U.S. Department of Justice

Federal Bureau of Investigation

In Reply, Please Refer to
File No.

1500 SW 1st Avenue, Suite 400
Portland, Oregon 97202
(503)224-4181

April 6, 2012

The Honorable Henry Heimuller
Columbia County Commisioner's Office
230 Strand Street 331
St. Helens, Oregon 97051

RE: FBI Participation in the
Columbia County Firearms Range

Dear Sir:

I wish to inform you of my decision to suspend the FBI's use of the Columbia County firearms range located adjacent to Highway 30 near Deer Island, Columbia County, Oregon. Beginning this month, the FBI will conduct firearms training at Camp Bonneville in Clark County, Washington.

Several reasons support this decision. As you may know, our office will soon relocate to a new building located near the Portland International Airport (PDX). Camp Bonneville offers us a more convenient and cost efficient location. In addition, our agreement with Clark County and the Clark County Sheriff's Office will, on occasion, allow us to invite our law enforcement partners to participate in FBI sponsored training exercises. Under the terms of the January 2009 lease agreement between Columbia County and landowner Knife River Corporation (an MDU Resources Company), the FBI has been precluded from inviting official guests onto the Columbia County firearms range who do not satisfy specified insurance requirements. This has impeded our ability to offer meaningful training to members of the law enforcement community.

Another reason for our decision is based on the enclosed report concerning the potential risks associated with the physical location of the Columbia County firearms range. The range is located adjacent to an ammonium nitrate manufacturing facility owned and operated by the Dyno Nobel Corporation. In late 2011, the FBI requested the U.S. Public Health Service to conduct a review of the range site in order to evaluate the potentiual chemical exposure risk to individuals in the range. On December 9, 2011, the Division of Federal Occupational Health, U.S. Public Health Sevice produced a final report. The report

identifies the risks associated with location of the range. It also includes several reccomendations for continued use of the range. Enclosed is a copy of the report for your review.

Finally, as you are likely aware, the Environmental Protection Agency (EPA) is conducting an investigation of the Dyno Nobel facility. A copy of the enclosed report was given to the EPA to assist in their investigation.

I know the FBI and several other agencies worked and invested significant resources in developing and building the Columbia County firearms range. I want to express my appreciation for your efforts in this regard.

Should you have any questions regarding this letter or the enclosed report, please feel free to contact either myself or Supervisory Special Agent (SSA) Jared Garth, who is FBI Portland's Chief Division Counsel. His direct telephone number is (503) 552-5209.

Sincerely,

Gregory Alan Fowler
Special Agent-in-Charge

JJG:jjg
Enclosure

DEPARTMENT OF HEALTH & HUMAN SERVICES

U.S. Public Health Service

Federal Occupational Health Service
90 7th St. #4-310
San Francisco, CA 94103
Timothy.Jiggens@foh.hhs.gov
415.722.0179

DATE: December 9, 2011

TO: Mr. Scott Bohnhoff
Chief, OSEP Unit
Federal Bureau of Investigation

FROM: CDR Timothy Jiggens
Senior Program Management Officer, Environmental Health Services
Division of Federal Occupational Health, U.S. Public Health Service

SUBJECT: Portland, OR Firing Range Chemical Release Contingency Planning

CC: LCDR James Hall, FOH

The Federal Bureau of Investigation (FBI) Occupational Safety and Environmental Programs (OSEP) Unit requested that Federal Occupational health (FOH) evaluate the potential chemical exposure risks to FBI agents training at the small arms firing range in Columbia County, OR. In particular the FBI requested that FOH provide:

- recommend type and locations of fixed gas monitor(s) for the firing range;
- compile a list of the chemicals which could potentially impact the FBI firing range facility, including health information and material safety data sheets;
- provide a draft standard emergency procedure for response to a gas alarm, including evacuation routes and emergency response procedures;
- recommended training for any persons entering onto the firing range property; and,
- recommendations for signage and postings to inform firing range personnel who may be unfamiliar with the emergency procedures.

FOH reviewed chemical information provided by the FBI, Dyno Nobel, the State of Oregon, and other sources; conducted a site visit; and researched chemical monitoring systems in order to complete this report. The project was identified with FOH as A105698 S156485 P161302.

The Columbia County Firearms Range Complex is an uncovered outdoor facility with four small arms firing ranges built into a former gravel mine in Deer Island, OR. The range site is bounded on the north by an active Knife River Corporation mine and on the south by the AirGas and Dyno Nobel industrial facilities. The predominant chemical exposure threat to range users is ammonia, particularly anhydrous ammonia. Anhydrous ammonia is stored as a liquefied gas under pressure and is reactive, irritating, and toxic. Compressed anhydrous ammonia can leak large volumes quickly and it is used and stored at several locations on the property adjacent to the range, including trucks and rail cars, as well as aloft in the tower section of the Dyno Nobel plant. The history of

accidental releases at the Dyno Nobel facility indicates the propensity of anhydrous ammonia to escape to the environment.

The simplest way to protect FBI agents from anhydrous ammonia exposure would be to secure access to a different small arms firing range. Should the FBI wish to continue training at the Columbia County Firearms Range Complex FOH makes the following recommendations to protect the health and safety of FBI personnel.

Recommendation 1: Detection
An open path ammonia detection system should be installed along the edge of the range property adjacent to the Dyno Nobel and AirGas facilities. The system should use tunable diode laser absorption spectroscopy detectors to provide a detection beam about five feet above the ground and another approximately twenty feet above the ground.

Recommendation 2: Alert
An alert system using horns and strobe lights should be installed to quickly warn shooters in case of ammonia detection.

Recommendation 3: Communications
The FBI and Dyno-Nobel should install a direct line from the range training building to the Dyno-Nobel control room.

Recommendation 4: Evacuation

A. An evacuation stairway should be constructed in the north corner of the range parcel so range users can exit the range facility if the driveway is blocked.
B. A windsock should be placed on top of the berm above the training building to aid in evacuation decisions.
C. A written Emergency Action Plan should be implemented based on the sample provided in Appendix C.

Recommendation 5: Coordination

A. The FBI should inform the Dyno Nobel control room whenever its personnel arrive or depart the range.
B. The FBI should meet regularly with Dyno Nobel, AirGas, and Knife River representatives so all sides can advise each other of changes in operations.
C. The FBI should conduct joint drills with Dyno Nobel to test communication, coordination, and evacuation procedures.

Introduction

Federal Occupational Health (FOH) has prepared this report for the Federal Bureau of Investigation (FBI) Occupational Safety and Environmental Programs (OSEP) Unit. The purpose of this project was to evaluate the potential chemical exposure risks to FBI agents training at the small arms firing range in Columbia County, OR. In particular the FBI requested FOH provide:

- recommend type and locations of fixed gas monitor(s) for the firing range;
- compile a list of the chemicals which could potentially impact the FBI firing range facility, including health information and material safety data sheets;
- provide a draft standard emergency procedure for response to a gas alarm, including evacuation routes and emergency response procedures;
- recommended training for any persons entering onto the firing range property; and,
- recommendations for signage and postings to inform firing range personnel who may be unfamiliar with the emergency procedures.

Methods

CDR Jiggens met with FBI Special Agent Michael Burdick and FBI Region X Safety manager Thi Pham and Thi on November 9, 2011. They visited the Columbia County Firearms Range Complex firing range and met with Greg Godfrey, Dyno Nobel Plant Director and Michael Cave, Dyno Nobel Senior Health and Safety Representative.

The Oregon Office of State Fire Marshal annually collects information about the presence of hazardous and incidents involving hazardous substances in accordance with the Superfund Amendment and Reauthorization Act (SARA) Title III -Emergency Planning and Community Right to Know Act (EPCRA). Once collected, this information is provided to emergency responders and emergency planners, including Local Emergency Planning Committees (LEPC) and local fire departments, to aid in hazardous materials pre-emergency planning and response. The information is also available to the general public in order to provide familiarity with the hazardous materials in their communities.

The Hazardous Substance Information Survey (HSIS) database maintained by the Oregon Office of State Fire Marshal was accessed to determine reportable quantities of hazardous substances used, stored, manufactured or disposed of at Dyno Nobel, AirGas, and Knife River in 2010. Quantities of liquids or pressurized gases greater than 10,000 gallons (about the size of a highway tanker truck) were selected as potentially high hazard materials for further review.

The Hazardous Materials Incident Searchable (HMIS) database was searched for key information pertaining to incidents reported at the same facilities. Since incidents reported after 31 December 2009 were recorded in the Excel Hazmat Incidents spreadsheet this tool was also searched. The Environmental Protection Agency website newsroom was also searched for news about incidents these facilities.

The American Industrial Hygiene Association (AIHA) has developed Emergency Response Planning Guidelines (ERPGs) for a number of substances to assist in planning for catastrophic

releases to the community. The ERPG-2 represents the concentration below which it is believed nearly all individuals could be exposed for up to one hour without irreversible or serious health effects. ERPG-2 values .if they existed, were reported for potentially high hazard materials.

The National Institute of Occupational Safety and Health (NIOSH) has established an Immediately Dangerous to Life and Health (IDLH) level for many chemicals. They were first developed in the mid-1970's for use in selecting respirators, and represent a level of exposure to airborne contaminants that is likely to cause death, permanent adverse health effects, or severe eye or respiratory irritation or other reactions that would hinder escape. Revised (March 1995) IDLH values were reported for potentially high hazard materials when they existed.

Results

Descriptions of Facilities

Columbia County Firearms Range Complex
The Columbia County Firearms Range Complex is an uncovered outdoor facility with four small arms firing ranges:

Range 1	50yd Turning Target
Range 2	Flat Tactical
Range 3	200yd Rifle
Range 4	Practical Shooting Range.

The facility was built into a former gravel mine operated by Knife River Corporation adjacent to Highway 30 in Deer Island, OR. Over a million cubic yards of material was removed from the site to create a 60-foot bowl. The range site is bounded on the north by an active Knife River Corporation mine and on the south by the AirGas and Dyno Nobel industrial facilities (See figures 1-4 in Appendix A). A rail siding used by Dyno Nobel runs along the western boundary, terminating past the range area. Highway 30 (Columbia River Highway) passes to the east. The site is on the flat floor of the Columbia River valley, and the river flows due north here. Low hills rise immediately west of the site.

The facility houses two shipping containers used for storage and light maintenance tasks on the main level with the ranges. The northern corner of the site is elevated approximately thirty feet higher and contains a training building with toilets and water well. The sole means of access to the range complex is a driveway with a locked gate near the eastern corner of the parcel.

Dyno Nobel St. Helens Plant
Dyno Nobel manufactures and uses several nitrogen-related compounds at its facility adjacent to the range including ammonia, urea (diesel exhaust fluid additive), ammonium nitrate (fertilizer and explosives manufacturing), and urea ammonium nitrate solution (fertilizer). While large amounts of anhydrous ammonia are produced and sometimes stored at the plant, anhydrous ammonia is an

intermediary compound in the production of other products and relatively little is shipped as a final product. The processes at the facility include high pressures and temperatures as well as reactive chemicals such as ammonia and nitric acid. Nearly all of the plant processes and piping are outdoors, including an approximately fifty foot tall tower section and several smokestacks.

The facility employs approximately 50 people and operates continuously. Portions of the plant can be shut down while others remain in operation. Of particular interest to this project, the 'front end' process producing ammonia can continue to operate while the 'back end' processes producing urea products are closed down. This increases the amount of ammonia stored in the four spherical tanks at the south end of the plant (Figure 5).

Tanker trucks enter from Columbia River Highway to deliver certain raw materials or load finished products. Materials are also transferred to rail cars on the spur behind the plant. Hopper cars are loaded with solid urea products while tank cars are loaded with aqua ammonia or anhydrous ammonia. Aqua ammonia liquid tank cars are filled with 'stinger' hoses which reportedly operate with a vapor recovery dome much like modern gasoline filling hoses as well as a water spray device to scrub fugitive emissions out of air displaced from the tank. Anhydrous ammonia is loaded into insulated liquefied compressed gas tank car using smart hoses. These hoses have valves in each end which automatically close if the hose loses pressurization, for instance if inadvertently disconnected or ruptured. In such cases the ammonia in the hose may be lost to the atmosphere but the contents of the process line or tank care will remain contained. Loading ammonia is a high-risk high-security operation regulated by the Departments of Transportation and Homeland Security. All ammonia loading is conducted in a single day each week, and cars are shipped out of the plant as soon as possible. Liquefied anhydrous ammonia cars are shipped under a documented chain of custody and cannot be left unattended on the rail siding. Generally fewer than a half dozen cars are filled with ammonia products and shipped at a time.

Air monitoring to detect ammonia releases is carried out primarily using RigRat portable monitoring stations from BW Technologies. These stations can recharge their batteries via solar cells for extended operations and can transmit data wirelessly to a command center. The Dyno Nobel control room is staffed continuously and the plant has organized a hazardous materials incident response team. The response team is trained and equipped to stop and clean up a spill, and can deploy handheld monitors to measure ammonia and nitrogen dioxide (formed when nitric acid is released). The plant uses the CAMEO suite of applications developed by the Environmental Protection Agency Office of Emergency Management to plan and manage hazardous material emergency responses. The monitoring data and information from the onsite meteorological station are used to position mobile monitoring stations and predict dispersion of release plumes during normal and upset operations. The Dyno Nobel Plant Director, Greg Godfrey, is also Chair of the Columbia Emergency Planning Association, the Local Emergency Planning Committee (LEPC) for Columbia County.

The results of the HSIS query are presented in Appendix B. Thirteen materials were selected as potentially high hazard materials for further review, as presented in Table I.

Table I. Potentially High Hazard Materials at Dyno Nobel					
Chemical Trade Name	**Most Hazardous Ingredient**	**Physical State**	**Max Qnty (Gallons)**	**Haz Class 1**	**Haz Class 2**
AMMONIA ANHYDROUS	AMMONIA	GAS	1,000,000-2,499,999	Acute Health Hazard	Corrosives
AMMONIUM NITRATE	AMMONIUM NITRATE	LIQUID	10,000-49,999	Acute Health Hazard	Oxidizers
AQUA AMMONIA 19%	AMMONIUM HYDROXIDE	LIQUID	10,000-49,999	Corrosives	Acute Health Hazard
AQUA AMMONIA 30%	AMMONIUM HYDROXIDE	LIQUID	50,000-99,999	Corrosives	Acute Health Hazard
CARBON DIOXIDE LIQUID	CARBON DIOXIDE	GAS	50,000-99,999	Acute Health Hazard	
DIESEL FUEL	PETROLEUM MID-DISTILLATES	LIQUID	10,000-49,999		
NITRIC ACID	NITRIC ACID	LIQUID	10,000-49,999	Corrosives	Oxidizers
SODIUM HYPOCHLORITE-5.25%	SODIUM HYPOCHLORITE	LIQUID	10,000-49,999	Corrosives	Acute Health Hazard
UREA 32.5% SOUTION	UREA	LIQUID	10,000-49,999	Acute Health Hazard	
UREA 40% SOLUTION	UREA	LIQUID	10,000-49,999	Acute Health Hazard	
UREA AMMONIUM NITRATE SOLUTION	MONOCARBAMIDE AMMONIUM NITRATE	LIQUID	1,000,000-2,499,999	Acute Health Hazard	
USED OIL/WATER	PETROLEUM HYDROCARBONS	LIQUID	10,000-49,999	Combustible Materials	Chronic Health Hazard
WASTE OIL	PETROLEUM HYDROCARBONS	LIQUID	10,000-49,999	Combustible Materials	Chronic Health Hazard

Airgas

The north corner of the Dyno-Nobel parcel, nearest the range and associated driveway, is occupied by Airgas Dry Ice and Airgas Specialty Chemicals (see figure 5). According to its website Airgas Specialty Products is a leading distributor of anhydrous and aqua ammonia, DEF and related services in the United States. Airgas Dry Ice manufactures dry ice (solid carbon dioxide). The results of the HSIS query are presented in Appendix B. Two materials were selected as potentially high hazard materials for further review, as presented in Table II. The amount of ammonia onsite is much smaller than the amounts at Dyno Nobel, but is worth noting because of the proximity of the site to the range and access road. This facility also reportedly receives truckloads of liquefied anhydrous ammonia refrigerant.

