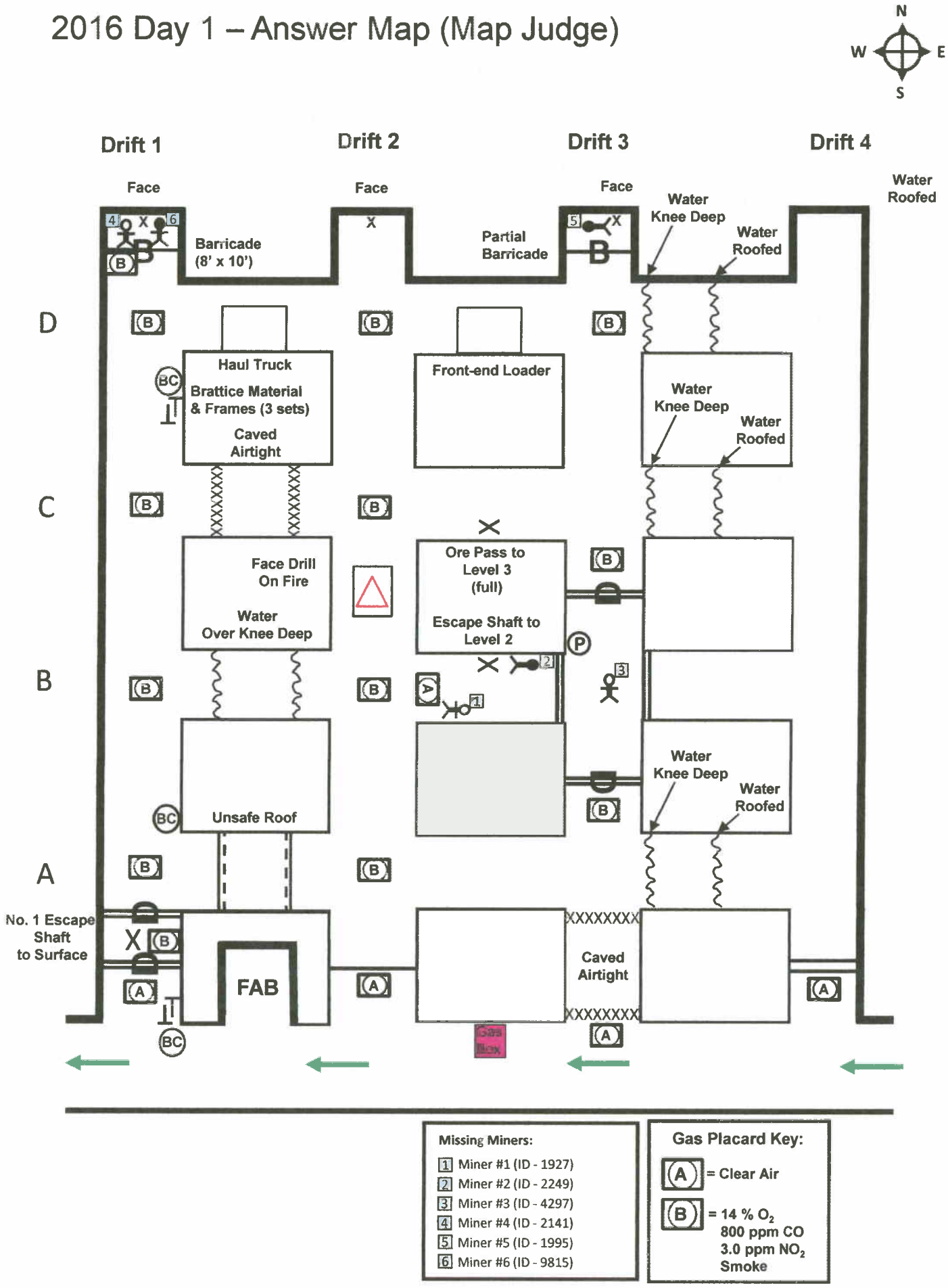


2016 Day 1 – FAB Alternate (#1 Work Level)

