San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

JUN 29 2018

Sav Mancieri
Lawrence Livermore National Laboratory
PO Box 808, Mail drop: L-627
Livermore, CA 94551

Re: Notice of Preliminary Decision - Authority to Construct
Facility Number: N-472
Project Number: N-1173492

Dear Mr. Mancieri:

Enclosed for your review and comment is the District's analysis of Lawrence Livermore National Laboratory's application for an Authority to Construct for open detonation of non-radiactive explosive material, at Site 300 building 851 complex, located in rural foothills approximately six miles southwest of Tracy, California.

The notice of preliminary decision for this project will be published approximately three days from the date of this letter. After addressing all comments made during the 30-day public notice period, the District intends to issue the Authority to Construct. Please submit your written comments on this project within the 30-day public comment period, as specified in the enclosed public notice.

Thank you for your cooperation in this matter. If you have any questions regarding this matter, please contact Mr. Jag Kahlon of Permit Services at (209) 557-6452.

Sincerely,

Arnaud Marjollet
Director of Permit Services

AM: JK

Enclosures

cc: Tung Le, CARB (w/ enclosure) via email

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San Joaquin Valley Air Pollution Control District

Authority to Construct Application Review

Open Detonation of Non-Radioactive Explosive Materials

Facility Name:	Lawrence Livermore National Lab	Date:	June 26, 2018
Mailing Address:	PO Box 808 L-627 Livermore, CA 94551	Engineer:	Jag Kahlon
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Application #(s):	N-472-84-0		
Project #:	N-1173492		
Deemed Complete:	December 19, 2017		

I. Proposal

Lawrence Livermore National Lab (LLNL) is requesting an Authority to Construct (ATC) permit to conduct open-air detonations of non-radioactive, conventional explosive material on an existing outdoor 7,057 square-foot firing table in a secured existing Department of Energy/National Nuclear Security Administration (DOE/NNSA) testing facility, known as the Site 300 Building 851 complex. The proposed operation will use up to 1,000 pounds per day and 7,500 pounds per year of explosive material. Since the proposed material usage rate is greater than District's permit exemption[1] thresholds of 100 pounds per day and 1,000 pounds per year, the proposed operation is subject to the San Joaquin Valley Air Pollution Control District's (District) permitting requirements. According to LLNL, the proposed increase in conventional explosives is necessary so they can conduct experiments, each with its own objective, design, and execution, to gather research data vital to the United States counterterrorism and counterproliferation program and stockpile stewardship program missions detailed in the DOE/NNSA's Final Environmental Assessment report DOE/EA-2076[2].

II. Potentially Applicable Rules

Rule 2020	Exemptions (12/18/14)
Rule 2201	New and Modified Stationary Source Review Rule (2/18/16)
Rule 2410	Prevention of Significant Deterioration (6/16/11)
Rule 2520	Federally Mandated Operating Permits (6/21/01)
Rule 4001	New Source Performance Standards (4/14/99)

[1] Section 7.4 of District Rule 2020 (12/18/14)

[2] https://www.energy.gov/sites/prod/files/2018/03/f49/EA-2076_FINAL%20EA.pdf

Rule 4002	National Emissions Standards for Hazardous Air Pollutants (5/20/04)
Rule 4101	Visible Emissions (2/17/05)
Rule 4102	Nuisance (12/17/92)
Rule 4103	Open Burning (6/1/10) – ***Not Applicable***
Rule 4106	Prescribed Burning and Hazard Reduction Burning (6/21/01) – ***Not Applicable***
Rule 4201	Particulate Matter Concentration (12/17/92)
Rule 4202	Particulate Matter – Emission Rate (12/17/92)
Rule 4801	Sulfur Compounds (12/17/92)
CH&SC 41700	Health Risk Assessment
CH&SC 42301.6	School Notice

Public Resources Code 21000-21177: California Environmental Quality Act (CEQA)
California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000-15387: CEQA Guidelines

III. Project Location

The proposed operation will be located at an existing DOE/NNSA secured testing facility at Site 300, Building 851 complex. This site is located in rural foothills approximately six miles southwest of Tracy, California. This site is not within 1,000 feet of the outer boundary of any K-12 school. Therefore, the public notification requirement of California Health and Safety Code 42301.6 is not applicable to this project. See section VIII (Compliance Determination) of this document to see evaluation of other potential public notification requirements.

IV. Process Description

The existing outdoor firing table at the Building 851 complex has been in operation since 1962, and has been used since that time to conduct various experiments related to research objectives involving outdoor explosives detonations. According to LLNL, this firing table is designed to conduct tests for "shape charge" explosives, which are directional explosives. The explosives are discharged toward an existing, 35-foot-high soil berm on the Northwest side of the firing table, which is designed to contain fragments from the explosion. The explosives experiments at this existing firing table have historically not used more than 100 pounds of explosives per day or 1,000 pounds of explosives per year, so this explosives testing operation was exempt from District permit requirements.

Under this project, LLNL is proposing to increase the explosives used for these experiments to a maximum of 1,000 pounds per day and 7,500 pounds per year, which will make the operation subject to District permit requirements. As mentioned earlier, LLNL claims this increase in explosives usage is necessary to accomplish research objectives to support the DOE/NNSA's counterterrorism and counterproliferation and stockpile stewardship program missions, which are described below.

As mentioned earlier, the proposed project will support the DOE/NNSA's counterterrorism, counterproliferation, and stockpile stewardship program missions. According to LLNL, the counterterrorism and counterproliferation program missions require the design and execution of experiments to better understand the impacts of improvised explosives, explosive devices, and similar weapons commonly used in terrorist activities under real life conditions. The data from these experiments will be used to develop countermeasures against those real life terrorist threats. Likewise, LLNL states the stockpile stewardship program mission requires the design and execution of experiments to obtain a better understanding of the performance characteristics of the existing nuclear weapons stockpile without having to test those nuclear weapons. To support this mission, LLNL will design and conduct "hydrodynamic" and "equation of state" experiments. Hydrodynamic experiments investigate the fluid-like movement of solid materials at the center of an explosion, and equation of state experiments investigate the relationships between pressure, volume, and temperature for a given substance. The data gathered from the hydrodynamic and equation of state experiments will be used to develop and enhance the computer models used to predict nuclear weapon performance over a wide range of conditions and scenarios without having to actually test those weapons.