Table II. Potentially High Hazard Materials at AirGas

Chemical Trade Name	Most Hazardous Ingredient	Physical State	Max Qnty (Gallons)	Haz Class 1	Haz Class 2
CARBON DIOXIDE LIQUID	CARBON DIOXIDE	GAS	50,000-99,999	Acute Health Hazard	
AMMONIA ANHYDROUS	AMMONIA	GAS	5,000-9,999	Acute Health Hazard	Corrosives

Knife River

Knife River is one of the top 10 aggregate, ready-mix and sand and gravel producers in the nation. It actively mines the parcel northwest of the range and the range itself sits on Knife River land which was previously mined (see figure 3). The Knife River Hazardous Substance Information Survey data from the Oregon Office of State Fire Marshal is presented in Appendix B. The materials at Knife River present little health or safety risk to shooters at the range.

Characterization of Risk

This section will review toxicology, physical properties, and uses of the potentially high hazard materials mentioned in the last section. Material Safety Data Sheets for these materials are included in appendix C.

Ammonia, Anhydrous Ammonia, Aqua Ammonia

Ammonia is a gas which is stored as a liquid under pressure. Ammonia is hygroscopic (water seeking). Anhydrous ammonia (NH_3) is very pure, reactive ammonia. Aqua ammonia is ammonia dissolved in water. It is commonly called ammonium hydroxide (NH_4OH) because that is the chemical form in solution. For the purpose of this project all of these products can be conceptualized as differing strengths of ammonia.

Low concentrations of ammonia causes eye nose and throat irritation. More severe exposure can cause respiratory injuries and death. Concentrations above about 100 ppm are uncomfortable to most people; concentrations in the range of 300 to 500 ppm will cause people to leave the area immediately. The IDLH level is 300 ppm and the ERPG-2 for ammonia is 150 ppm. According to the AIHA, the odor of ammonia should be detectable near 25 ppm.

In refrigeration and storage systems ammonia is liquefied under pressure. If liquid ammonia leaks out some will immediately vaporize and cool the area. Sometimes ammonia rapidly absorbs moisture in the air and forms a dense, visible white cloud of ammonium hydroxide. The cool dense mixture of vapor and fog tends to travel along the ground rather than rising and dispersing. Pressurized gases are inherently difficult to contain and large amounts can be released to the air quickly.

The Dyno Nobel facility can potentially store millions of gallons of anhydrous ammonia, though typically smaller amounts of this precursor chemical are kept in storage. The AirGas facility uses smaller amounts of anhydrous ammonia in its refrigeration equipment, but this facility is very near the range. Aqua ammonia (ammonium hydroxide), while containing the same toxic agent, presents a lower risk to the range as the ammonia must first volatize out of solution to form an airborne plume. Transfers of these agents to and from trucks and rail cars present opportunities for fugitive emissions as well as catastrophic leaks.

The HMIS search turned up two recent incidents that appear to be at the Dyno Nobel facility, but details are lacking in the database and the Office of the Fire Marshall has been slow to deliver the requested written reports. From conversations with Dyno Nobel personnel it appears that one incident is an overpressure event in the tower section of the plant that reportedly released about a ton of ammonia to the atmosphere. (The other incident appears to be an oil spill, the exact location cannot be determined without the hazardous material incident report.)

The search of the EPA newsroom revealed that in 2009 Dyno Nobel was fined for a September, 2008 release of approximately 448 pounds of ammonia in which emergency response entities were not notified until 11 hours later. In April of the same year a 250 gallon above-ground storage tank leaked a small amount of anhydrous ammonia undetected for several days, but no fine was issued. The previous owner of the facility was fined in 2004 for a prior year release of approximately 40,880 pounds of ammonia into the air from a leak in one of its production units.

Ammonium Nitrate

Ammonium nitrate solution (NH_4NO_3) is a solid salt of ammonia and nitric acid dissolved in water. It contains 80%-90% ammonium nitrate in water, and is often kept hot (>176 °F) to help keep the salt dissolved. It is commonly used as an agricultural fertilizer and in the manufacture of explosives. Though the solution contains little or no free ammonia it can decompose when heated to liberate ammonia and toxic nitrogen oxides. Ammonium nitrate solution can explode if heated in a confined space or with organic materials.

Carbon Dioxide

About 0.03% of the Earth's atmosphere is carbon dioxide. Natural gas and air are used at the Dyno Nobel facility to synthesize large amounts of pure carbon dioxide which is used to make urea compounds. Excess carbon dioxide is sold to AirGas and compressed into dry ice. Carbon dioxide is a simple asphixiant – it can displace air but is not toxic. The OSHA eight hour permissible exposure limit (PEL) is 5000 PPM and the NIOSH IDLH is 40,000 ppm. AIHA has not developed an ERPG for carbon dioxide.

A release of liquid carbon dioxide will cool as it expands and form cloud of gas over a puddle of slush. Solid carbon dioxide (dry ice) spilled on the ground will sublimate (convert from solid directly to vapor) slowly. Gas from a spill of solid or liquid carbon dioxide will be cold and dense, and will tend to disperse along the ground until they reach ambient temperature.

The largest vessel of liquefied carbon dioxide at AirGas has a capacity of 240,000 pounds, which would form approximately 54,000 cubic meters of gas. This is the same order of magnitude as the shooting area of the range pit (200 meters long x 50 meters wide x 10 meters deep = 100,000 cubic meters). Theoretically a catastrophic release at the AirGas facility could endanger shooters at the range. The physical transfers from liquid and solid to gas would take time, however, so a much smaller volume of gas would be liberated at any particular instant. Furthermore the same north wind required to sweep cool dense gas up over the berm would also tend to disrupt the settling of carbon dioxide into the pit.

Diesel fuel, used oil, used oil/water

These materials are primarily groundwater pollution threats. They are not likely to impact the health and safety of FBI agents training at the range.

Nitric acid

Nitric acid (HNO_3) is a liquid which oxidizes organic materials so vigorously that spontaneous combustion may result. Spills of liquid nitric acid react quickly to form nitric oxides, which are also toxic. It is highly corrosive to human tissue. The IDLH level is 25 ppm and the AIHA ERPG-2 for nitric acid is 6 ppm. Dyno Nobel operates a plant onsite to make nitric acid for synthesizing ammonium nitrate. Nitric acid is not a primary product.

Sodium Hypochlorite

The 5.25% sodium hypochlorite (NaOCl) in water is household bleach. Bleach is corrosive and a moderately strong oxidizer Bleach slowly decomposes to form chlorine gas, a process which is greatly accelerated by the addition of acid to bleach. Dyno Nobel reportedly stores bleach in five gallon plastic drums to treat groundwater pumped from the onsite well. The use of small containers makes a large release unlikely.

Chlorine has a pungent odor which can be detected at 0.3 ppm, according to the Agency for Toxic Substances and Disease Registry. The OSHA Ceiling limit for chlorine is 1 ppm, the NIOSH IDLH is 10 ppm, and the AIHA EPRG-2 for chlorine is 3 ppm.

Urea solution
Urea is a water soluble compound, $CO(NH_2)_2$, occurring in urine and other body fluids as a product of protein metabolism. It is synthesized from liquid ammonia and liquid carbon dioxide and used as a fertilizer, animal feed, in the synthesis of plastics, resins, and drugs. Urea from Dyno Nobel is also used to make diesel exhaust fluid, which is used in a catalytic converter to reduce pollution from diesel engines. It is not a health threat to users of the range and has no IDLH or EPRG-2.

Urea Ammonium Nitrate Solution
Urea ammonium nitrate solution contains urea $CO(NH_2)_2$ and ammonium nitrate (NH_4NO_3) in water. It is commonly used as an agricultural fertilizer and generally considered a low hazard material. Although the solution contains little or no free ammonia it can decompose when heated to liberate ammonia. Urea ammonium nitrate solution can form explosive mixtures with organic materials if the water is evaporated away.

Conclusion

The predominant chemical exposure threat to range users is ammonia, particularly anhydrous ammonia. The agent is toxic and irritating. Compressed anhydrous ammonia can leak large volumes quickly and it is used and stored at several locations, including trucks and rail cars, as well as aloft in the tower section of the Dyno Nobel plant. The history of accidental releases at the Dyno Nobel facility indicates the propensity of anhydrous ammonia to escape to the environment.

Recommendations

Recommendation 1: Detection
An open path ammonia detection system should be installed along the edge of the range property adjacent to the Dyno Nobel and AirGas facilities. The system should use tunable diode laser absorption spectroscopy detectors to provide a detection beam about five feet above the ground and another approximately twenty feet above the ground.

Discussion

FOH considered permanent, portable, and personal ammonia detection systems. Since the sources and receptors move within limited areas the flexibility of personal and portable systems present no advantages, while the late detection of personal monitors and inherent complexity of mobile systems are significant drawbacks. Thus permanent systems were judged the best detection solution.

Permanent ammonia detection systems can be classified as point detectors or open beam detectors. Point detectors such as electrolytic cells or metal oxide semiconductors are inexpensive and sensitive, but point detectors only detect ammonia that reaches them. The possibility of a plume passing between monitoring points is too great to ignore, and the variety of release points and

surface structures at the site imply a need for a large number of monitoring points. In contrast an open beam will detect ammonia which crosses anywhere along the beam. Thus two or more beams can be used to create a fence or wall of detection. FOH judged open path detection to be the appropriate class of detection systems for the FBI.

Open beam detection systems used in fenceline monitoring applications available commercially apply one of three techniques using two different configurations. Fourier-Transform Infrared (FTIR) systems have limited range, are most affected by weather, and require an automated system to keep the detecting element cooled in liquid nitrogen. Ultraviolet Differential Optical Absorption Spectroscopy (UV DOAS) monitors are less affected by weather and have sufficient range (up to 1000 m path length) if xenon light sources are used. However the light sources need to be replaced every 2000 hours of operation (about every three months) and the systems are sensitive to beam misalignment and hydrocarbon interference. Tunable Diode Laser Absorption Spectroscopy (TDLAS) systems use a solid state laser to provide an intense beam within a narrow range of frequencies. These qualities produce a system that is low maintenance, has long range and high sensitivity, and is unaffected by interfering compounds. The beam is intense enough that bi-static configurations (telescope on each end of the beam) are not required. The mono-static configuration bounces the beam off a retroreflector so the beam is emitted and detected at the same location. This configuration is less sensitive to misalignment problems, increases sensitivity, and decreases cost. Therefore FOH determined that a mono-static TDLAS system is the best technique and configuration available. The LasIR MP110 (Unisearch Associates) Spectra-1 (PKL Technologies) and GasFinder series (Boreal Laser) are all commercially available TDLAS instruments, with purchase prices ranging from $25,000 - $40,000 each. The GasFinder MC notably uses fiber optics to allow one unit to support several detection beams.

Since ammonia releases might originate near ground level or several stories in the air the detection system should have a beam about five feet above the ground and another perhaps twenty feet high. The recommended two-beam geometry is displayed in Figure 6. This configuration is necessary to detect an ammonia release caused by a truck accident in the driveway, fugitive emissions from rail car filling, or releases from both the Dyno Nobel and Air Gas main plant complexes. Conversations with TDLAS Instrument suppliers revealed that these systems have been mounted on concrete monopoles or even lightweight truss towers steadied by guy wires (see Figure 7).

An open beam ammonia detection system would be most effective and reliable if it were integrated into the Dyno Nobel preparedness and response structure so the control room could immediately process a detection or failure signal in light of other monitor readings, knowledge of product properties and behavior, current meteorological conditions, and ongoing plant operations. If a Gasfinder MC was the system selected by the FBI and the system were integrated into the Dyno-Nobel network, a more sophisticated cross-beam pattern could be employed (see figure 8) to allow detection of leaks within the plant perimeter as well as at the plant boundary, permitting earlier alert of shooters at the range. While the alarm levels should be set as low as possible to detect the leading edge of a plume, while not so low as to produce false alarms, any quantitative discussion must wait for the selection of instrument and determination of path length.

Alternatives
Using a different small arms firing range would eliminate the chemical hazards. If the cost of a TDLAS system is too high a UV-DOAS system would likely be less expensive to purchase, though higher operating costs will erode any savings. If an easement cannot be secured to monitor across the railroad tracks then a second monitoring leg will be required along the west berm to detect a plume 'bouncing' off the hills to the west and circumventing the beams along the south berm.

Recommendation 2: Alert
An alert system using horns and strobe lights should be installed to quickly warn shooters in case of ammonia detection.

Discussion
Generally the FBI uses informal voice communications to transmit word of a medical or other emergency at the range, though larger teams using more than a single range at once can communicate via radio. If ammonia is detected at the edge of the range property shooters may need to take action immediately; there may not be time to run up to every shooter in hearing protection and tap them on the shoulder. Manual pull boxes should be placed at the training building and in the shooting area, so the alarm can be sounding manually in case ammonia or other gas is sensed by range occupants.

Strobe (daytime visible) and horn (audible with hearing protection) annunciators should be placed on the firing lines of the ranges and near the training building. Indoor annunciators should be placed inside the training building and may be needed inside the storage units. Users of the range might gain additional time to react to an ammonia release if the Dyno-Nobel plant alarm was routed to the range annunciators, though this would also produce alarms when small fugitive emissions were detected at locations distant from the range.

Alternatives
Neither the status quo nor personal alert devices (pagers) were considered viable alternatives.

Recommendation 3: Communications
The FBI and Dyno-Nobel should install a direct line from the range training building to the Dyno-Nobel control room.

Discussion
Cell phone coverage was described as "good" at the training building and "functional" in the range areas, except the west end of the pit (Practical and Turning Target ranges), where reception can be "spotty". A dedicated line is likely more reliable. Since the range is at the bottom of a pit a repeater would need to be installed on the berm for range users to access Dyno-Nobel plant radio frequencies.

Alternatives
Cell phones would be an alternative means of communication between the FBI agents at the range and the Dyno-Nobel control room.

Recommendation 4: Evacuation

A. An evacuation stairway should be constructed in the north corner of the range parcel so range users can exit the range facility if the driveway is blocked (see figure 9).
B. A windsock should be placed on top of the berm above the training building to aid in evacuation decisions.
C. A written Emergency Action Plan should be implemented based on the sample provided in Appendix D.

Discussion

Currently the only way to exit the range facility requires traveling directly toward the Dyno-Nobel plant, skirting the Airgas portion of the parcel. The Airgas facility is a potential source of an ammonia release, as is a truck accident on the driveway leading to Highway 30. Therefore a second means of egress leading away from the plant is needed to avoid trapping people inside the range. The slope above the training facility is too loose and unstable to climb. If a flight of stairs were erected in the northernmost corner it would lead to a small grassy clearing where Knife River Corporation keeps a trailer. There is an easily traversable vehicle path leading from this area to the shoulder of Highway 30 (figure 9).