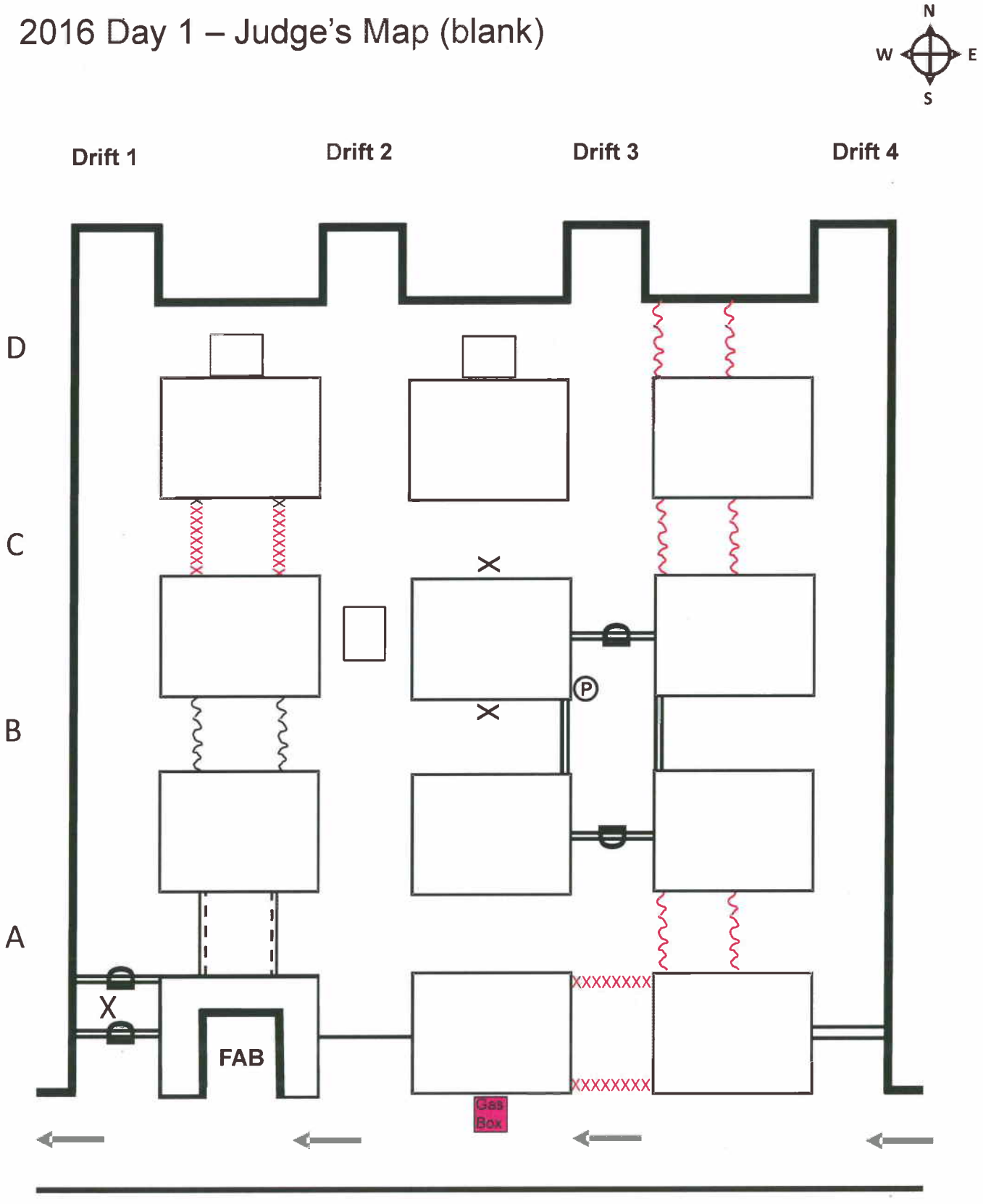
Do Not Score



2016 Day 1 – Answer Map (Map Judge)