Furthermore, LLNL claims these experiments must be conducted outdoors, and cannot be conducted in their existing confined firing facility (CFF) or in any reasonably sized temporary or permanent enclosure. For instance, their existing permitted CFF has a structural limitation of no more than 132 pounds of explosive material detonation per experiment, so LLNL's existing CFF is not suitable for the proposed experiments necessary to meet their mission requirements.

According to LLNL, a primary component of these experiments is the high-speed photographic analysis of the explosion shockwave and evaluation of incremental pathways and interactions of the materials as they are being transformed during and immediately after the explosion. When total data collection time needs extend beyond 20 milliseconds, such experiments must be conducted outdoors to avoid shockwave reflections and interferences from deflected accelerating materials during the explosion. A permanent or temporary containment of a reasonably achievable size would obscure this vital experimental data; therefore, it is not practically feasible to conduct these experiments in a reasonably sized CFF. Please refer to the District's Best Available Control Technology (BACT) analysis in **Appendix B** of this document for a more detailed analysis of options to control emissions from the proposed operation.

For each experiment, once the necessary experiment appurtenances and instruments are installed, LLNL will install and align a firing stand above the firing table. The explosive assembly will then be loaded onto the firing stand. On the day of the detonation, LLNL will conduct a final inspection of the entire setup to ensure that fragment shields, instrumentation, etc. are all properly placed. Upon completing these steps, the assembly will be detonated on the firing stand. Instrumentation is used to observe and gather data on the pressures, temperatures, and shockwaves generated from the unconstrained detonation of conventional explosives in an open-air environment.

As mentioned earlier, neither the proposed explosive compounds nor the test assemblies will contain any radioactive materials. LLNL states that the explosive detonations will be directed toward the protective berm. In order to accommodate the proposed project, LLNL will prepare the site by reinforcing the existing 3-foot-deep gravel firing table by placing a concrete pad or metal plate on top, placing clean gravel over the ground within a 121 foot (37 meter) radius of the firing table, and reinforcing the existing 35-foot-high, soil berm facing the firing table with concrete. The berm is located at the edge of the gravel bed on the Northwest side of the firing table, so the ground around the firing table and between the firing table and the berm will be completely covered with clean gravel. Together, the reinforced firing table, clean gravel bed, and reinforced berm will prevent disturbance of the underlying soils and will control propagation of the explosion shockwave sufficiently to prevent any of the surface soils beyond 121 feet of the firing table from being disturbed and entrained into the air by the explosion shockwave.

Prior to each detonation, LLNL staff will inspect the firing table, gravel bed, and concrete-reinforced berm and will make any repairs necessary to ensure the structural integrity of the firing table and berm. LLNL will also replace any displaced gravel with new, clean gravel.

V. Equipment Listing

N-472-84-0: OPEN-AIR DETONATION OF NON-RADIOACTIVE EXPLOSIVE ASSEMBLIES ON A 7,057 SQUARE FOOT FIRING TABLE LOCATED AT THE BUILDING 851 COMPLEX AT SITE 300

VI. Emission Control Technology Evaluation

The sources of potential emissions from the proposed project are:

1. Detonation of explosives and fragmentation of the assembly containing the explosives

   The combustion of the explosive materials and the surrounding assembly will result in emissions of a variety of pollutants, including nitrogen oxides, carbon monoxide, volatile organic compounds, particulate matter, sulfur oxides, and a variety of other hazardous air compounds, as discussed later in this evaluation. Due to the necessary open-air nature of the experiment and experimental objectives, containment and capture of emissions from the detonation of the explosives is not practical. Therefore, no control equipment is proposed for emissions that are directly emitted from detonation the explosives and assembly.

2. Surface cratering and surface scouring due to the explosion shockwave

   The shockwave from the explosives detonation may potentially also generate particulate matter from surface cratering of the firing table and from the surface scouring of the ground near the firing table. LLNL used the Army Research Laboratory's Combined Obscuration Model for Battlefield Induced Contaminants (COMBIC) to determine the area that could potentially be affected from shockwave propagation from the proposed largest explosive detonations. The model results showed that detonation of 1,000 pounds of explosives on the open-air firing table could affect an area up to 121 feet (37 meters) from the center of

the firing table. This area includes firing table itself, concrete structures (instrument enclosures), berm, roads inside the complex, and other unpaved surfaces.

LLNL has proposed to prepare and reinforce all these areas prior to each detonation experiment. For instance, LLNL will prepare the site by reinforcing the existing 3-foot-deep gravel firing table by placing a concrete pad or metal plate on top, placing clean gravel over the ground within a 121 foot (37 meter) radius of the firing table, and reinforcing the existing 35-foot-high, soil berm facing the firing table with concrete. The berm is located at the edge of the gravel bed on the Northwest side of the firing table (the direction of the directional explosions), so the ground around the firing table and between the firing table and the berm will be completely covered with clean gravel. Together, the reinforced firing table, clean gravel bed, and reinforced berm will prevent any disturbance of the underlying soils and will control propagation of the explosion shockwave sufficiently to prevent any of the surface soils beyond 121 feet of the firing table from being disturbed and entrained into the air by the explosion shockwave. LLNL proposes to inspect the firing table, gravel bed, concrete reinforced berm, and the areas beyond after each detonation and make any necessary repairs prior to the next detonation.

The District will include permit conditions to enforce LLNL's proposed site preparation actions.

VII. General Calculations

A. Assumptions

- Assumptions will be stated as they are made during the evaluation.
- To streamline emission calculations, $PM_{2.5}$ emissions are conservatively assumed to be equal to PM_{10} emissions.

B. Emission Factors

Please refer to **Appendix C** for details on the emission factors.

C. Calculations

1. Pre-Project Potential to Emit (PE1)

Since this is a new operation, PE1 is zero for all pollutants.