The range is sometimes used by more than 10 FBI agents, so the emergency action plan required by OSHA (29 CFR 1910.38 Means of Egress) must be in writing. The FBI should create a comprehensive plan to include procedures for fire, medical or other emergency. FBI staff and visitors at the range should be briefed on the contents of the plan prior to their first visit to the range, whenever their responsibilities within the plan are changed, or whenever the plan is changed. A logbook at the training building will facilitate this and can be employed as part of a formal check-in process to assist in personnel accountability during an emergency.

The stairway and ramp evacuation routes should be marked with "Evacuation Route" signs. A copy of the emergency action plan should be posted in a weatherproof enclosure outside the training building so the latest contact information, evacuation routes, and procedures are freely available for review by range users and are readily available for use in an emergency.

The floor of the pit where the ranges are located is not a safe place to evaluate the situation or make decisions. The training building is on a plateau about thirty feet above the floor of the pit. Due to the elevation and distance from the potential sources of release the training building is the safest place to gather within the range complex.

If a plume of ammonia impacts the range complex the training building is in a vulnerable, difficult to rescue location. A toxic atmosphere could persist within the excavated range complex for an extended period of time. Thus the training building is not a suitable facility for range users to shelter-in-place.

Alternatives

The status quo is not an advisable alternative. The exact location of the wind sock is flexible. As long as it is between the rally point and the industrial facilities and is visible from the rally point.

Recommendation 5: Coordination

A. The FBI should inform the Dyno Nobel control room whenever its personnel arrive or depart the range.
B. The FBI should meet regularly with Dyno Nobel, AirGas, and Knife River representatives so all sides can advise each other of changes in operations.
C. The FBI should conduct joint drills with Dyno Nobel to test communication, coordination, and evacuation procedures.

Alternatives

The status quo is not advisable. The expertise found with in Dyno Nobel and AirGas will be invaluable in protecting the health and safety of FBI agents training at the range.

Attachments

Appendix A - Photographs and Maps
Appendix B - Hazardous Substance Information Survey Data
Appendix C - Material Safety Data Sheets
Appendix D - Draft Emergency Action Plan

Appendix A

Photographs and Maps

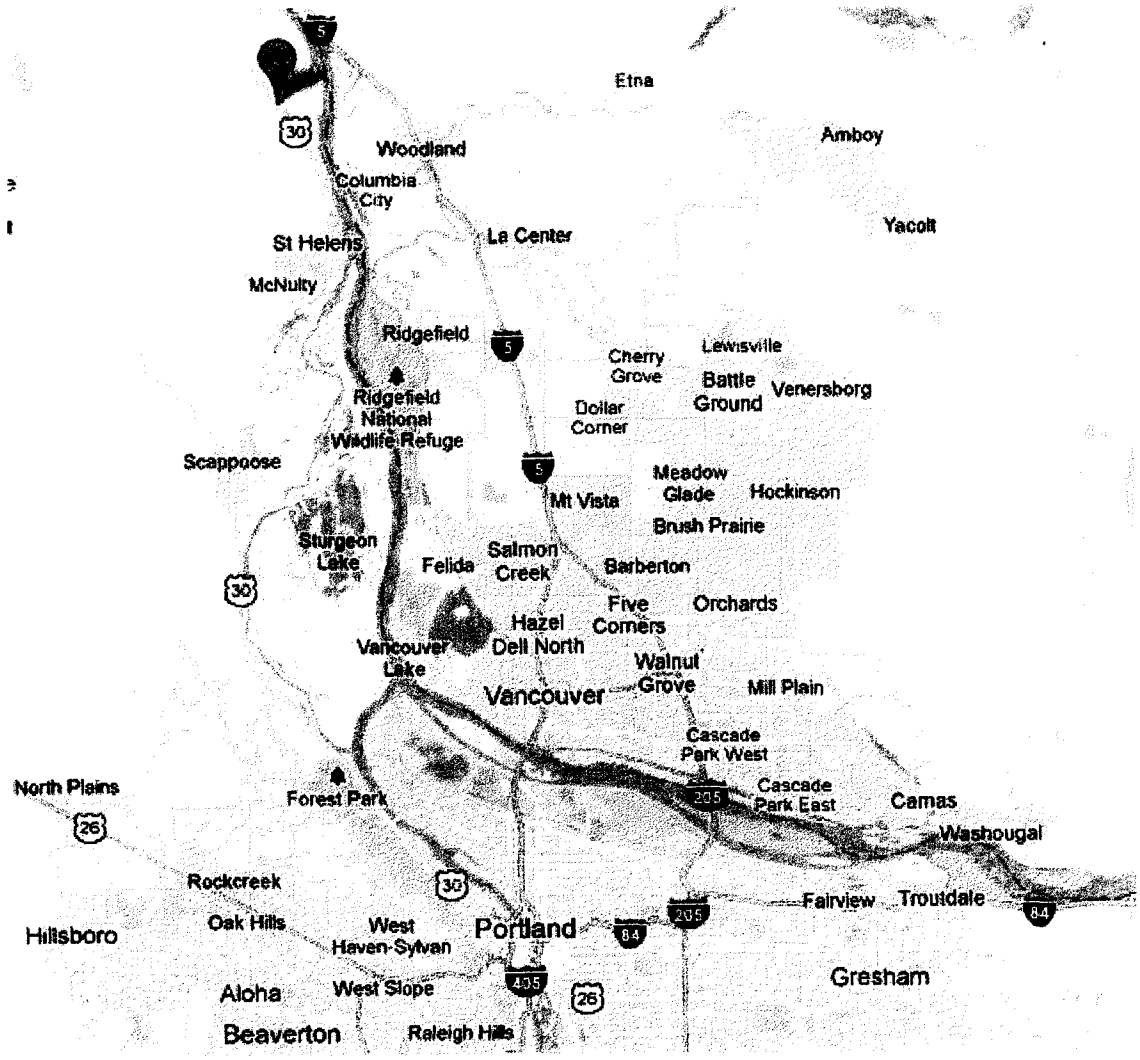

Figure 1. Location of Columbia County Firearms Range Complex (Point A on the map)

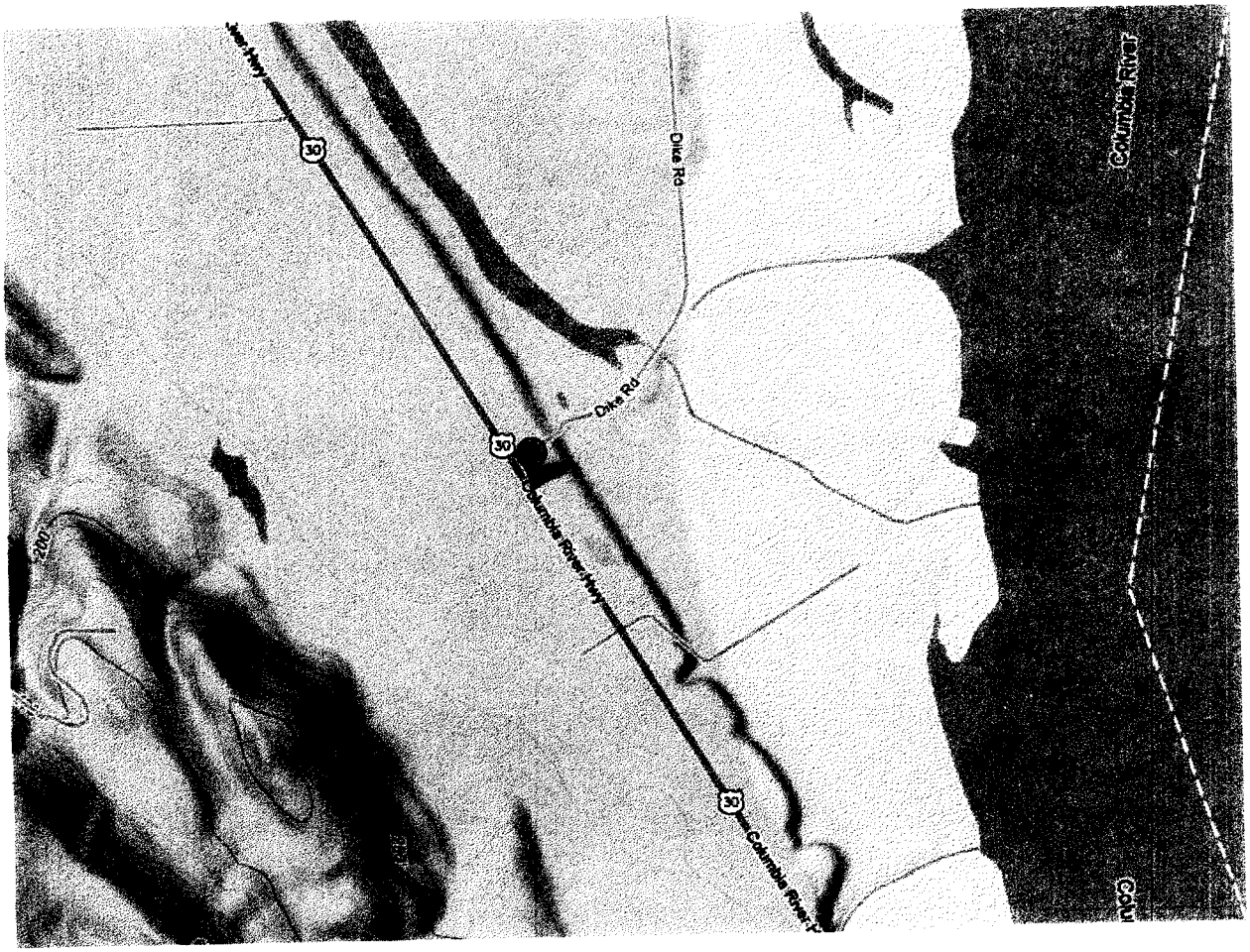

Figure 2. Geography of Columbia County Firearms Range Complex (Point A on the map) and vicinity.

Figure 3. Satellite image of Columbia County Firearms Range Complex, including neighboring facilities.

Figure 4. Satellite image of Columbia County Firearms Range Complex

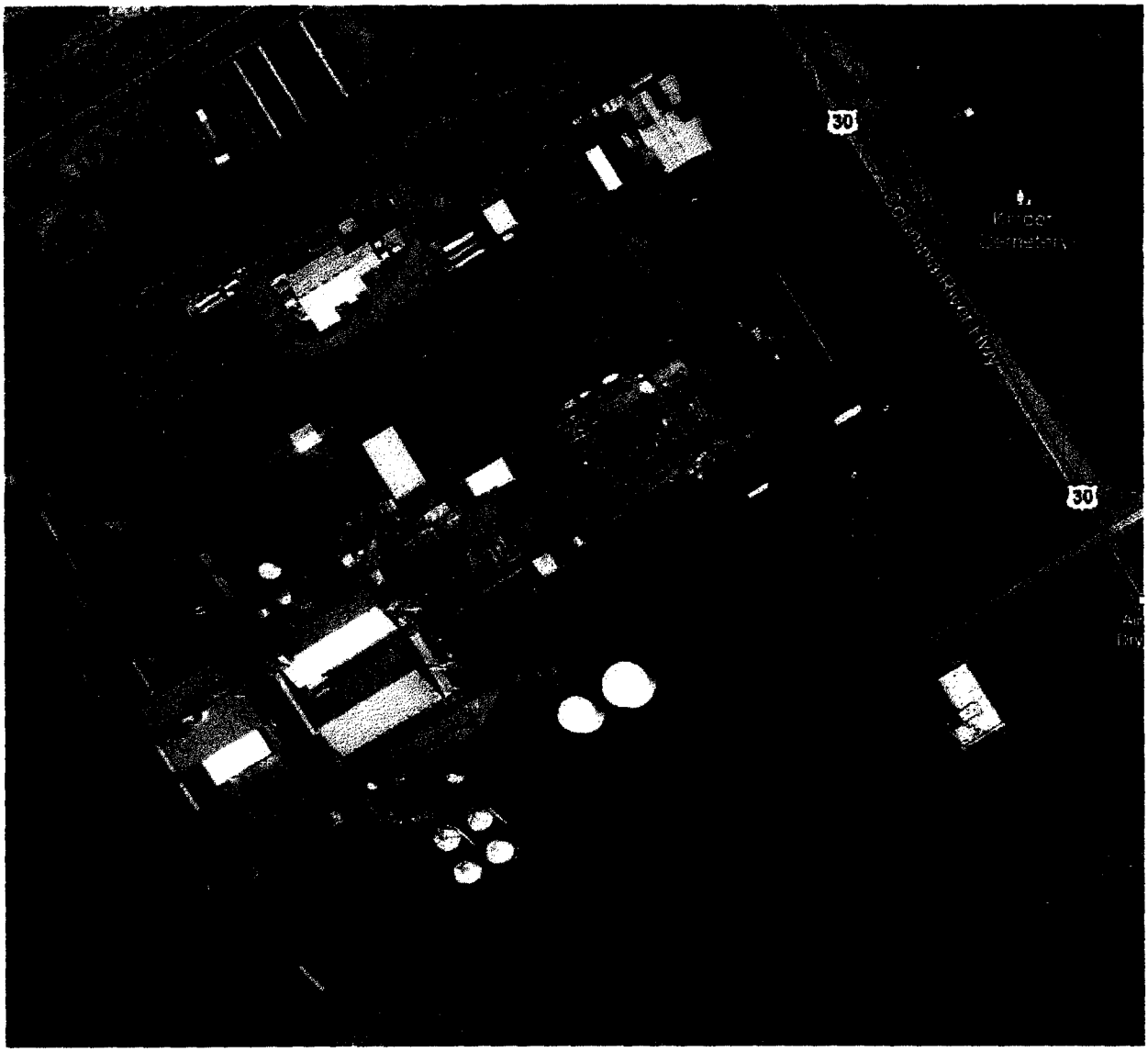

Figure 5. Satellite image of Dyno Nobel and AirGas industrial facilities south of Columbia County Firearms Range Complex

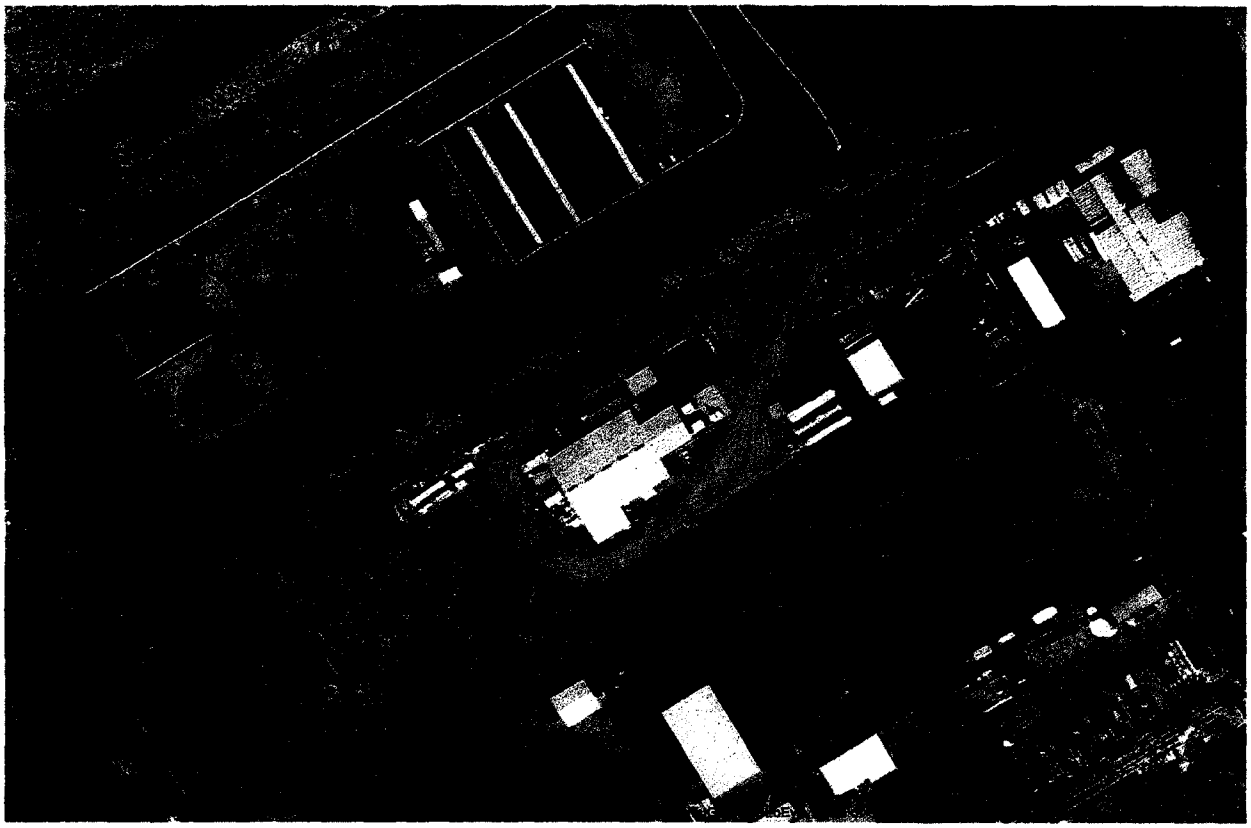

Figure 6. Recommended location of open path gas detection system (black line).