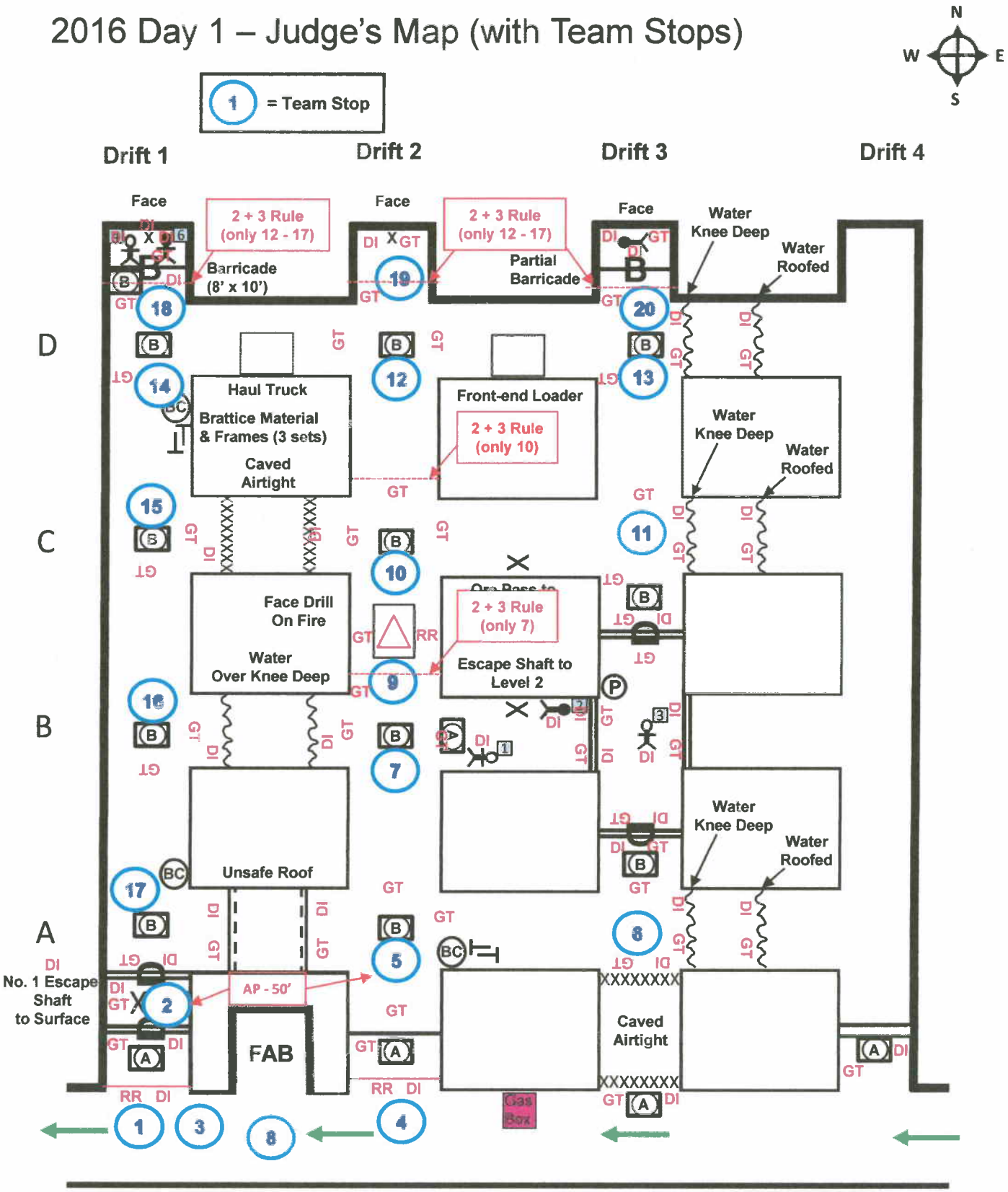
2016 Day 1 – Judge's Map (blank)