2. Post Project Potential to Emit (PE2)

The proposed open-air detonations will release several pollutants into the atmosphere. The maximum hourly and annual potential emissions are listed in **Appendix C** of this document. Note that since only one detonation will occur in a given day and emissions from a single detonation occur in less than an hour, the hourly emissions from this proposal are set equal to daily emissions.

Table below summarizes the daily and annual emission rates of criteria pollutants from the proposed operation. For a full list of emission rates of all pollutants, please refer to **Appendix C**.

Pollutant	PE2 (lb/day)	PE2 (lb/year)
NO_X	31.0	233
SO_X	0.0	0
PM_{10}	167.0	1,324
CO	4.8	36
VOC	15.6	117

3. Pre-Project Stationary Source Potential to Emit (SSPE1)

Pursuant to District Rule 2201, the SSPE1 is the Potential to Emit (PE) from all units with valid Authorities to Construct (ATC) or Permits to Operate (PTO) at the Stationary Source and the quantity of Emission Reduction Credits (ERC) that have been banked since September 19, 1991 for Actual Emissions Reductions (AER) that have occurred at the source, and which have not been used on-site. The potential emissions for each permit unit are provided in **Appendix D** of this document.

SSPE1 (lb/year)					
Category	**NO_X**	**SO_X**	**PM_{10}**	**CO**	**VOC**
$SSPE1_{Permit\ Unit}$	1,761	5	11,720	2,593	16,409
$Total_{ERC}$	175	63	17	43	4
SSPE1	**1,936**	**68**	**11,737**	**2,636**	**16,413**

4. Post Project Stationary Source Potential to Emit (SSPE2)

Pursuant to District Rule 2201, the SSPE2 is the PE from all units with valid ATCs or PTOs at the Stationary Source and the quantity of ERCs that have been banked since September 19, 1991 for AER that have occurred at the source, and which have not been used on-site.

SSPE2 (lb/year)					
Category	**NO_X**	**SO_X**	**PM_{10}**	**CO**	**VOC**
$SSPE1_{Permit\ Unit}$	1,761	5	11,720	2,593	16,409
N-472-84-0	**233**	**0**	**1,324**	**36**	**117**
$SSPE2_{Permit\ Unit}$	1,994	5	13,044	2,629	16,526
$Total_{ERC}$	175	63	17	43	4
SSPE2	**2,169**	**68**	**13,061**	**2,672**	**16,530**

5. Major Source Determination

Rule 2201 Major Source Determination:

Pursuant to District Rule 2201, a Major Source is a stationary source with a SSPE2 equal to or exceeding one or more of the following threshold values. For the purposes of determining major source status the following shall not be included:

- Any ERCs associated with the stationary source
- Emissions from non-road IC engines (i.e. IC engines at a particular site at the facility for less than 12 months)
- Fugitive emissions, except for the specific source categories specified in 40 CFR 51.165

Rule 2201 Major Source Determination (lb/year)						
Category	**NO_X**	**SO_X**	**PM_{10}**	***$PM_{2.5}$**	**CO**	**VOC**
SSPE1	1,761	5	11,720	11,720	2,593	16,409
SSPE2	1,994	5	13,044	13,044	2,629	16,526
Major Source Threshold	20,000	140,000	140,000	140,000	200,000	20,000
Major Source? (Y/N)	N	N	N	N	N	N

*$PM_{2.5}$ are assumed to be equal to PM_{10}

As seen in the table above, the facility is not an existing Major Source and is not becoming a Major Source as a result of this project.

Rule 2410 Major Source Determination:

The facility or the equipment evaluated under this project is not listed as one of the categories specified in 40 CFR 52.21 (b)(1)(iii). Therefore, the PSD Major Source threshold is 250 tpy for any regulated NSR pollutant.

PSD Major Source Determination (tons/year)						
Category	**NO_2**	**VOC**	**SO_2**	**CO**	**PM**	**PM_{10}**
Estimated Facility PE before Project Increase	0.9	8.2	0.0	1.3	5.9	5.9
PSD Major Source Thresholds	250	250	250	250	250	250
PSD Major Source? (Y/N)	N	N	N	N	N	N

As shown above, the facility is not an existing PSD major source for any regulated NSR pollutant expected to be emitted at this facility.

6. Baseline Emissions (BE)

The BE calculation (in lb/year) is performed pollutant-by-pollutant for each unit within the project to calculate the QNEC, and if applicable, to determine the amount of offsets required.

Pursuant to District Rule 2201, BE = PE1 for:

- Any unit located at a non-Major Source,
- Any Highly-Utilized Emissions Unit, located at a Major Source,
- Any Fully-Offset Emissions Unit, located at a Major Source, or
- Any Clean Emissions Unit, located at a Major Source.

Otherwise,

BE = Historic Actual Emissions (HAE), calculated pursuant to District Rule 2201.

Since the proposed operation is a new operation, PE1 is zero for each pollutant.

7. SB 288 Major Modification

SB 288 Major Modification is defined in 40 CFR Part 51.165 as "any physical change in or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any pollutant subject to regulation under the Act."

Per section VII.C.5 of this document, this facility is not a major source for any pollutant. Thus, this project will not trigger an SB 288 major modification.

8. Federal Major Modification

District Rule 2201 states that a Federal Major Modification is the same as a "Major Modification" as defined in 40 CFR 51.165 and part D of Title I of the CAA.

Per section VII.C.5 of this document, this facility is not a major source for any pollutant. Thus, this project will not trigger a Federal major modification.

9. Rule 2410 – Prevention of Significant Deterioration (PSD) Applicability Determination

Rule 2410 applies to any pollutant regulated under the Clean Air Act, except those for which the District has been classified nonattainment. The pollutants which must be addressed in the PSD applicability determination for sources located in the SJV and which are emitted in this project are (See 52.21 (b) (23) definition of significant):

- NO_2 (as a primary pollutant)
- SO_2 (as a primary pollutant)

- CO
- PM, PM_{10}
- Lead
- Fluorides
- Hydrogen sulfide (H_2S)
- Total reduced sulfur (inlcuding H_2S)
- Reduced sulfur compounds

I. Project Emissions Increase - New Major Source Determination

The post-project potentials to emit from all new and modified units are compared to the PSD major source thresholds to determine if the project constitutes a new major source subject to PSD requirements.