Figure 7. Illustration of TDLAS source/detector unit and retroreflectors on tower (PKL Technologies)

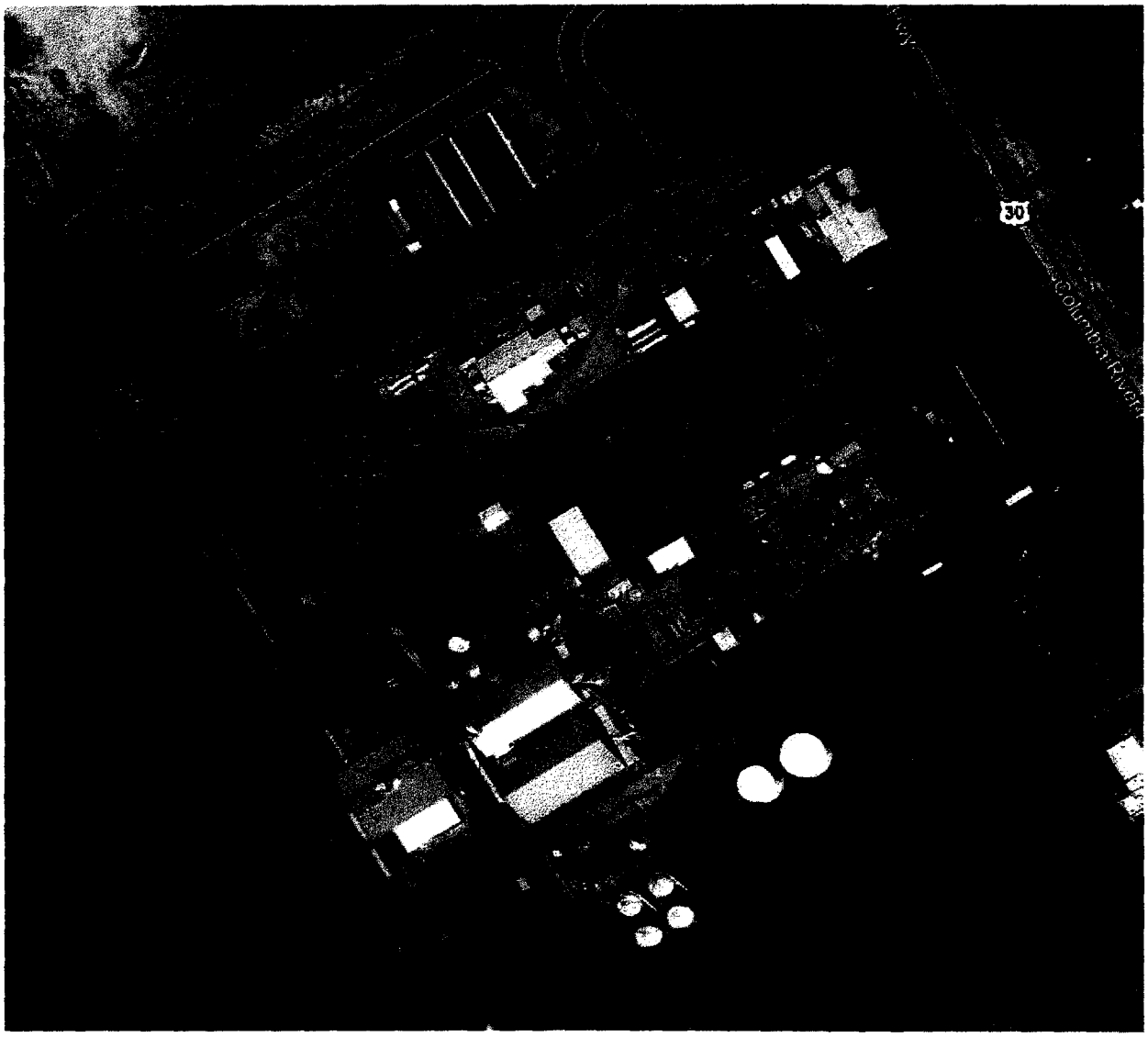

Figure 8. Alternative configuration of multiple open path gas detection system.

Figure 9. Recommended location of alternative means of egress from the range.

Appendix B

Hazardous Substance Information Survey Data

1. **Dyno Nobel Inc.**
2. **AirGas Dry Ice and AirGas Specialty Products**
3. **Knife River**

	CARBON	SOLID	POUNDS	5,000-9,999	Misc.Haz. Materials		BAG	PL NC ME DE
	AMMONIA	GAS	GALLONS	1,000,000-2,499,999	Acute Health Hazard	Corrosives	ABOVEGROUND TANK	RA
	AMMONIUM NITRATE	LIQUID	GALLONS	10,000-49,999	Acute Health Hazard	Oxidizers	ABOVEGROUND TANK	
)-	METHYL CELLULOSE	LIQUID	GALLONS	50-199	Misc.Haz. Materials		PLASTIC OR NON-METALLIC DRUM	
	ETHYLENE GLYCOL	LIQUID	GALLONS	200-499	Acute Health Hazard		STEEL DRUM	
A	AMMONIUM HYDROXIDE	LIQUID	GALLONS	10,000-49,999	Corrosives	Acute Health Hazard	ABOVEGROUND TANK	
A	AMMONIUM HYDROXIDE	LIQUID	GALLONS	50,000-99,999	Corrosives	Acute Health Hazard	ABOVEGROUND TANK	
	ARGON	GAS	CUBIC FEET	1,000-4,999	NonFlammable Gases		CYLINDER	
	ARGON	GAS	CUBIC FEET	200-499	Acute Health Hazard	NonFlammable Gases	CYLINDER	
R	NITROGEN	GAS	CUBIC FEET	1,000-4,999	NonFlammable Gases		CYLINDER	
)	CARBON DIOXIDE	GAS	GALLONS	50,000-99,999	Acute Health Hazard		ABOVEGROUND TANK	CY
	CATIONIC POLYMER	LIQUID	GALLONS	500-999	Acute Health Hazard	Combustible Materials	TOTEBIN	
-	ALUMINUM CHLORHYDRATE	LIQUID	GALLONS	500-999	Acute Health Hazard		TOTEBIN	
	METHYLDIETHANOLAMINE	LIQUID	GALLONS	1,000-4,999	Acute Health Hazard	Combustible Materials	TOTEBIN	PL NC ME DE
	PROPRIETARY ALKYLAMINE	LIQUID	GALLONS	500-999	Acute Health Hazard	Combustible Materials	PLASTIC OR NON-METALLIC DRUM	
I	DIATOMACEOUS EARTH	SOLID	POUNDS	1,000-4,999	Misc.Haz. Materials		BAG	
	PETROLEUM MID-DISTILLATES	LIQUID	GALLONS	10,000-49,999			ABOVEGROUND TANK	ST
	PETROLEUM DISTILLATES	LIQUID	GALLONS	1,000-4,999		Acute Health Hazard	ABOVEGROUND TANK	
	SILICON DIOXIDE	SOLID	POUNDS	1,000-4,999	Misc.Haz. Materials		BAG	
	SODIUM/CALCIUM BOROSILICATE	SOLID	POUNDS	500-999	Chronic Health Hazard		BOX	
	HELIUM	GAS	CUBIC FEET	1,000-4,999	NonFlammable Gases		CYLINDER	
G	HELIUM	GAS	CUBIC FEET	500-999	Acute Health Hazard	NonFlammable Gases	CYLINDER	
	HYDROGEN	GAS	CUBIC FEET	1,000-4,999	Flammable Gases		OTHER	C
N %	HYDROGEN	GAS	CUBIC FEET	500-999	Flammable Gases		CYLINDER	
	HYDROGEN	GAS	CUBIC FEET	500-999	Flammable		CYLINDER	

SODIUM BISULFITE	LIQUID	GALLONS	500-999	Acute Health Hazard	Reactive Material	TOTEBIN	
SODIUM BISULFITE	LIQUID	GALLONS	50-199	Acute Health Hazard		TOTEBIN	
MONOBUTYLETHERS OF GLYCOL	LIQUID	GALLONS	500-999	Acute Health Hazard		TOTEBIN	
SODIUM HYDROXIDE	LIQUID	GALLONS	50-199	Corrosives	Reactive Material	STEEL DRUM	
NITRIC ACID	LIQUID	GALLONS	10,000-49,999	Corrosives	Oxidizers	ABOVEGROUND TANK	TA BU
NITROGEN	GAS	CUBIC FEET	200-499	Acute Health Hazard	NonFlammable Gases	CYLINDER	
SODIUM TUNGSTATE	LIQUID	GALLONS	500-999	Acute Health Hazard		TOTEBIN	
NITROGEN	GAS	CUBIC FEET	1,000-4,999	NonFlammable Gases		CYLINDER	
NITROGEN	GAS	CUBIC FEET	500-999	Flammable Gases		CYLINDER	
NITROGEN	GAS	GALLONS	1,000-4,999	NonFlammable Gases	Acute Health Hazard	ABOVEGROUND TANK	
OXYGEN	GAS	CUBIC FEET	1,000-4,999	Oxidizers	NonFlammable Gases	CYLINDER	
PROPANE	GAS	GALLONS	1,000-4,999	Flammable Gases	Acute Health Hazard	ABOVEGROUND TANK	
ALUMINUM OXIDE	SOLID	POUNDS	1,000-4,999	Misc.Haz. Materials		PLASTIC OR NON-METALLIC DRUM	
SODIUM CHLORIDE	SOLID	POUNDS	10,000-49,999	Acute Health Hazard		BAG	
SODIUM CHLORIDE	LIQUID	GALLONS	200-499	Acute Health Hazard		TANK INSIDE BUILDING	
SILICA, SAND CRYSTALLINE	SOLID	POUNDS	1,000-4,999	Chronic Health Hazard		BAG	
SILICA	LIQUID	GALLONS	1,000-4,999	Acute Health Hazard		STEEL DRUM	FII
C12-C13 PARAFFINIC HYDROCARBONS	LIQUID	GALLONS	50-199	Combustible Materials		STEEL DRUM	
SODIUM HYPOCHLORITE	LIQUID	GALLONS	10,000-49,999	Corrosives	Acute Health Hazard	PLASTIC OR NON-METALLIC DRUM	
SODIUM HYPOCHLORITE	LIQUID	GALLONS	1,000-4,999	Reactive Material	Oxidizers	ABOVEGROUND TANK	
PETROLEUM HYDROCARBON	LIQUID	GALLONS	50-199	Combustible Materials		STEEL DRUM	
UREA	LIQUID	GALLONS	10,000-49,999	Acute Health Hazard		TANK INSIDE BUILDING	
UREA	LIQUID	GALLONS	10,000-49,999	Acute Health Hazard		TANK INSIDE BUILDING	
UREA	SOLID	POUNDS	25,000,000-49,999,999	Reactive Material		OTHER	
MONOCARBAMIDE AMMONIUM NITRATE	LIQUID	GALLONS	1,000,000-2,499,999	Acute Health Hazard		ABOVEGROUND TANK	
UREA FORMALDEHYDE	LIQUID	GALLONS	5,000-9,999	Combustible Materials		ABOVEGROUND TANK	

Facility Name: **AIRGAS DRY ICE** Facility ID Number: **086896**

SIC Code Definition: **INDUSTRIAL GASES-MFG**

Location Address: **63201 COLUMBIA RIVER HWY DEER ISLAND** Zip: **97054** County: **COLUMBIA**

Owner/CEO/Reg Agent: **PHIL FILER PRES** Business Phone: **(503) 366-1882**

Chemical Trade Name	Most Hazardous Ingredient	Physical State	Unit	Max Qnty	Haz Class 1	Haz Class 2	Storage 1
ACETYLENE	ACETYLENE	GAS	CUBIC FEET	50-199	Flammable Gases	Acute Health Hazard	CYLINDER
CARBON DIOXIDE LIQUID	CARBON DIOXIDE	GAS	GALLONS	50,000-99,999	Acute Health Hazard		ABOVE GROUND TANK
DRY ICE	CARBON DIOXIDE	SOLID	POUNDS	100,000-249,999	Acute Health Hazard		TOTEBIN
FREON 22	CHLORODIFLUOROMETHANE	GAS	GALLONS	200-499	NonFlammable Gases	Acute Health Hazard	ABOVEGROUND TANK
HYDRAULIC OIL	BASE LUBRICATING OILS	LIQUID	GALLONS	200-499	Combustible Materials		ABOVE GROUND TANK
KEROSENE	PETROLEUM DISTILLATE, ALIPHATIC	LIQUID	GALLONS	200-499		Acute Health Hazard	ABOVE GROUND TANK
OXYGEN	OXYGEN	GAS	CUBIC FEET	200-499	Oxidizers	NonFlammable Gases	CYLINDER
PROPANE	PROPANE	GAS	GALLONS	200-499	Flammable Gases	Acute Health Hazard	ABOVE GROUND TANK
WASTE HYDRAULIC OIL	PETROLEUM HYDROCARBONS	LIQUID	GALLONS	50-199	Combustible Materials		ABOVE GROUND TANK

Facility Name: **AIRGAS SPECIALTY PRODUCTS** Facility ID Number: **107044**

SIC Code Definition: **0000**

Location Address: **63201 COLUMBIA RIVER HWY DEER ISLAND** Zip: **97054** County: **COLUMBIA**

Owner/CEO/Reg Agent: **MARTIN WEHNER** Business Phone: **(503) 545-3699**

Chemical Trade Name	Most Hazardous Ingredient	Physical State	Unit	Max Qnty	Haz Class 1	Haz Class 2	Storage 1
AMMONIA ANHYDROUS	AMMONIA	GAS	GALLONS	5,000-9,999	Acute Health Hazard	Corrosives	TANK WAGON