Judge Name - _____

Team No. - _____

2016 Day 1 – Judge's Map (with Team Stops)



Judge Name - _____

Team No. - _____

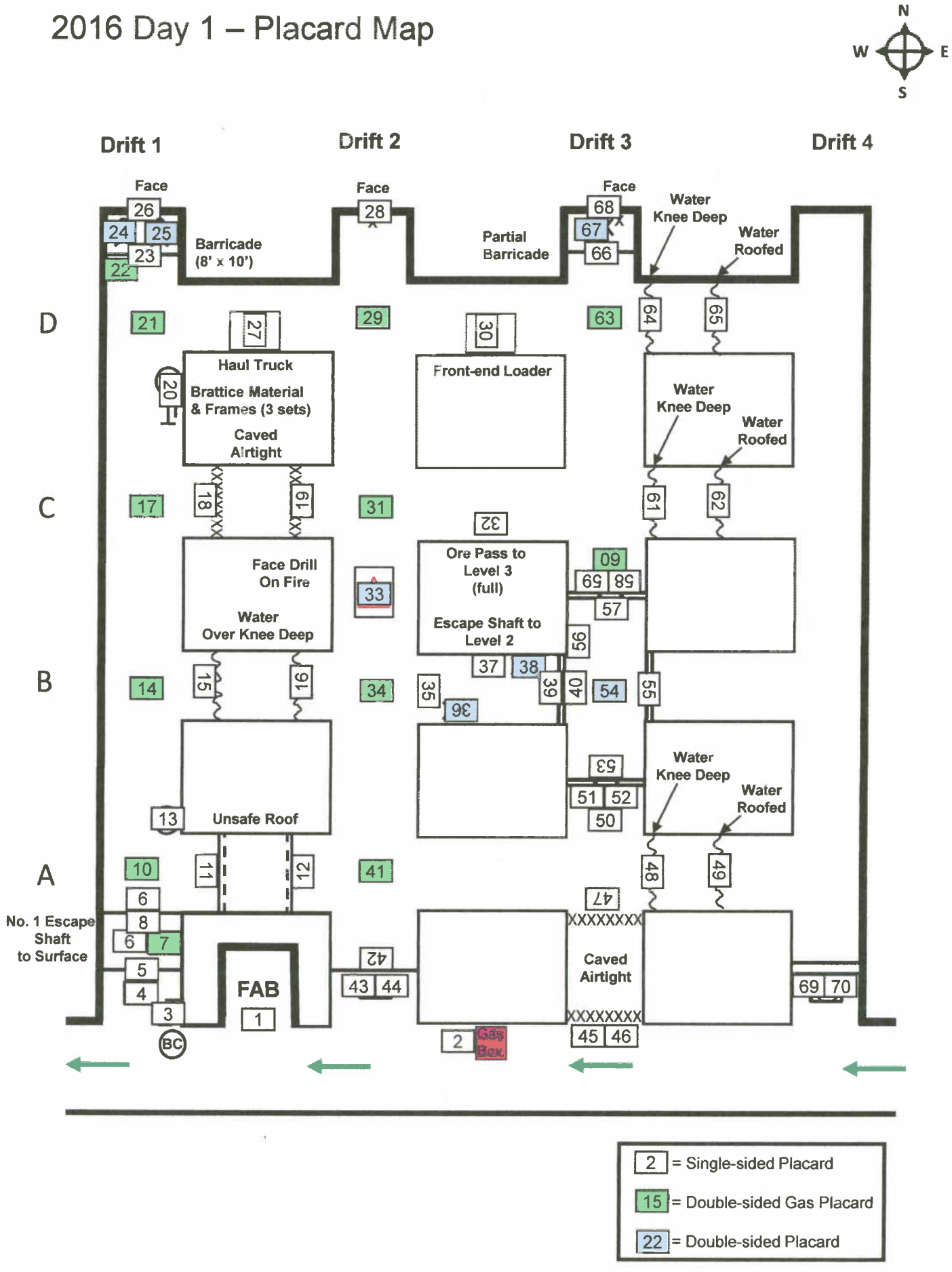
Missing Miners:

1. Miner #1 (ID - 1927)
2. Miner #2 (ID - 2249)
3. Miner #3 (ID - 4297)
4. Miner #4 (ID - 2141)
5. Miner #5 (ID - 1995)
6. Miner #6 (ID - 9815)

Gas Placard Key:

- (A) = Clear Air
- (B) = 14 % O_2, 800 ppm CO, 3.0 ppm NO_2, Smoke

2016 Day 1 – Placard Map



2016 Day 1 – Construction Map