The facility or the equipment evaluated under this project is not listed as one of the categories specified in 40 CFR 52.21 (b)(1)(iii). The PSD Major Source threshold is 250 tpy for any regulated NSR pollutant.

PSD Major Source Determination: Potential to Emit (tons/year)						
Category	**NO_2**	**VOC**	**SO_2**	**CO**	**PM**	**PM_{10}**
Total PE from New and Modified Units	0.1	0.1	0.0	0.0	0.7	0.7
PSD Major Source threshold	250	250	250	250	250	250
New PSD Major Source? (Y/N)	N	N	N	N	N	N

As seen in the above table, the facility is not a major PSD source for any pollutant.

Furthermore, the emissions increases of lead, fluoride, hydrogen sulfide, total reduced sulfur compounds (including H_2S) and reduced sulfur compounds (see table in **Appendix C)** from the proposed project are compared with the Significant Thresholds in the following table.

Pollutant	Proposed Emission Increase	Significance Threshold	PSD Major Source?
Lead	1.82 lb/yr (0 tons/yr)	0.6 tons/yr	N
Fluoride (including hydrogen fluoride and sulfur hexafluoride)	315 lb/yr (0.2 tons/yr)	3 tons/yr	N
Hydrogen Sulfide	2 lb/yr (0 tons/yr)	10 tons/yr	N
Total Reduced Sulfur (including sulfur and hydrogen sulfide)	4 lb/yr (0 tons/yr)	10 tons/yr	N
Reduced Sulfur (including sulfur)	2 lb/yr (0 tons/yr)	10 tons/yr	N

Therefore, it is concluded that Rule 2410 is not applicable and no further analysis is required.

10. Quarterly Net Emissions Change (QNEC)

The QNEC is calculated solely to establish emissions that are used to complete the District's PAS emissions profile screen. Detailed QNEC calculations are included in **Appendix F**.

VIII. Compliance Determination

Rule 2020 Exemptions

Although LLNL currently operates an existing open-air explosives detonation operation at the proposed site, it is exempt from District air permit requirements per Section 7.4 of District Rule 2020 because the explosives usage does not exceed 100 lb/day and 1,000 lb/year.

With this project, LLNL is proposing to increase the explosives usage to 1,000 lb/day and 7,500 lb/year, so this operation is now subject to District air permit requirements. Therefore, the proposed open-air explosives detonation operation will be evaluated as a new emission unit.

Rule 2201 New and Modified Stationary Source Review Rule

A. Best Available Control Technology (BACT)

1. BACT Applicability

BACT requirements are triggered on a pollutant-by-pollutant basis and on an emissions unit-by-emissions unit basis. Unless specifically exempted by Rule 2201, BACT shall be required for the following actions*:

- Any new emissions unit with a potential to emit exceeding two pounds per day for any Affected Pollutant,
- The relocation from one Stationary Source to another of an existing emissions unit with a potential to emit exceeding two pounds per day for any Affected Pollutant,
- Modifications to an existing emissions unit with a valid Permit to Operate resulting in an Adjusted Increase in Permitted Emissions (AIPE) exceeding two pounds per day for any Affected Pollutant, and/or
- Any new or modified emissions unit, in a stationary source project, which results in an SB 288 Major Modification or a Federal Major Modification, as defined by the rule.

*Except for CO emissions from a new or modified emissions unit at a Stationary Source with an SSPE2 of less than 200,000 pounds per year of CO.

a. New emissions units – PE > 2 lb/day

Per Section VII.C.2 above, the potential emissions from the proposed open-air explosives detonation operation are greater than 2 lb/day for NOx, VOC, CO, and PM_{10}. As shown in Section VII.C.5 above, this facility's total CO emissions are less than 200,000 lb/year, so BACT is not triggered for CO emissions.

Therefore, BACT is triggered for NOx, VOC, and PM_{10} emissions.

Other pollutants (HAPs and Toxics) with potential emissions greater than 2.0 lb/day will be addressed via District's Air Toxics Policy APR-1905 via Toxics-BACT (T-BACT).

b. Relocation of emissions units – PE > 2 lb/day

None of the emission units is being relocated from one stationary source to another; therefore, BACT is not triggered for relocation of an emission unit.

c. Modification of emissions units – AIPE > 2 lb/day

The proposed project does not involve modification of any existing permitted emissions units. Therefore, BACT is not triggered for modification of an emission unit.

d. SB 288/Federal Major Modification

As discussed in Sections VII.C.7 and VII.C.8 above, this project does not constitute an SB 288 and/or Federal Major Modification for any pollutant. Therefore, BACT is not triggered for any pollutant.

2. BACT Guideline

NO_x, PM_{10}, VOC

No valid guideline exists that appropriately address BACT for the proposed open-air explosives detonation operation; therefore, a Top Down BACT analysis will be performed to create a new BACT guideline for this source category.

3. Top-Down BACT Analysis

Based on the Top-Down BACT Analysis in **Appendix B** of this document, the following emission control techniques are required:

NOx, VOC: None

PM_{10}: Use concrete or metal pad on open air firing table; use clean gravel over surrounding surface that could potentially be affected by the explosion (i.e. skirt area); use concrete-reinforced protrusion (e.g. berm, or similar other object(s)) surrounding the skirt area. The following conditions will be included in the permit:

- The 7,057 square foot firing table shall be comprised of at least a 3-foot-deep gravel bed covered with a concrete cap or a metal plate thick enough to prevent particulate matter emissions from surface cratering of the underlying soils. [District Rules 2201 and 4102]

- The berm area facing the firing table shall have at least a 6-inch thick concrete lining to prevent particulate matter emissions from surface scouring of the underlying soils. [District Rules 2201 and 4102]

- Clean gravel shall be laid to a sufficient depth over the ground surface (except for paved/concrete areas) from the firing table pad out to at least a 121 foot (37 meter) radius from the center of the firing table to prevent particulate matter emissions from surface scouring of the underlying soils. [District Rules 2201 and 4102]

- Explosive detonations shall not disturb surface soils beyond a 121-foot radius from the center of the firing table. [District Rules 2201 and 4102]