Owner/CEO/Reg Agent: **STEVE FREY** Business Phone: **(541) 928-6491**

Chemical Trade Name	Most Hazardous Ingredient	Physical State	Unit	Max Qnty	Haz Class 1	Haz Class 2	Storag
ACETYLENE	ACETYLENE	GAS	CUBIC FEET	500-999	Flammable Gases	Acute Health Hazard	CYLINDER
ANTIFREEZE	ETHYLENE GLYCOL	LIQUID	GALLONS	200-499	Acute Health Hazard		STEEL DRUI
CHEVRON COMPRESSOR OIL ISO 32, 68, 100	SYNTHETIC HYDROCARBON OIL	LIQUID	GALLONS	50-199	Combustible Materials		STEEL DRUI
CHEVRON DRIVE TRAIN FLUID	HIGHLY REFINED MINERAL OIL	LIQUID	GALLONS	50-199	Combustible Materials		STEEL DRUI
DIESEL FUEL	PETROLEUM MID-DISTILLATES	LIQUID	GALLONS	1,000-4,999			ABOVEGRO TANK
GEAR LUBRICANT ISO GRADES	NONE LISTED ON MSDS	LIQUID	GALLONS	200-499	Combustible Materials		STEEL DRUI
GREASE	SEVERELY REFINED PETROLEUM DISTILLATE	SOLID	POUNDS	500-999	Combustible Materials		STEEL DRUI
HYDRAULIC OIL	BASE LUBRICATING OILS	LIQUID	GALLONS	200-499	Combustible Materials		STEEL DRUI
HYPERFLOC 626	NONE LISTED ON MSDS	LIQUID	GALLONS	5,000-9,999	Combustible Materials		PLASTIC OR METALLIC D
HYPERFLOC AF307	NONE LISTED ON MSDS	SOLID	POUNDS	1,000-4,999	Misc.Haz. Materials		BAG
HYPERFLOC AF307 SOLN	NONE LISTED ON MSDS	LIQUID	GALLONS	5,000-9,999	Misc.Haz. Materials		PLASTIC OR METALLIC D
MOTOR OIL	PETROLEUM HYDROCARBONS	LIQUID	GALLONS	200-499	Combustible Materials	Chronic Health Hazard	STEEL DRUI
OXYGEN	OXYGEN	GAS	CUBIC FEET	1,000-4,999	Oxidizers	NonFlammable Gases	CYLINDER
SAE 80W-90 GEAR LUBE	HIGHLY REFINED MINERAL OIL (C15-C50)	LIQUID	GALLONS	200-499	Combustible Materials		ABOVEGRO TANK
USED OIL	PETROLEUM HYDROCARBONS	LIQUID	GALLONS	200-499	Combustible Materials	Chronic Health Hazard	STEEL DRU

Appendix C

Material Safety Data Sheets

1. **Anhydrous Ammonia**
2. **Aqua Ammonia**
3. **Ammonium Nitrate**
4. **Carbon Dioxide (liquid)**
5. **Nitric Acid**
6. **Sodium Hypochlorite (5.25%)**
7. **Urea Ammonium Nitrate Solution**

Material Safety Data Sheet

Dyno Nobel Inc.
2795 East Cottonwood Parkway, Suite 500
Salt Lake City, Utah 84121
Phone: 801-364-4800 Fax: 801-321-6703
E-Mail: dnna.hse@am.dynonobel.com
FOR 24 HOUR EMERGENCY, CALL CHEMTREC (USA) 800-424-9300
CANUTEC (CANADA) 613-996-6666

MSDS # 1129
Date 09/16/10

Supercedes
MSDS # 1129 08/13/08

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): Ammonia, Anhydrous

Synonyms: Liquid Ammonia: R-Grade (Refrigeration Grade), Commercial Grade, Agricultural Grade; 82-0-0

Product Class: Ammonia

Product Appearance & Odor: Colorless liquefied gas, pungent and extremely irritating odor.

DOT Hazard Shipping Description: UN1005 Ammonia, anhydrous 2.2 RQ*

* "RQ" required only if container (drum, rail tank car, etc.) has 100 pounds or more of Ammonia.

Label Required:

INHALATION HAZARD

ANHYDROUS AMMONIA

QT or **NQT** if < 0.2% water **RQ**

NFPA Hazard Classification:

Health (Blue) =	3
Flammability (Red) =	1
Reactivity (Yellow) =	0

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	Occupational Exposure Limits ACGIH TLV-TWA	OSHA PEL-TWA
Ammonia, anhydrous	7664-41-7	99.5 – 100.0	25 ppm 35 ppm (STEL)	50 ppm

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: -33°C (-28°F) @ 1 atm
Vapor Density: 0.6 (air = 1)
Percent Volatile by Volume: 100%
Vapor Pressure: 124 psia @ 20°C (68°F)
Specific Gravity: 0.62 g/cc (5.15 lb/gal)
Solubility in Water: 51 g/100 g @ 20°C (68°F)

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not flammable

Flammable Limits: Lower 16.0%
Upper 25.0%

Extinguishing Media: Water fog is best. (Ammonia will react with Carbon Dioxide to form a dense white cloud)
Special Fire Fighting Procedures: Use water spray or fog to keep fire-exposed containers cool. Do not completely extinguish flame unless gas flow is shut off! Ammonia burns to form oxides of nitrogen. Firefighters should wear self-contained breathing apparatus and full protective clothing.
Unusual Fire and Explosion Hazards: Although classified nonflammable, Ammonia does have an explosive range. Ammonia can be a dangerous fire and explosion hazard when mixed with air.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: May cause severe eye irritation with corneal injury and permanent vision impairment.
Skin: If contact with gas is prolonged for more than a few minutes, severe burning pain and corrosive damage will occur. Contact with liquid will cause severe tissue damage.
Ingestion: Extremely irritating to mucous membranes causing vomiting, nausea and burns.
Inhalation: The gas is extremely irritating to mucous membranes and lung tissue. Coughing, chest pain, and difficulty in breathing may result. Prolonged exposure may result in bronchitis, pulmonary edema, and chemical pneumonitis. Breathing high concentrations may result in death.
Systemic or Other Effects: May aggravate preexisting pulmonary, lung or eye conditions.

Carcinogenicity: **NTP: No** **IARC Monographs: No** **OSHA Regulated: No**

Emergency and First Aid Procedures

Eyes: Immediately flush with large amounts of water, including under the eyelids. Seek medical attention immediately, preferably an Ophthalmologist. Speed and thoroughness in rinsing eyes are important to avoid permanent injury.
Skin: Immediately flush with large amounts of tepid water while removing clothing. Thaw frozen clothing before removal. If a freeze burn has occurred, get medical attention.
Ingestion: Do not induce vomiting. Rinse mouth out with water. Drink large amounts of water or milk. Seek medical attention immediately.
Inhalation: Remove promptly to fresh air. If breathing has stopped, apply artificial respiration. Apply oxygen as soon as possible. Seek medical attention immediately.
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable.
Conditions to Avoid: Avoid exposing containers to heat or flame. Keep separated from incompatible materials.
Materials to Avoid (Incompatibility): Acids, strong oxidizing agents, chlorine, bromine, pentafluoride, nitrogen trifluoride, mercury, silver oxide, calcium, and chlorides of iron. Do not use copper, brass, bronze, or galvanized steel in ammonia service.
Hazardous Decomposition Products: Ammonia and oxides of Nitrogen (Nitrogen Dioxide, Nitric Oxide).
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Remove sources of heat or ignition, including internal combustion engines and power tools. Keep people away. Stay upwind and warn people downwind of possible exposure. Wear self-contained breathing apparatus if condition warrants. Follow applicable Federal, State and local reporting requirements.
Waste Disposal Method: Anhydrous Ammonia will not leave residue when spilled; no chemical clean-up will be required. Vegetation, insects, reptiles, fish and small mammals contacted by liquid Ammonia and/or the vapor cloud will likely die; post spill conservation measures may be required.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Provide adequate general and local exhaust ventilation to attain occupational exposure limits, to prevent the formation of explosive atmospheres; and to prevent the formation of an oxygen deficient atmosphere, particularly in a confined space area.
Respiratory Protection: Use a NIOSH approved chemical cartridge respirator with full facepiece for ammonia concentrations up to 300 ppm. Use a positive pressure (pressure demand) SCBA for concentrations above 300 ppm, for emergency response, or for entry into unknown concentrations.
Protective Clothing: Ammonia is severely corrosive to epidermal tissue. Wearing nonporous clothing: pants, sleeves, footwear, and gloves is the recommended protection against skin contact.
Eye Protection: Ammonia is severely corrosive to mucosal membranes (eyes, nose, throat). Remove contact lenses and wear chemical goggles. A face shield is also advised for additional skin protection where contact with liquid or vapor may occur.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in compliance with all Federal, State, and local regulations. Store cylinders and tanks in a well ventilated area, away from incompatible materials (i.e. Chlorine), sources of heat and ignition. Empty containers may contain residual gas and can be dangerous. Ground or bond all lines and equipment used for the transfer and storage of ammonia gas to prevent static sparks. Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, flames, sparks or other sources of ignition; they may explode and cause injury or death.
Other Precautions: None.

SECTION X - SPECIAL INFORMATION

EPCRA Section 311/312 Hazard Categorization:

Acute	Chronic	Fire	Pressure	Reactive
X		X	X	

EPCRA & CAA Hazardous Substance Reporting Requirements:

Ingredient	CAS No.	% by wt	CAA 112(r)	302 TPQ lb.	304 RQ lb.	313 TRI
Ammonia	7664-41-7	>99	10,000 lb	500	100	X

Key: **CAA 112(r) = Toxic Substance with potential for airborne release**
Sec. 302 TPQ = Extremely Hazardous Substances (EHS) Threshold Planning Quantity
Sec. 304 RQ = EHS and CERCLA Reportable Quantity if spilled
Sec. 313 TRI =Toxic Chemicals to be reported on Toxic Release Inventory if spilled

Disclaimer

Dyno Nobel Inc. and its subsidiaries disclaim any warranties with respect to this product, the safety or suitability thereof, the information contained herein, or the results to be obtained, whether express or implied, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND/OR OTHER WARRANTY. The information contained herein is provided for reference purposes only and is intended only for persons having relevant technical skills. Because conditions and manner of use are outside of our control, the user is responsible for determining the conditions of safe use of the product. Buyers and users assume all risk, responsibility and liability whatsoever from any and all injuries (including death), losses, or damages to persons or property arising from the use of this product or information. Under no circumstances shall either Dyno Nobel Inc. or any of its subsidiaries be liable for special, consequential or incidental damages or for anticipated loss of profits.

Material Safety Data Sheet

Dyno Nobel Inc.
2795 East Cottonwood Parkway, Suite 500
Salt Lake City, Utah 84121
Phone: 801-364-4800 Fax: 801-321-6703
E-Mail: dnna.hse@am.dynonobel.com
FOR 24 HOUR EMERGENCY, CALL CHEMTREC (USA) 800-424-9300
CANUTEC (CANADA) 613-996-6666

MSDS # 1130
Date 09/16/10

Supercedes
MSDS # 1130 08/13/08

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): Ammonia, Aqua

Synonyms: Ammonia Solutions; Ammonium Hydroxide; High Strength Aqua Ammonia (30% NH_3); Regular Strength Aqua Ammonia (19% NH_3)

Product Class: Ammonia Solutions

Product Appearance & Odor: Colorless liquid, pungent and extremely irritating odor.

DOT Hazard Shipping Description: UN2672, Ammonia solutions 8 III RQ*

* "RQ" required only if container (drum, rail tank car, etc.) has 100 pounds or more of Aqua Ammonia at >20% strength or 1,000 pounds or more at <20% strength.

Label Required:

RQ

NFPA Hazard Classification:

Health (Blue) =	3
Flammability (Red) =	1
Reactivity (Yellow) =	0

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	Occupational Exposure Limits ACGIH TLV-TWA (limits as ammonia)	Occupational Exposure Limits OSHA PEL-TWA
Ammonia, aqueous (ammonium hydroxide)	1336-21-6	10-35% NH_3 in water	25 ppm 35 ppm (STEL)	50 ppm

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: 27 - 49°C (80 - 120°F)
Vapor Density: 0.6 (air = 1) for gaseous ammonia
Percent Volatile by Volume: 100%
Vapor Pressure: 4.5 – 11.0 psia @ 20°C (68°F)
Specific Gravity: 0.89 – 0.93 g/cc (7.45 – 7.75 lb/gal)
Solubility in Water: infinitely soluble

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not flammable
Flammable Limits (for ammonia)**:** LEL 16.0%; UEL 25%
Extinguishing Media: Water fog is best. (Ammonia will react with Carbon Dioxide to form a dense white cloud)
Special Fire Fighting Procedures: Aqua ammonia is an aqueous solution that will not support combustion. Use water spray or fog to keep fire-exposed containers cool. Ammonia burns to form oxides of nitrogen. Firefighters should wear self-contained breathing apparatus and full protective clothing.
Unusual Fire and Explosion Hazards: If exposed to elevated temperatures, Aqua Ammonia will release Ammonia gas. Although classified nonflammable, Ammonia does have an explosive range. Ammonia can be a dangerous fire and explosion hazard when mixed with air.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: May cause severe eye irritation with corneal injury and permanent vision impairment.
Skin: If contact with gas is prolonged for more than a few minutes, severe burning pain and corrosive damage will occur. Contact with liquid will cause severe tissue damage.
Ingestion: Extremely irritating to mucous membranes causing vomiting, nausea and burns.
Inhalation: The gas is extremely irritating to mucous membranes and lung tissue. Coughing, chest pain, and difficulty in breathing may result. Prolonged exposure may result in bronchitis, pulmonary edema, and chemical pneumonitis. Breathing high concentrations may result in death.
Systemic or Other Effects: May aggravate preexisting pulmonary, lung or eye conditions.

Carcinogenicity: NTP: No IARC Monographs: No OSHA Regulated: No

Emergency and First Aid Procedures

Eyes: Immediately flush with large amounts of water, including under the eyelids. Seek medical attention immediately, preferably an Ophthalmologist. Speed and thoroughness in rinsing eyes are important to avoid permanent injury.
Skin: Immediately flush with large amounts of tepid water while removing clothing. Thaw frozen clothing before removal. If a freeze burn has occurred, get medical attention.
Ingestion: Do not induce vomiting. Rinse mouth out with water. Drink large amounts of water or milk. Seek medical attention immediately.
Inhalation: Remove promptly to fresh air. If breathing has stopped, apply artificial respiration. Apply oxygen as soon as possible. Seek medical attention immediately.
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable.
Conditions to Avoid: Avoid exposing containers to heat or flame. Keep separated from incompatible materials.
Materials to Avoid (Incompatibility): Acids, strong oxidizing agents, chlorine, bromine, pentafluoride, nitrogen trifluoride, mercury, silver oxide, calcium, and chlorides of iron. Do not use copper, brass, bronze, or galvanized steel in Aqua Ammonia service.
Hazardous Decomposition Products: Ammonia and oxides of Nitrogen (Nitrogen Dioxide, Nitric Oxide).
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Keep people away. Stay upwind and warn people downwind of possible exposure. Wear self-contained breathing apparatus if condition warrants. Follow applicable Federal, State and local reporting requirements.
Waste Disposal Method: Aqua Ammonia is an immediate poison to marine life. Vegetation, insects, reptiles, fish and small mammals contacted by Aqua Ammonia (or a large gaseous Ammonia vapor clouds released by heat) will likely die; post spill conservation measures may be required. Minimize runoff to watersheds by diking, containment or absorption. Contaminated dirt may be spread as a fertilizer.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Provide adequate general and local exhaust ventilation to attain occupational exposure limits, to prevent the formation of explosive atmospheres; and to prevent the formation of an oxygen deficient atmosphere, particularly in a confined space area.
Respiratory Protection: Use a NIOSH approved chemical cartridge respirator with full facepiece for ammonia concentrations up to 300 ppm. Use a positive pressure (pressure demand) SCBA for concentrations above 300 ppm, for emergency response, or for entry into unknown concentrations.
Protective Clothing: Aqua Ammonia is severely corrosive to epidermal tissue. Wearing nonporous clothing: pants, sleeves, footwear, and gloves is the recommended protection against skin contact.
Eye Protection: Aqua Ammonia is severely corrosive to mucosal membranes (eyes, nose, throat). Remove contact lenses and wear chemical goggles. A face shield is also advised for additional skin protection where contact with liquid or vapor may occur.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in compliance with all Federal, State, and local regulations. Store cylinders and tanks in a well ventilated area, away from incompatible materials (i.e. Chlorine), sources of heat and ignition. Empty containers may contain residual liquid or gas and can be dangerous. Ground or bond all lines and equipment used for the transfer and storage of ammonia gas to prevent static sparks. Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, flames, sparks or other sources of ignition; they may explode and cause injury or death.