- Prior to each detonation, the permittee shall inspect the firing table, concrete-lined berm, and surrounding areas and shall resurface the firing table pad, replace any displaced gravel, and resurface the concrete-lined berm as necessary to prevent the explosion from disturbing any underlying soils and any surface soils. The permittee shall keep records of each inspection including any firing table resurfacing, berm resurfacing, and/or gravel replacement performed. [District Rules 2201 and 4102]

- The permittee shall keep sufficient records of each detonation and the subsequent inspections of the firing table pad, berm, gravel bed, and the surrounding areas to demonstrate that each detonation has not disturbed the surface soils beyond 121 feet from the firing table. [District Rules 2201 and 4102]

B. Offsets

1. Offset Applicability

Offset requirements shall be triggered on a pollutant-by-pollutant basis and shall be required if the SSPE2 equals or exceeds the offset threshold levels in Table 4-1 of Rule 2201. The SSPE2 is compared to the offset thresholds in the following table.

Offset Determination (lb/year)					
Category	NO_X	SO_X	PM_{10}	CO	VOC
SSPE2	2,169	68	13,061	2,672	16,530
Offset Thresholds	20,000	54,750	29,200	200,000	20,000
Offsets Triggered? (Y/N)	N	N	N	N	N

2. Quantity of Offsets Required

As seen above, the SSPE2 is not greater than the offset thresholds for any criteria pollutant. Therefore offset calculations are not necessary and offsets will not be required for this project.

C. Public Notification

1. Applicability

Public noticing is required for:

- New Major Sources, Federal Major Modifications, and SB 288 Major Modifications,
- Any new emissions unit with a Potential to Emit greater than 100 pounds during any one day for any one Affected Pollutant,
- Any project which results in the offset thresholds being surpassed,
- Any project with an SSIPE of greater than 20,000 lb/year for any Affected Pollutant, and/or
- Any project which results in a Title V significant permit modification

a. New Major Sources, Federal Major Modifications, and SB 288 Major Modifications

New Major Sources are new facilities, which are also Major Sources. Since this is not a new facility, public noticing is not required for this project for New Major Source purposes.

As demonstrated in Sections VII.C.7 and VII.C.8, this project does not constitute an SB 288 or Federal Major Modification; therefore, public noticing for SB 288 or Federal Major Modification purposes is not required.

b. PE > 100 lb/day

The PE2 for this new unit is compared to the daily PE Public Notice thresholds in the following table:

PE > 100 lb/day Public Notice Thresholds			
Pollutant	**PE2 (lb/day)**	**Public Notice Threshold**	**Public Notice Triggered?**
NO_X	31.0	100 lb/day	No
SO_X	0.0	100 lb/day	No
PM_{10}	167.0	100 lb/day	**Yes**
CO	4.8	100 lb/day	No
VOC	15.6	100 lb/day	No

Additionally, the potential emissions for other pollutants shown in **Appendix C** are not greater than 100 lb/day.

Since PM_{10} emissions are greater than 100 lb/day, public notice is required for this project.

c. Offset Threshold

The SSPE1 and SSPE2 are compared to the offset thresholds in the following table.

Offset Thresholds				
Pollutant	**SSPE1 (lb/year)**	**SSPE2 (lb/year)**	**Offset Threshold**	**Public Notice Required?**
NO_X	1,936	2,169	20,000 lb/year	No
SO_X	68	68	54,750 lb/year	No
PM_{10}	11,737	13,061	29,200 lb/year	No
CO	2,636	2,672	200,000 lb/year	No
VOC	16,413	16,530	20,000 lb/year	No

As detailed above, there were no thresholds surpassed with this project; therefore, public noticing is not required for offset purposes. Note that the other pollutants shown in **Appendix** C do not have offset thresholds.

d. SSIPE > 20,000 lb/year

Public notification is required for any permitting action that results in a SSIPE of more than 20,000 lb/year of any Affected Pollutant. According to District policy, the SSIPE = SSPE2 – SSPE1. The SSIPE is compared to the SSIPE Public Notice thresholds in the following table.

SSIPE Public Notice Thresholds					
Pollutant	**SSPE2 (lb/year)**	**SSPE1 (lb/year)**	**SSIPE (lb/year)**	**SSIPE Public Notice Threshold**	**Public Notice Required?**
NO_X	2,169	1,936	233	20,000 lb/year	No
SO_X	68	68	0	20,000 lb/year	No
PM_{10}	13,061	11,737	1,324	20,000 lb/year	No
CO	2,672	2,636	36	20,000 lb/year	No
VOC	16,530	16,413	117	20,000 lb/year	No

Additionally, SSIPE for pollutants shown in **Appendix C** are less than 20,000 lb/yr. Therefore, public noticing for SSIPE purposes is not required.

e. Title V Significant Permit Modification

Since this facility is not a major source, it does not have a Title V operating permit, so this change is not a Title V significant Modification.

2. Public Notice Action

As discussed above, public noticing is required for this project for PM_{10} emissions in excess of 100 lb/day. Therefore, the District's preliminary decision and supporting documents will be submitted to the California Air Resources Board (CARB) for a 30-day review period, and public notice of the District's preliminary decision published in a local newspaper of general circulation, which will begin a 30-day public comment period on the proposed preliminary decision. The District will consider and respond to all comments received during the 30-day comment period prior to making a final decision on the proposed project.

D. Daily Emission Limits (DELs)

DELs and other enforceable conditions are required by Rule 2201 to restrict a unit's maximum daily emissions, to a level at or below the emissions associated with the maximum design capacity. The DEL must be contained in the latest ATC and contained in or enforced by the latest PTO and enforceable, in a practicable manner, on a daily basis. DELs are also required to enforce the applicability of BACT.

Proposed Rule 2201 (DEL) Conditions:

- No radioactive materials shall be used in the explosives, the explosive assemblies, or in any part of the structures or appurtenances associated with any experiment conducted at the firing table at the Building 851 complex. [District Rules 2201 and 4102]

- Emissions shall not exceed any of the following limits: NOx (as NO2) – 0.031 lb/lb of explosive detonated; SOx (as SO2) – 0.00004 lb/lb of explosive detonated, PM10 – 0.167 lb/lb of explosive detonated, CO – 0.0048 lb/lb of explosive detonated, VOC – 0.0156 lb/lb of explosive detonated. [District Rules 2201 and 4102]

- The quantity of explosives detonated shall not exceed any of the following limits: 1,000 lb/day and 7,500 lb/year. [District Rules 2201 and 4102]

- No more than one explosive detonation shall be conducted during any one day. [District Rule 2201]

- The explosives shall be discharged toward the berm facing the firing table. [District Rule 2201]

- The 7,057 square foot firing table shall be comprised of at least a 3-foot-deep gravel bed covered with a concrete cap or a metal plate thick enough to prevent particulate

matter emissions from surface cratering of the underlying soils. [District Rules 2201 and 4102]

- The berm area facing the firing table shall have at least a 6-inch thick concrete lining to prevent particulate matter emissions from surface scouring of the underlying soils. [District Rules 2201 and 4102]

- Clean gravel shall be laid to a sufficient depth over the ground surface (except for paved/concrete areas) from the firing table pad out to at least a 121 foot (37 meter) radius from the center of the firing table to prevent particulate matter emissions from surface scouring of the underlying soils. [District Rules 2201 and 4102]

- Explosive detonations shall not disturb surface soils beyond a 121-foot radius from the center of the firing table. [District Rules 2201 and 4102]

- Prior to each detonation, the permittee shall inspect the firing table, concrete-lined berm, and surrounding areas and shall resurface the firing table pad, replace any displaced gravel, and resurface the concrete-lined berm as necessary to prevent the explosion from disturbing any underlying soils and any surface soils. The permittee shall keep records of each inspection including any firing table resurfacing, berm resurfacing, and/or gravel replacement performed. [District Rules 2201 and 4102]

- The permittee shall keep sufficient records of each detonation and the subsequent inspections of the firing table pad, berm, gravel bed, and the surrounding areas to demonstrate that each detonation has not disturbed the surface soils beyond 121 feet from the firing table. [District Rules 2201 and 4102]

E. Ambient Air Quality Analysis (AAQA)

As part of this analysis, the District's Technical Services Division performed an AAQA to determining whether the emissions increases from the proposed operation will cause or make worse a violation of an ambient air quality standard. Refer to **Appendix E** of this document for the AAQA summary sheet.

The proposed location is in an attainment area for NO_X, CO, and SO_X. As shown by the AAQA summary sheet the proposed equipment will not cause a violation of an air quality standard for NO_X, CO, or SO_X.

The proposed location is in a non-attainment area for the State's PM_{10} as well as federal and State $PM_{2.5}$ thresholds. As shown by the AAQA summary sheet the proposed equipment will not cause a violation of an air quality standard for PM_{10} and $PM_{2.5}$.

F. Compliance Assurance

1. Source Testing

Due to the necessarily unconfined nature of the detonations, source testing is not possible.

2. Monitoring

LLNL is a DOE facility and is subject to a Federal National Emissions Standard for Hazardous Air Pollutants (NESHAPS) - 40 CFR Part 61 Subpart H (National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities). Subpart H requires monitoring to ensure that radiation from DOE facilities not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 millirems. LLNL continually monitors this site to ensure compliance with Subpart H.

The District has not been delegated authority by the US EPA to enforce Subpart H; however, District has confirmed with US EPA Region 9 staff that LLNL is in compliance with Subpart H (see correspondence in **Appendix G**), and must continue to demonstrate compliance after the proposed project that is the subject of this evaluation takes place.

No additional monitoring has been found by the District to be necessary to assure compliance with local, state, and federal regulations.

3. Recordkeeping

The daily and annual emissions are limited in terms of explosives usage. Daily and annual records of explosives usage will be required to determine compliance with those limitations.

Rule 2410 Prevention of Significant Deterioration

As shown in Section VII.C.9 above, this project does not result in a new PSD major source or PSD major modification. No further discussion is required.

Rule 2520 Federally Mandated Operating Permits

Since this facility's potential emissions do not exceed any major source thresholds of Rule 2201, this facility is not a major source, and Rule 2520 does not apply.

Rule 4001 New Source Performance Standards (NSPS)

This rule incorporates NSPS from Part 60, Chapter 1, Title 40, Code of Federal Regulations (CFR); and applies to all new sources of air pollution and modifications of existing sources of air pollution listed in 40 CFR Part 60. However, no subparts of 40 CFR Part 60 apply to open detonation of non-radioactive explosive materials.

Rule 4002 National Emission Standards for Hazardous Air Pollutants (NESHAPs)

This rule incorporates NESHAPs from Part 61, Chapter I, Subchapter C, Title 40, CFR and the NESHAPs from Part 63, Chapter I, Subchapter C, Title 40, CFR; and applies to all sources of hazardous air pollution listed in 40 CFR Part 61 or 40 CFR Part 63.

LLNL is a DOE facility and is subject to a Federal National Emissions Standard for Hazardous Air Pollutants (NESHAPS) - 40 CFR Part 61 Subpart H (National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities). Subpart H requires that radiation at DOE facilities not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 millirems. LLNL continually monitors this site to ensure compliance with Subpart H.

The District has not been delegated authority by the US EPA to enforce Subpart H; however, District has confirmed with US EPA Region 9 staff that LLNL is in compliance with Subpart H (see correspondence in **Appendix G**). According to US EPA Region 9, LLNL's most recent annual monitoring report for Site 300 showed a radiation amount of 0.00022 millirems, which is well below the 10 millirem/yr limit specified in Subpart H. Since the proposed explosives detonation operation will not involve any radioactive materials, the proposed operation is not expected to result in any increase in radiation exposure profile at the Building 851 firing table area. Therefore, although the District is not authorized to enforce the relevant requirements, the District has determined that the proposed project will not adversely affect LLNL's ability to comply with Subpart H.

Rule 4101 Visible Emissions

Rule 4101 states that no person shall discharge into the atmosphere emissions of any air contaminant aggregating more than 3 minutes in any hour which is as dark as or darker than Ringelmann 1 (or 20% opacity). The following conditions will be included in the permit:

- No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

Compliance with this rule is expected.