Other Precautions: None.

Material Safety Data Sheet

SECTION X - SPECIAL INFORMATION

EPCRA Section 311/312 Hazard Categorization:

Acute	Chronic	Fire	Pressure	Reactive
X				

EPCRA & CAA Hazardous Substance Reporting Requirements:

Ingredient	CAS No.	% by wt	CAA 112(r)	302 TPQ lb.	304 RQ lb.	313 TRI
Ammonium Hydroxide	1336-21-6	For <20% Ammonia Soln	Not Listed	Not Listed	1,000	
Ammonium ion in water	7664-41-7	For >20% Ammonia Soln	20,000 lb	500	100	X

Key: **CAA 112(r) = Toxic Substance with potential for airborne release**
Sec. 302 TPQ = Extremely Hazardous Substances (EHS) Threshold Planning Quantity
Sec. 304 RQ = EHS and CERCLA Reportable Quantity if spilled
Sec. 313 TRI =Toxic Chemicals to be reported on Toxic Release Inventory if spilled

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Material Safety Data Sheet

Dyno Nobel Inc.
2795 East Cottonwood Parkway, Suite 500
Salt Lake City, Utah 84121
Phone: 801-364-4800 Fax: 801-321-6703
E-Mail: dnna.hse@am.dynonobel.com
FOR 24 HOUR EMERGENCY, CALL **CHEMTREC (USA) 800-424-9300**
CANUTEC (CANADA) 613-996-6666

MSDS # 1020
Date 09/16/10

Supercedes
MSDS # 1020 08/13/08

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): Superprill™, Prilled Ammonium Nitrate, Industrial Grade
LoDAN, Ammonium Nitrate, Industrial Grade
HiDAN, Ammonium Nitrate, Agricultural Grade

Chemical Name/Product Class: Ammonium Nitrate

Synonyms: Prilled Ammonium Nitrate; Ammonium Nitrate: Industrial, Fertilizer or Agricultural Grade; AN; 35-0-0.

Product Appearance & Odor: White to off-white, solid prills or fine granules. Slight ammonia odor.

DOT Hazard Shipping Description: **UN2067** Ammonium Nitrate Based Fertilizers 5.1 III Label: Oxidizer

NFPA Hazard Classification:

Health (Blue)	2
Flammability (Red)	0
Reactivity (Yellow)	3
Specific Hazard (White)	Oxidizer

HMIS (III) Classification:

Health	1
Flammability	1
Physical Hazard	3
PPE	E

SECTION II - HAZARDOUS INGREDIENTS

			Occupational Exposure Limits	
Ingredients:	**CAS#**	**% (Range)**	**ACGIH TLV-TWA**	**OSHA PEL-TWA**
Ammonium Nitrate	6484-52-2	98 – 100%	None[1]	None[2]

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m^3 ; respirable fraction, 5 mg/m^3 .
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m^3 ; respirable part., 3 mg/m^3 .

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: Decomposes between 177-210°C (350-410°F)
Vapor Density: Not Applicable
Percent Volatile by Volume: Not Applicable
Evaporation Rate (Butyl Acetate = 1): Not Applicable
Vapor Pressure: Not Applicable
Density: 0.72 - 1.00 g/cc (Poured bulk density)
Solubility in Water: 192 g/100 ml @ 20°C (68°F)
118 g/100 ml @ 0°C (32°F)
Melting Point: 170°C (337°F)

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable
Flammable Limits: Not Applicable
Extinguishing Media: Use water only. Do not attempt to smother. Do not use salt water, dry chemical, carbon dioxide, steam or foam.
Special Fire Fighting Procedures: Fight only small fires in initial stages when not confined. Immediately ventilate structures and transport containers to minimize confinement and prevent pressure buildup that increases the possibility of explosion. In advanced stage, or for any large fire or fire engulfing confining containers, abandon fire-fighting efforts and quickly evacuate all personnel to a safe distance of at least 2,500 feet. Use large quantities of water to cool. If possible, plug drains or dike channels to prevent either molten material or water runoff from entering storm drains or surface waters. Firefighters should wear self-contained breathing apparatus (SCBA) and full turnout gear.
Unusual Fire and Explosion Hazards: May explode or detonate under confinement and high temperatures. Ammonium nitrate emits toxic nitrogen oxides when heated to decomposition and will release ammonia to air upon reaction with strong alkalis. Explodes more readily if contaminated with organic materials or other fuels.

SECTION V - HEALTH HAZARD DATA

Carcinogenicity: NTP: No IARC Monographs: No OSHA Regulated: No

Effects of Overexposure

Not found to be toxic by oral, dermal and inhalation exposure as defined by OSHA.
Eyes: May cause irritation, redness, tearing or blurred vision.
Skin: Prolonged contact may irritate skin, resulting in reddening of the skin and possible dermatitis, or may aggravate pre-existing dermatitis.
Ingestion: May cause gastric irritation, abdominal spasms, nausea, pain and faintness. Large amounts may be harmful if swallowed, potentially causing systemic acidosis and methemoglobinemia.
Inhalation: Dust is irritating to mucous membranes and respiratory tract, and may cause sore throat, coughing, difficult breathing and severe lung congestion, and may also aggravate pre-existing lung conditions. Inhalation may also lead to ingestion effects. Delayed reactions may result in pulmonary edema and chemical pneumonitis.
Systemic or Other Effects: Decomposition of ammonium nitrate at high temperatures produces highly toxic Nitrogen Oxides (NO_X). High level exposure to NO_X can cause serious injury or death. Chronic exposure to NO_X can produce respiratory and/or kidney damage.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.
Skin: Remove contaminated clothing. Wash with soap and water.
Ingestion: Seek medical attention. Do not induce vomiting. Treat for methemoglobinemia.
Inhalation: Remove to fresh air, seek medical attention.
Special Considerations: If an exposure to toxic NO_X vapors occurs, restore or support breathing as necessary, seek immediate medical attention. Observe for delayed reactions to NO_X exposure that may involve pulmonary edema.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions. May explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.
Conditions to Avoid: Keep away from heat, flame, ignition sources and strong shock.
Materials to Avoid (Incompatibility): Flammable liquids, organic solvents and materials, explosives, metal powders and other combustible materials. Reducing agents, chlorides, phosphorus and sulfur. Corrosives (strong acids and bases).
Hazardous Decomposition Products: Nitrogen Oxides (NO_X), Ammonia (NH_3), Nitric Acid (HNO_3).
Hazardous Polymerization: Does not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of large fire or fire engulfing containers, evacuate an area not less than 2,500 feet in all directions. If possible, plug drains or dike channels to prevent either molten material or water runoff from entering storm drains or surface water. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable federal, state, and local spill reporting requirements. Contact of this product with water may result in a reportable release.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. Ammonium Nitrate is used as a fertilizer and, in some cases, recovered material may be put to beneficial use. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any hazardous material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling. Provide adequate ventilation as needed to avoid exceeding exposure limits for nuisance dust, especially in confined spaces.
Respiratory Protection: Wear NIOSH approved respirator when airborne exposure limits for nuisance dust are exceeded. Refer to OSHA standard 1910.134 for proper selection and use of respirators.
Protective Clothing: Wear long sleeved clothing and protective gloves to prevent prolonged and repeated skin contact.
Eye Protection: Safety glasses with side shields or chemical goggles are recommended. Eye baths should be provided when direct eye contact is likely.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storage: Store in cool, dry, non-combustible buildings and avoid contamination. Automatic sprinklers are appropriate. Keep separate from other chemicals and combustible materials. Refer to applicable fire and building codes.
Empty containers may contain residue and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, flames, sparks or other sources of ignition without first thoroughly decontaminating the containers; they may evolve poisonous gas and cause injury or death.
Other Precautions: Drains in storage area should be plugged to prevent entry of molten material during fire conditions.

SECTION X - SPECIAL INFORMATION

EPCRA Section 311/312 Hazard Categorization

Acute	Chronic	Fire	Pressure	Reactive
X		X		

The reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR 372 may become applicable if the physical state of this product is changed to an aqueous solution. If an aqueous solution of this product is manufactured, processed, or otherwise used, the nitrate compounds category and ammonia listing of the previously referenced regulation should be reviewed.

Slightly toxic to aquatic organisms as defined by USEPA.

Disclaimer

Material Safety Data Sheet

Dyno Nobel Inc.
2795 East Cottonwood Parkway, Suite 500
Salt Lake City, Utah 84121
Phone: 801-364-4800 Fax: 801-321-6703
E-Mail: dnna.hse@am.dynonobel.com
FOR 24 HOUR EMERGENCY, CALL CHEMTREC (USA) 800-424-9300
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MSDS # 1118
Date 09/16/10

Supercedes
MSDS # 1118 08/13/08

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): Carbon Dioxide, Refrigerated Liquid

Synonyms: Carbonic Acid; Carbonic Anhydride; CO_2; Liquefied CO_2

Product Class: Carbon Dioxide

Product Appearance & Odor: Colorless gas, no odor.

DOT Hazard Shipping Description: UN2187 Carbon Dioxide, refrigerated liquid 2.2 II

Label Required: CARBON DIOXIDE, REFRIGERATED LIQUID

QT

NFPA Hazard Classification:

Health (Blue) =	3
Flammability (Red) =	0
Reactivity (Yellow) =	0

SECTION II - HAZARDOUS INGREDIENTS

			Occupational Exposure Limits	
Ingredients:	**CAS#**	**% (Range)**	**ACGIH TLV-TWA**	**OSHA PEL-TWA**
Carbon Dioxide	124-38-9	99.9	5,000 ppm 30,000 ppm (STEL)	5,000 ppm

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Sublimation Point: -78°C (-109°F) @ 1 atm
Vapor Density: 1.522 (air = 1)
Percent Volatile by Volume: 100%
Vapor Pressure: 60 atm (881.4 psia) @ 22.4°C (72.3°F)
Specific Gravity: 1.02 g/cc (8.5 lb/gal)
Solubility in Water: 0.14 g/100 g @ 0°C (32°F)

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not flammable
Flammable Limits: Not Flammable
Extinguishing Media: Not applicable
Special Fire Fighting Procedures: Not applicable.
Unusual Fire and Explosion Hazards: Not applicable.

SECTION V - HEALTH HAZARD DATA

Carcinogenicity: **NTP: No** **IARC Monographs: No** **OSHA Regulated: No**

Effects of Overexposure

Eyes: Contact with solid or gas from rapidly evaporating liquid can cause frostbite and freeze burns.
Skin: Contact with solid or gas from rapidly evaporating liquid can cause frostbite and freeze burns.
Ingestion: Not considered a likely scenario.
Inhalation: Carbon dioxide is the most powerful cerebral vasodilator known. Can result in increased respiration, dizziness, shortness of breath and headache. Exposure to high concentrations for a period of time can result in oxygen deficiency, effects of which may include rapid breathing, diminished mental alertness, impaired muscular coordination, faulty judgment, depression of all sensations, emotional instability, and fatigue. As asphyxiation progresses, nausea, vomiting, prostration, and loss of consciousness may result, eventually leading to convulsions, coma and death. Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.
Systemic or Other Effects: Agents such as CO_2, which can induce hypoxia at high concentrations, have been shown to produce teratogenic effects in laboratory animals. May aggravate pre-existing pulmonary conditions.

Emergency and First Aid Procedures

Eyes: In cases of freezing or cryogenic "burns" by rapidly evaporating liquid, remove the victim from the source of contamination and open eyelids wide to allow liquid/solid to evaporate/sublime. DO NOT WASH THE EYES WITH HOT OR EVEN TEPID WATER! If the victim cannot tolerate light, protect eyes from light with a bandage or handkerchief. Seek immediate medical attention, preferably from an Ophthalmologist.
Skin: Immediately flush the affected area with lukewarm, not **hot**, water. If a freeze burn has occurred, get medical attention.
Ingestion: Not considered a likely scenario.
Inhalation: Immediately remove to fresh air. Unconscious persons should be given supplemental oxygen. If breathing has stopped, apply artificial respiration. Keep warm and at rest. Get immediate medical attention for all cases of overexposure. Note: Carbon Dioxide has no warning properties!

Special Considerations: None.

Material Safety Data Sheet

SECTION VI - REACTIVITY DATA

Stability: Stable.
Conditions to Avoid: Protect vessel from source of heat that could lead to increased pressure.
Materials to Avoid (Incompatibility): Reactive metals such as potassium, sodium and magnesium. Other incompatible materials are acrylaldehyde, aziridine, cesium oxide, metal acetylides, and peroxides.
Hazardous Decomposition Products: Carbon Monoxide may be formed at temperatures above 1,700°C (3,092 °F).
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Keep spill response perimeter back to point of 19% (or more) oxygen. Wear self-contained breathing apparatus for any emergency situation requiring work in spill area. Follow applicable Federal, State and local reporting requirements.
Waste Disposal Method: Liquid Carbon Dioxide will evaporate over time and will not leave residue; no chemical clean up will be necessary. Vegetation, insects, reptiles, fish and small mammals contacted by liquid Carbon Dioxide and/or the vapor cloud may be injured or killed. Further environmental restoration measures may be required.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Provide adequate general and local exhaust ventilation to attain occupational exposure limits and to prevent the formation of an oxygen deficient atmosphere, particularly in a confined space area.
Respiratory Protection: Wearing of SCBA is required if containing large spills or upon entry into large tanks, vessels, and other designated confined space areas. Situations where airborne concentrations may exceed occupational exposure limits require proper ventilation.
Protective Clothing: CO_2 is extremely cold (–109°F, –78°C), contact with solid and/or gas may cause tissue damage. Wearing of appropriate protective clothing and gloves that provide some insulating ability is suggested to prevent contact with this chemical.
Eye Protection: CO_2 is extremely cold (–109°F, –78°C), contact with solid and/or gas may cause tissue damage. Remove contact lenses and wear safety glasses, chemical goggles or face shield when handling this chemical.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in compliance with all Federal, State, and local regulations. The high vapor pressure of liquid Carbon Dioxide is the main concern in storage. Protect vessel from puncture and store away from sources of heat that will cause the pressure to increase
Other Precautions: None.