Rule 4102 Nuisance, and California Health and Safety Code 41700

Rule 4102 prohibits discharge of air contaminants, which could cause injury, detriment, nuisance or annoyance to the public. The following condition will be included in the permit:

- No air contaminant shall be released into the atmosphere, which causes a public nuisance. [District Rule 4102]

In addition, the District has analyzed the potential health risk impact of the proposal under District Policy APR 1905 – *Risk Management Policy for Permitting New and Modified Sources*, which prohibits any permit from creating a new health risk nuisance. This policy specifies that for an increase in emissions associated with a proposed new source or modification, the District must perform an analysis to determine the possible health risks to the nearest resident or worksite.

District Policy APR 1905 specifies that the increase in emissions associated with a proposed project cannot result in acute or chronic risk indices, or a cancer risk greater than the following significance levels:

- Acute risk index greater than 1
- Chronic risk index greater than 1
- Cancer risk greater than 20 in a million (20E-6)

The District performed a Health Risk Assessment (HRA) to determine the short-term acute risk index, long-term chronic risk index, and the maximum cancer risk from increased emissions of hazardous air pollutants that could potentially be emitted by the proposed project (**Appendix E**).

A summary of the HRA results is presented in the following table:

HRA Summary			
Unit	**Acute Hazard Index**	**Chronic Hazard Index**	**Maximum Individual Cancer Risk**
N-472-84-0	2.89E-01	1.27E-04	3.95E-10
Project Totals	2.89E-01	1.27E-04	3.95E-10
Facility Totals	2.93E-01	5.23E-03	1.54E-05

The HRA results in the above table show that the acute and chronic risk indices are below 1.0 and the cancer risk associated with the project is many orders of magnitude lower than 20 in a million. Therefore, the proposed project is not expected cause any significant health risk to the nearby community.

Furthermore, District Policy APR 1905 states that the Best Available Control Technology for toxic emissions (T-BACT) is required if the cancer risk from the project exceeds one in one million (1.0E-6). As shown in the table above, the emissions of hazardous air pollutants are so low that the maximum cancer risk associated with the proposed project is much less than one in one million. Therefore, T-BACT is not required for any pollutant emitted by the proposed project.

Therefore, compliance is with Rule 4102 and Section 41700 of the California Health and Safety Code is expected.

Rule 4103 Open Burning

This rule applies to open burning conducted in the San Joaquin Valley Air Basin, with the exception of prescribed burning and hazard reduction burning as defined in Rule 4106 (Prescribed Burning and Hazard Reduction Burning).

Section 3.23 of this rule define Open Burning or Open Outdoor Fire as the combustion of any combustible refuse or other material of any type outdoors in the open air, not in any enclosure, where the products of combustion are not directed through a flue. For the purposes of this rule, prescribed burning and hazard reduction burning are not considered to be open burning.

This rule prohibits the use of open burning, except as specifically provided for in the rule, "for the purpose of burning or disposal of petroleum wastes; demolition or construction debris; residential rubbish; garbage or vegetation; tires; tar; trees; wood waste; or other combustible or flammable solid, liquid or gaseous waste; or for metal salvage or burning of motor vehicle bodies."

The proposed operation is not for the purpose of burning or disposing of any of these materials; rather, it is to gather scientific data vital to the research in DOE/NNSA's Counterterrorism, Counterproliferation and Stockpile Stewardship Program missions. Therefore, the proposed operation is not subject to the requirements of this rule.

Rule 4106 Prescribed Burning and Hazard Reduction Burning

The provisions of this rule apply to all prescribed burning, and to hazard reduction burning in wildland/urban interface.

Section 3.7 of this rule defines *Hazard Reduction Burning* as the burning of flammable vegetation that has been removed and cleared away from buildings or structures in compliance with local ordinances to reduce fire hazard pursuant to Section 4291 of the California Public Resources Code for the purpose of maintaining a firebreak of up to 100 feet from such buildings or structures.

Section 3.12 of this rule defines *Prescribed Burning* as the planned application of fire, including natural or accidental ignition, to vegetation on lands selected in advance of such application to meet specific planned resource management objectives as set forth in section 3.11. The resource management objectives include forest management, wildlife habitat management, range improvement, fire hazard reduction, wilderness management, weed abatement, watershed rehabilitation, vegetation manipulation, disease and pest prevention, and ecosystem management.

The proposed operation does not meet hazed reduction burning or prescribed burning definitions; therefore, it is not subject to the requirements of this rule.

Rule 4201 Particulate Matter Concentration

Section 3.0 states that a person shall not release or discharge into the atmosphere from any single source operation, dust, fumes, or total suspended particulate matter emissions in excess of 0.1 grain per cubic foot of gas at dry standard conditions, as determined by the test methods in section 4.0.

This rule is intended for industrial processes where the emissions can be reasonably passed through an exhaust stack that can be tested utilizing the test methods in section 4.0 of this rule.

Given the nature of the proposed project, the discharge from the proposed operation cannot be reasonably captured and passed through a stack, therefore, this rule does not apply.

Rule 4202 Particulate Matter – Emission Rate

Section 4.0 requires that a person shall not discharge into the atmosphere from any source operation, particulate matter in excess of that allowed by one of the following applicable equation:

$E = 3.59\ P^{0.62}$, P is process weight less than or equal to 30 tons/hr
$E = 17.31\ P^{0.16}$, P is process weight greater than 30 tons/hr

E = Emissions in pounds per hour
P = Process weight rate in tons per hour

This rule is not intended for processes that occur over a very short duration, such as the proposed open-air detonation of explosives. However, the proposed operation will comply with this rule, as demonstrated below:

Explosive weight = 1,000 lb
Time = 0.1 to 0.3 milliseconds; conservatively, 0.3 milliseconds (8.333×10^{-8} hours) are used.