Material Safety Data Sheet

SECTION X - SPECIAL INFORMATION

EPCRA Section 311/312 Hazard Categorization:

Acute	Chronic	Fire	Pressure	Reactive
X			X	

EPCRA & CAA Hazardous Substance Reporting Requirements:

Ingredient	CAS No.	% by wt.	CAA 112(r)	302 TPQ lb.	304 RQ lb.	313 TRI
none listed						

Key: **CAA 112(r) = Toxic Substance with potential for airborne release**
Sec. 302 TPQ = Extremely Hazardous Substances (EHS) Threshold Planning Quantity
Sec. 304 RQ = EHS and CERCLA Reportable Quantity if spilled
Sec. 313 TRI =Toxic Chemicals to be reported on Toxic Release Inventory if spilled

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Material Safety Data Sheet

Dyno Nobel Inc.
2795 East Cottonwood Parkway, Suite 500
Salt Lake City, Utah 84121
Phone: 801-364-4800 Fax: 801-321-6703
E-Mail: dnna.hse@am.dynonobel.com
FOR 24 HOUR EMERGENCY, CALL CHEMTREC (USA) 800-424-9300
CANUTEC (CANADA) 613-996-6666

MSDS # 1023
Date 09/16/10

Supercedes
MSDS # 1023 06/08/09

SECTION I - PRODUCT IDENTIFICATION

Trade Name: Nitric Acid **Chemical Name/Product Class:** Nitric Acid

Synonyms: 53%-68% Nitric Acid, Tower Acid, HNO_3

Product Appearance & Odor: Clear to yellowish/brown fuming liquid. Pungent, acrid odor.

DOT Hazard Shipping Description: **UN2031** Nitric Acid 8 II RQ*
Label: Corrosive

* "RQ" required only if container (drums, rail tank car, etc.) has 1,000 pounds or more of Nitric Acid.

NFPA Hazard Classification:
Health (Blue) = 3
Flammability (Red) = 0
Reactivity (Yellow) = 0
Special Hazard (White) = Oxidizer

HMIS Classification:

Health	3
Flammability	0
Reactivity	1
PPE	K

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	Occupational Exposure Limits ACGIH TLV-TWA	Occupational Exposure Limits OSHA PEL-TWA
Nitric Acid	7697-37-2	53-68	5 mg/m^3 10 mg/m^3 (STEL)	5 mg/m^3

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in de minimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: 117 - 121°C (243 - 250°F)

Vapor Pressure: 5.6-7.0 mm Hg at 20°C

Vapor Density: (Air=1) 2.2

Density: 1.33-1.41 g/cc @ 20°C

Percent Volatile by Volume: 100% at 122°C

Solubility in Water: Complete

Evaporation Rate (Butyl Acetate = 1): <1

Melting Point: - 20°C to - 40°C (- 4°F to – 40°F)

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable **Flammable Limits:** Not Applicable
Extinguishing Media: Water
Special Fire Fighting Procedures: Soak with water. Use water spray to cool containers and reduce and knock down vapors. Apply water from as far away as possible and avoid directing water into the acid. Neutralize small amounts of spilled acid with crushed limestone, soda ash or lime. Wear self-contained breathing apparatus and full fire-fighting protective gear.
Unusual Fire and Explosion Hazards: Will emit oxides of nitrogen upon heating. Strong oxidizer. May cause spontaneous combustion when in contact with organic or combustible materials. Reacts vigorously with water to liberate heat, fumes of nitric acid or nitrogen oxides.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: Will produce severe, immediate damage and may result in permanent damage or loss.
Skin: Will produce immediate, penetrating chemical burns, with a characteristic yellow coloration. Severe and fatal skin burns can occur with necrosis and scarring.
Ingestion: Will cause immediate irritation, chemical burns to mouth and throat, and may cause hemorrhaging, necrosis and perforation of the gastrointestinal tract. Based on toxicity data for other acids, not expected to be toxic by oral exposure as defined by OSHA.
Inhalation: Highly toxic by inhalation as defined by OSHA. Mild exposure may cause irritation and burning of the nose and throat. Extreme inhalation may cause difficult breathing, loss of consciousness, pulmonary edema or death. Lung damage may appear after a delay of up to 48 hours after exposure.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. Seek immediate medical attention.
Skin: Immediately remove contaminated clothing. Flush with running stream of water for at least fifteen minutes. Wash with soap. Seek medical attention.
Ingestion: **Do not induce vomiting.** Drink three or more glasses of water or milk to dilute acid. Seek immediate medical attention.
Inhalation: Remove from exposure immediately. Restore or support respiration. Seek immediate medical attention for unprotected exposures beyond exposure limits.
Special Considerations: If exposure to Nitric Acid vapor occurs, medical observation should continue for 24 - 48 hours after exposure. Delayed reactions may cause pulmonary edema.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions.
Conditions to Avoid: Avoid exposure to sunlight, which promotes oxide formation.
Materials to Avoid (Incompatibility): Bases. Organic and combustible materials. Will corrode most metals. Beware of containers, pumps, and hoses of inadequate construction and/or contamination by incompatible materials.
Hazardous Decomposition Products: Nitrogen Oxides (NO_x)
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Evacuate unnecessary personnel to safe area upwind of spill. Nitric acid vapor is denser than air and will concentrate in low spots. If necessary to enter spill area, wear full protective clothing including boots and proper breathing apparatus. Dike large spills and pump to salvage. If not possible to salvage, neutralize with soda ash or lime. If possible, carefully dilute the acid or the neutralizing material with water to slow down exceedingly vigorous neutralization reactions. Water spray can be used to reduce and knock down the vapors. Apply water from as far away as possible and avoid directing it into the acid. Do not get water in salvage containers since a violent reaction may occur. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. Follow Federal, State, and local spill reporting requirements.
Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any hazardous material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Mechanical ventilation and/or local exhaust is recommended where needed to meet TLV requirement.
Respiratory Protection: For concentrations above the exposure limits, use full face supplied air respirator approved by NIOSH for nitric acid or nitrogen oxide gases or mists. **Chemical cartridge or canister respirators are not suitable for nitric acid or nitrogen oxide use.**
Protective Clothing: Neoprene or PVC gloves are required. Where spill or splash potential exists, rubberized aprons or chemical resistant suits are strongly recommended.
Eye Protection: Acid proof goggles and face shield should be required where acid is transferred, sampled, or where persons are otherwise potentially exposed. Eye baths should be provided when direct contact is possible.
Other Precautions Required: Provide safety showers and eyewash in immediate vicinity.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storage: Store in clean, cool, well-ventilated area away from organic chemicals, bases, and metal powders.
Other Precautions: Avoid hydrocarbon lubricants and packing materials. Corrosion-resistant materials, such as stainless steel, must be used.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	% By Weight
Nitric Acid	7697-37-2	53 – 68%

Moderately toxic to aquatic organisms based on algae data and on fish data for other acids as defined by USEPA.

Disclaimer

MSDS

MATERIAL SAFETY DATA SHEET

24 Hour Emergency Telephone Number CHEMTREC 1-800-424-9300

SUNBELT CHEMICALS 71 HARGROVE GRADE PALM COAST, FLORIDA 32137

All non-emergency questions should be directed to Customer Service **(1-386-446-4595)** for assistance.

5.25% SODIUM HYPOCHLORITE SOLUTION (Household Bleach)

1. Product Identification

Synonyms: chlorinating solution, household bleach, a solution of chlorine in alkaline water.
CAS Number: 7681-52-9 **Product Name:** BRITE BLEACH
Part Number: 21280 **UPC Code:** 017926212806
Supplier GLN: 00179264004142 **GTIN:** 00179262128064

2. Composition/Information on Ingredients

Ingredient	CAS Number	Percent	Hazardous
sodium hypochlorite (NaOCl)	7681-52-9	5.25%	yes
water	7732-18-5	94.75%	no

3. Hazards Information

Emergency Overview

IRRITANT, HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. CAUSES SUBSTANTIAL, BUT TEMPORARY EYE INJURY.

Potential Health Effects

Inhalation: May cause irritation to the nose, throat and respiratory tract. Symptoms may include coughing and sore throat.

Ingestion: May cause nausea, vomiting and upset stomach.

Skin Contact: May irritate intact skin. May cause severe irritation to mucus membranes and broken skin.

Eye Contact: Eye contact may cause severe irritation and damage, especially at higher concentrations.

Chronic Exposure: A constant irritant to the eyes and throat. Low potential for sensitization after exaggerated exposure to broken skin or mucus membranes.

Aggravation of Pre-existing Conditions: Persons with impaired respiratory function, or hearts disorders (or disease) may be more susceptible to the effects of hypochlorite solutions.

Note to Physician: Consider oral administration of sodium thiosulfate solutions if sodium hypochlorite is ingested. Do not administer neutralizing agents, exothermic reaction may result and cause further damage.

4. First Aid Measures

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Seek immediate medical attention.

Ingestion: If swallowed DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Seek immediate medical attention.

Skin Contact: In case of contact with liquid, immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Seek immediate medical attention.

Eye Contact: Immediately flush eyes with plenty of flowing water for at least 15 minutes, while lifting upper and lower eyelids. Seek immediate medical attention.

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5. Fire Fighting Measures

NFPA ratings: Health **2** Flammability **0** Reactivity **0**

Fire: Not considered to be a fire hazard. Releases oxygen when heated, causing increased severity of an existing fire.

Explosion: Not considered to be an explosion hazard.

Fire Extinguishing Media: Water or water spray to cool fire exposed containers. Use any means to extinguish surrounding fire.

Special Information: In the event of fire, wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA), with full face shield, operated in positive pressure mode. Stay away from ends of tanks. Cool tanks and drums with water spray until well after fire is out.

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6. Accidental Release Measures

Adequately ventilate area of leak or spill. Wear appropriate personal protective equipment (PPE), as specified in Section 8. Isolate hazard area to keep unprotected personnel from entering. Stop the leak if possible. Contain and recover liquid when possible. Absorb spilled liquid with an inert material, such as vermiculite, sand, or earth and place recovered material in an approved, compatible chemical waste container. Do not use combustible materials such as cardboard or saw dust as an absorbent. Do not flush spilled liquid to the sewer. EPA regulations require reporting spills and releases to the soil, air and water, in excess of the reportable quantity (100 lbs of solution), to the National Response Center, telephone number 1-800-424-8802. Reporting to the State Emergency Response Commission (SERC) warning point and local authorities (911) is also required. Notify CHEMTREC, for specific information, in the event of any transportation related spills or leaks. (1-800-424-9300)

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7. Handling and Storage

Store in a cool, dry, ventilated storage area with good drainage. Protect from physical damage. Keep out of sunlight, away from direct heat, water and incompatible materials. Do not wash out container and use it for other purposes. Empty containers may be hazardous since they retain product residues of liquid and vapor. Observe all warnings and precautions stated on the container label. Wear personal protective equipment when handling, opening containers and using hypochlorite solutions.

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8. Exposure Control and Personal Protection

Airborne Exposure Limits:

OSHA Permissible Exposure Limit (PEL)	0.5 ppm (TWA)	1 ppm (STEL) as chlorine
NIOSH Relative Exposure Level (REL)	unavailable	
ACGIH Threshold Limit Value (TLV)	1 ppm (TWA)	3 ppm (STEL) as chlorine
NIOSH Immediately Dangerous Level (IDLH)	unavailable	

Ventilation: A system of local and/or general exhaust is recommended to keep exposure below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at it's source, preventing dispersion into occupied areas.

Personal Respirators (NIOSH Approved): If exposure limits are exceeded and engineering controls are not feasible, a full face respirator, with an acid gas cartridge, may be worn up to 50 times the permissible exposure limit (PEL). For emergencies or instances where the exposure levels are not known, use full face, positive pressure, air supplied respirator. WARNING, Air purifying respirators do not provide protection in oxygen deficient atmospheres.

Skin Protection: Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.

Eye Protection: Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick drench facilities (safety shower) in work areas.

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9. Physical and Chemical Properties

Appearance: Clear to yellowish liquid.

Odor: Chlorine like odor.

Solubility: Infinitely soluble in water.

Specific Gravity: 1.075 – 1.080

Percent Volatile: >98%

Boiling Point: >212 ^{o}F decomposes slightly

Vapor Density: unavailable

Vapor Pressure: 17.5 @ 68 ^{o}F (hypochlorite)

Evaporation Rate: < 1 (butyl acetate = 1)

pH: <11.4

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10. Stability and Reactivity

Stability: Slowly decomposes on contact with air. Decomposition rate increases with concentration and temperature. Exposure to sunlight accelerates decomposition. Sodium hypochlorite solutions become less toxic with age.

Hazardous Decomposition Products: When heated to decomposition, emits toxic chlorine fumes and will react with water or steam to produce heat and toxic, corrosive fumes. Thermal decomposition results in the emission of chlorine oxides.

Hazardous Polymerization: Will not occur.

Incompatibilities: Ammonia (chloramines gas may evolve), amines, ammonium salts, acids, methanol, cellulose, reducing agents, oxidizable metals, and bisulfates.

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11. Toxicological Information

Lethal ingested dose (LD50) in rats: 5800 mg/kg
Not listed on the OSHA, NTP or IARC list of carcinogens.

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12. Ecological Information

Environmental Fate: Decomposes in air and light to release chlorine gas, oxygen and sodium chloride solution (salt water).

Environmental Toxicity: Highly toxic to aquatic organisms.

13. Disposal Considerations

In case of a spill, flood area with large quantities of water. Small quantities of spilled or unusable product should be diluted with water before disposal to a sanitary sewer (through toilet).

State and local disposal regulations may slightly differ from Federal regulations. Dispose of waste in a facility permitted for non-hazardous waste.

Do not reuse empty container. Triple rinse container and place into trash or recycle bin where facilities accept pigmented white HDPE bottles.

Do not allow product to enter storm drains, lakes, streams or other bodies of water. Not harmful to septic systems.

14. Transport Information

Proper Shipping Name: Not Regulated

Full Shipping Description: Not Regulated

15. Regulatory Information

Regulated Ingredient: sodium hypochlorite (CAS # 7681-52-9)

TSCA Inventory Listed: Yes **CERCLA RQ:** 211.4 gals. of solution (100 lbs of hypochlorite)

SARA Title III, Section 302: Not listed **TPQ:** NA

SARA Title III, Section 312: Subject to Toxic Chemical Inventory Reporting

Acute: Yes **Chronic:** No **Fire:** No **Pressure:** No **Reactivity:** No

SARA Title III, Section 313: Not subject to Toxic Chemical Release Inventory Reporting

RCRA Hazardous Waste: Not a listed Hazardous Waste

Clean Air Act: Not a Listed Hazardous Air Pollutant (HAP)

16. Other Information

Label Hazard Warning:

IRRITANT, HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. CAUSES SUBSTANTIAL, BUT TEMPORARY EYE INJURY.

Label Precautions: Do not get in eyes, on skin, or on clothing. Avoid breathing vapor or mist. Keep container closed when not in use. Use with adequate ventilation. Wash thoroughly after handling. KEEP OUT OF REACH OF CHILDREN.

Label First Aid: If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water, for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. SEEK MEDICAL ATTENTION.

Material Safety Data Sheet

Dyno Nobel Inc.
2795 East Cottonwood Parkway, Suite 500
Salt Lake City, Utah 84121
Phone: 801-364-4800 Fax: 801-321-6703
E-Mail: dnna.hse@am.dynonobel.com
FOR 24 HOUR EMERGENCY, CALL CHEMTREC (USA) 800-424-9300
CANUTEC (CANADA) 613-996-6666

MSDS # 1138
Date 09/16/10

Supercedes
MSDS # 1138 05/30/06

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): Urea – Ammonium Nitrate Solution

Synonyms: UAN 23%, 26%, 32%; Non-Pressure Nitrogen Fertilizer Solution; Nitrogen Solution 23%, 32%; 23-0-0; 32-0-0

Product Class: Ammonium Nitrate Solutions; Urea Solutions

Product Appearance & Odor: Colorless liquid, may be dyed blue, slight ammonia odor.

DOT Hazard Shipping Description: Not hazardous per DOT regulations.

NFPA Hazard Classification:
Health (Blue) = 1
Flammability (Red) = 0
Reactivity (Yellow) = 0

SECTION II - HAZARDOUS INGREDIENTS

			Occupational Exposure Limits	
Ingredients:	**CAS#**	**% (Range)**	**ACGIH TLV-TWA**	**OSHA PEL-TWA**
Urea	57-13-6	28 - 37%	None	None
Ammonium Nitrate	6484-52-2	24 - 46%	None	None

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: 100°C (212°F) water
Vapor Pressure: Not applicable
Vapor Density: Not applicable
Specific Gravity: 1.29 – 1.33 g/cc (10.8 – 11.1 lb/gal)
Percent Volatile by Volume: Not applicable
Solubility in Water: soluble
Crystallization Temperature: -11°C (12°F) for 32.5% and 0°C (32°F) for 40% solution

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not applicable **Flammable Limits:** Not applicable
Extinguishing Media: Not applicable
Special Fire Fighting Procedures: Cool containing vessels with flooding quantities of water until well after fire is out. Firefighters should wear self-contained breathing apparatus and full protective clothing if Urea-Ammonium Nitrate solution reaches decomposition temperature.
Unusual Fire and Explosion Hazards: Material will not burn but thermal decomposition may result in flammable/toxic gases being formed if evaporated to near dryness. Dry residue may form explosive mixtures with organic materials. Avoid temperatures above 100°C (212°F) which may result in evaporation, thermal decomposition or explosion. May explode by detonation, heat or shock when evaporated to near dryness. Solution may detonate if subjected to heat and pressure. If evaporated to dryness, acts as an oxidizing agent, supports combustion by liberating oxygen even if smothered.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: Dried salts or liquid may cause redness, pain and irritation to eye.
Skin: Dried salts or liquid may irritate skin resulting in reddening of the skin and possible dermatitis. Frequent or prolonged contact may promote an allergic reaction.
Ingestion: Dried salts or liquid may cause gastric irritation, nausea, abdominal spasms, vomiting and faintness. Large doses may cause systemic acidosis and methemoglobinemia.
Inhalation: Dried salts may be irritating to mucous membranes, respiratory tract, causing sore throat, coughing, difficult breathing and severe lung congestion. Delayed reactions may result in pulmonary edema and chemical pneumonitis.
Systemic or Other Effects: The smell of ammonia, in the vapor space above the liquid, or dried salt may aggravate preexisting dermatitis and lung conditions.
Carcinogenicity: **NTP: No** **IARC Monographs: No** **OSHA Regulated: No**

Emergency and First Aid Procedures

Eyes: Immediately flush with large amounts of water, including under the eyelids. If discomfort persists contact a physician, preferably an Ophthalmologist. Speed and thoroughness in rinsing eyes are important to avoid permanent injury.
Skin: Immediately remove contaminated clothing and shoes. Wash the affected area with soap and flush with large amounts of water. Get medical attention if discomfort persists.
Ingestion: Do not induce vomiting. If vomiting occurs, keep head below hips to help prevent aspiration. Get immediate medical attention. Treat for methemoglobinemia.
Inhalation: Remove to fresh air. If breathing has stopped, apply artificial respiration. Keep warm and at rest. Get immediate medical attention.
Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable.
Conditions to Avoid: Avoid exposing containers to heat or flame. Keep separated from incompatible materials.
Materials to Avoid (Incompatibility): Concentrated acids, strong bases, and heat.
Hazardous Decomposition Products: Ammonia and Nitrogen Oxides (Nitric Oxide and Nitrogen Dioxide).
Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Remove sources of heat or ignition. Contain spills as much as possible. Do not flush to surface water. Spilled chemical can be used as fertilizer. Follow applicable Federal, State and local reporting requirements.
Waste Disposal Method: Dispose through a licensed waste disposal company. Follow federal, state and local regulations. Contaminated dirt may be spread as a fertilizer.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Provide adequate general and local exhaust ventilation to attain occupational exposure limits, particularly in a confined space area.
Respiratory Protection: Dried salt or aerosol solution will dissolve with mucosal membrane contact (lungs). Use approved respiratory protective equipment for cleaning large spills or upon entry into large tanks, vessels, and other designated confined space areas or in any situations where airborne concentrations may exceed occupational exposure limits. (15 mg/m^3, dust)
Protective Clothing: UAN 32% is an aqueous salt solution and will dissolve with perspiration contact. Wearing of appropriate protective clothing and gloves is suggested if epidermal sensitivity develops.
Eye Protection: UAN 32% is an aqueous salt solution and will dissolve with mucosal membrane contact (eyes). Remove contact lenses and wear safety glasses, chemical goggles or face shield where contact with liquid or dried salt may occur.
Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in compliance with all Federal, State, and local regulations. Store in a well ventilated area, away from incompatible materials or sources of heat and ignition. Empty containers may contain residue and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind or expose such containers to heat, flames, sparks or other sources of ignition; they may evolve noxious fumes.
Other Precautions: Never heat a dried UAN solution, especially when confined. Never combine with nitric acid.

Material Safety Data Sheet

SECTION X - SPECIAL INFORMATION

EPCRA Section 311/312 Hazard Categorization:

Acute	Chronic	Fire	Pressure	Reactive
X				

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number (Use Toxic Chemical Category Code)	% By Weight
Nitrate Compounds (Water dissociable reportable only when in aqueous solution)	N511	24 – 46%
Ammonia (Aqueous from dissociable salts)	7664-41-7	6 – 13%

Slightly toxic to aquatic organisms as defined by USEPA.

Disclaimer

Dyno Nobel Inc. and its subsidiaries disclaim any warranties with respect to this product, the safety or suitability thereof, the information contained herein, or the results to be obtained, whether express or implied, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND/OR OTHER WARRANTY. The information contained herein is provided for reference purposes only and is intended only for persons having relevant technical skills. Because conditions and manner of use are outside of our control, the user is responsible for determining the conditions of safe use of the product. Buyers and users assume all risk, responsibility and liability whatsoever from any and all injuries (including death), losses, or damages to persons or property arising from the use of this product or information. Under no circumstances shall either Dyno Nobel Inc. or any of its subsidiaries be liable for special, consequential or incidental damages or for anticipated loss of profits.

Appendix D

Draft Emergency Action Plan

for

Federal Bureau of Investigation

at the

Columbia County Firearms Range Complex

Revised 09 DEC 2011

1. The party responsible for maintaining this emergency action plan, training range users in this emergency action plan, and for managing an emergency at this location is:

Primary: Special Agent Michael Burdick Phone:
Secondary: Senior Range Instructor present Phone:

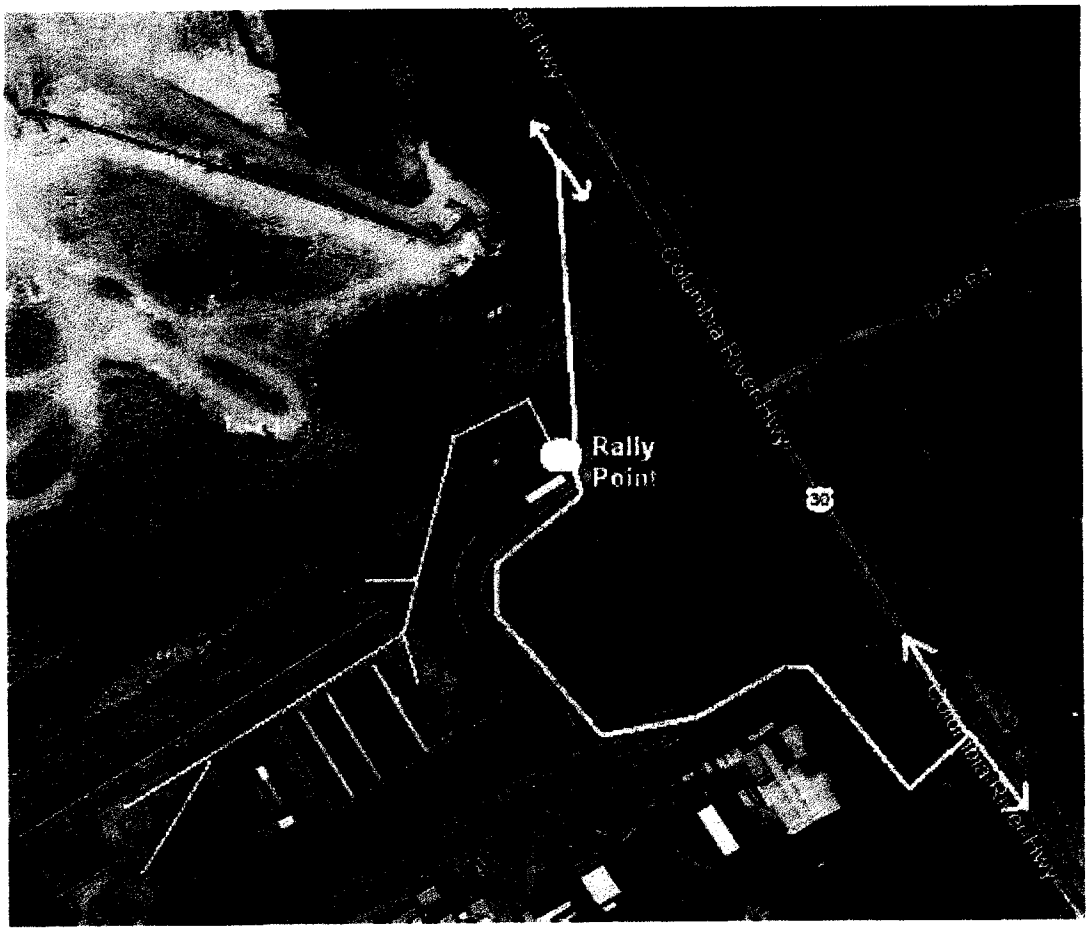
2. The responsible party shall ensure all FBI range users check in and out of the range complex so personal accountability can be maintained in an emergency.

3. The responsible party shall inform the Dyno Nobel control room when FBI personnel arrive at the range complex and when they vacate the range complex.

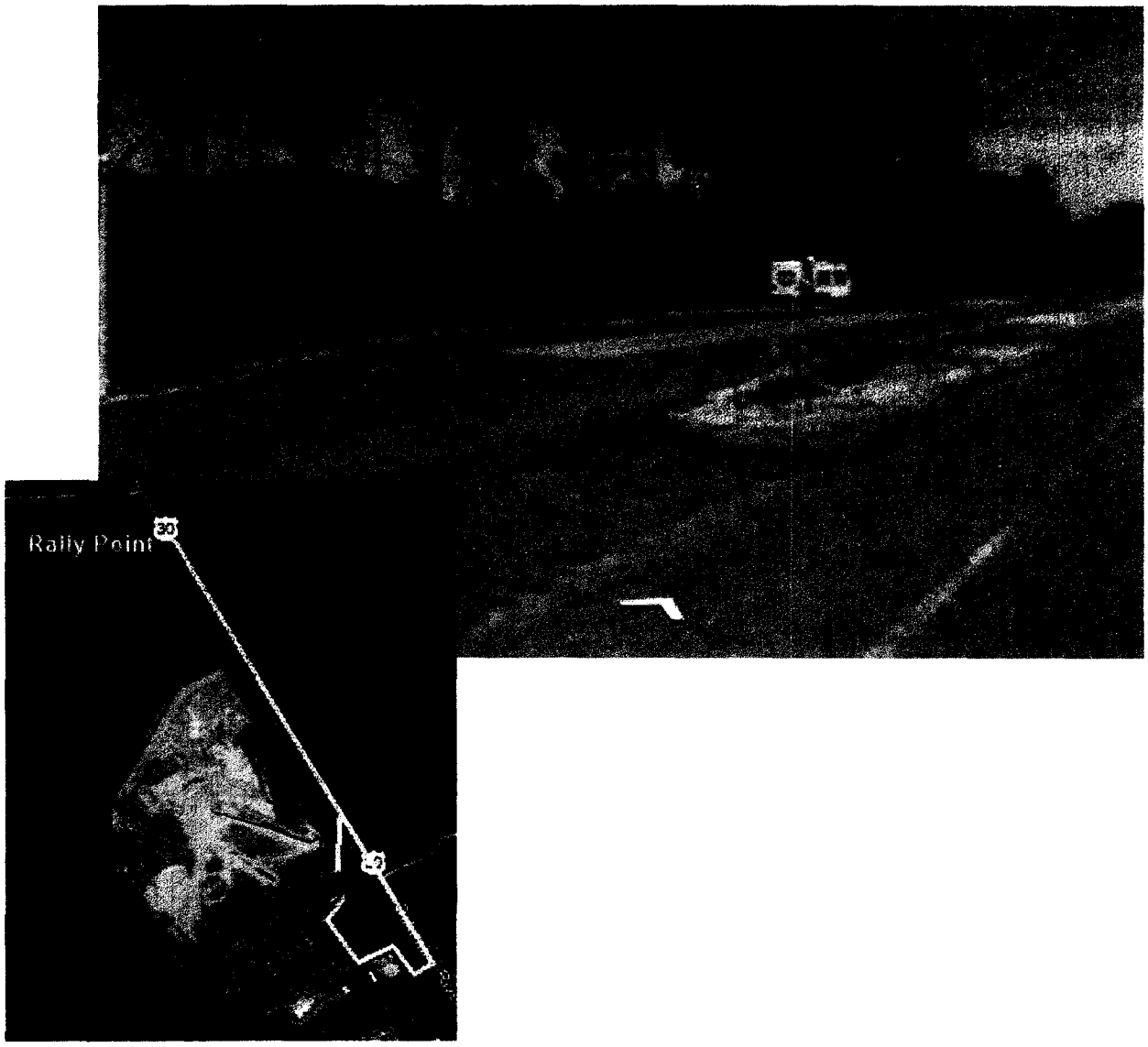
Primary: Dyno Nobel Control Room Phone:
Secondary: Dyno Nobel Safety & Health Phone: 503.939.5649

4. If the ammonia sensors detect ammonia the alarms will flash and sound (describe locations of strobes, sound of horn/siren). If you smell or otherwise detect ammonia or another chemical within the range complex the alarm can be activated manually by (describe location and activation of alarm pulls). If the alarms are activated:
    a. All FBI personnel shall meet at the training building (rally point) for personal accountability.
    b. The responsible party shall contact Dyno Nobel to determine the situation and determine whether evacuation is necessary.
    c. If the rally point is not safe proceed directly to evacuation.

5. Automobiles are the preferred means of evacuation as they are fast and provide some protection from the environment. If the driveway is not safe use the stairs at the north end of the range and evacuate by foot. Note the wind direction indicated by the windsock and move upwind or crosswind via Columbia River Highway (US 30) to get out of the chemical release plume as quickly as possible. Stop at the north or south rally point if personal accountability was not tallied at the range.



Evacuation routes from the Columbia County Firearms Range Complex



North evacuation route from the Columbia County Firearms Range Complex and north rally point.