$P = (1{,}000\ lb)/(8.333 \times 10^{-8}\ hr)$
$= 1.2 \times 10^{10}$ lb/hr, or 6,000,240 tons/hr

Since the process weight is greater than 30 tons/hr, the maximum allowable emissions would be:

$E_{max} = 17.31 \times (6{,}000{,}240\ tons/hr)^{0.16}$
$= 210$ lb/hr

$E_{proposed}$ = 167 lb-PM/hr

Since the proposed emission rate is less than the maximum allowable emissions, compliance with this rule is expected.

California Health & Safety Code 42301.6 (School Notice)

The District has verified that this site is not located within 1,000 feet of a school. Therefore, pursuant to Section 42301.6 of the California Health and Safety Code, a school notice is not required.

California Environmental Quality Act (CEQA)

CEQA requires each public agency to adopt objectives, criteria, and specific procedures consistent with CEQA Statutes and the CEQA Guidelines for administering its responsibilities under CEQA, including the orderly evaluation of projects and preparation of environmental documents. The District adopted its *Environmental Review Guidelines* (ERG) in 2001. The basic purposes of CEQA are to:

- Inform governmental decision-makers and the public about the potential, significant environmental effects of proposed activities;
- Identify the ways that environmental damage can be avoided or significantly reduced;
- Prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible; and
- Disclose to the public the reasons why a governmental agency approved the project in the manner the agency chose if significant environmental effects are involved.

District CEQA Findings

The District is the Lead Agency for this project because there is no other agency with broader statutory authority over this project. The District performed an Engineering Evaluation (this document) for the proposed project and determined that the activity will occur at an existing facility and the project involves negligible expansion of the existing use. Furthermore, the District determined that the activity will not have a significant effect on the environment. The District finds that the activity is categorically exempt from the provisions of CEQA pursuant to CEQA Guideline § 15301 (Existing Facilities), and finds that the project is exempt per the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment (CEQA Guidelines §15061(b)(3)). For additional information on the exemption analysis, please refer to **Appendix H** (CEQA Notice of Exemption Assessment).

IX. Additional Investigation

Potentially Contaminated Soils in Building 851 firing table area

The District has heard from members of the public that an area of potential concern is the possible entrainment and dispersion of surrounding soils, which may be contaminated due to previous research activities at this site.

LLNL Site 300 is designated as a USEPA Superfund site (site identification number CA 2890090002), so this area of concern was investigated by the District. According to USEPA's Superfund website for this facility, Site 300 is undergoing long-term remediation and clean-up activities in accordance with a Federal Facility Agreement. However, according to page 2-27, paragraph 2.7.2.11, of the July 2008 Site-Wide Record of Decision for Site 300, "*no risks or hazard associated with contaminants in surface soil, subsurface soil/bedrock, or ground water were identified for the Building 851 Firing Table area in the baseline risk assessment*[3].

In addition, as mentioned earlier, LLNL will be required to employ specific, enforceable site preparation measures to prevent disturbance, entrainment, and dispersion of the soils beneath and surrounding the Building 851 firing table. LLNL will be required by permit conditions discussed earlier in this document to perform these site preparation and inspection measures prior to each detonation event, and to prevent the proposed open-air explosives detonation operation from disturbing any soils either beneath the firing table or in the areas beyond the gravel bed and berm. Because the proposed explosives operation will not disturb or entrain any of the underlying or surrounding soils into the atmosphere, the District is confident that the proposed operation will not pose a health risk to the public.

X. Recommendation

The proposed open-air explosives detonation operation will comply with all applicable air quality rules and regulations. Furthermore, the District's analysis indicates that air contaminant emissions from the proposed project will not adversely affect the District's progress in attaining compliance with State and Federal ambient air quality standards, and will not pose a significant health risk to the public.

Therefore, pending a successful Public Noticing process, the District recommends issuance of ATC N-472-84-0 subject to the permit conditions on the attached draft ATC in **Appendix A**.

XI. Billing Information

Annual Permit Fees			
Permit Number	**Fee Schedule**	**Fee Description**	**Annual Fee**
N-472-84-0	3020-06	Miscellaneous	$116

[3] https://semspub.epa.gov/work/09/100002581.pdf.

Appendixes

A: Draft ATC
B: BACT Analysis
C: Potential to Emit Calculations
D: SSPE1 Calculations
E: HRA and AAQA Summary
F: Quarterly Net Emissions Change
G: Correspondence with EPA Region 9
H: CEQA Notice of Exemption Assessment
I: GHG Calculations

Appendix A
Draft ATC

San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

PERMIT NO: N-472-84-0

ISSUANCE DATE: DRAFT

LEGAL OWNER OR OPERATOR: LAWRENCE LIVERMORE NATL. LAB
MAILING ADDRESS: ATTN: SAV MANCIERI
PO BOX 808 L-627
LIVERMORE, CA 94551

LOCATION: CORRAL HOLLOW RD
TRACY, CA 95376

EQUIPMENT DESCRIPTION:
OPEN-AIR DETONATION OF NON-RADIOACTIVE EXPLOSIVE ASSEMBLIES ON A 7,057 SQUARE FOOT FIRING TABLE LOCATED AT THE BUILDING 851 COMPLEX AT SITE 300

CONDITIONS

1. {98} No air contaminant shall be released into the atmosphere which causes a public nuisance. [District Rule 4102]
2. {15} No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]
3. No radioactive materials shall be used in the explosives, the explosive assemblies, or in any part of the structures or appurtenances associated with any experiment conducted at the firing table at the Building 851 complex. [District Rules 2201 and 4102]
4. Explosive detonations shall not disturb surface soils beyond a 121-foot radius from the center of the firing table. [District Rules 2201 and 4102]
5. The 7,057 square foot firing table shall be comprised of at least a 3-foot-deep gravel bed covered with a concrete cap or a metal plate thick enough to prevent particulate matter emissions from surface cratering of the underlying soils. [District Rules 2201 and 4102]
6. The berm area facing the firing table shall have at least a 6-inch thick concrete lining to prevent particulate matter emissions from surface scouring of the underlying soils. [District Rules 2201 and 4102]
7. Clean gravel shall be laid to a sufficient depth over the ground surface (except for paved/concrete areas) from the firing table pad out to at least a 121 foot (37 meter) radius from the center of the firing table to prevent particulate matter emissions from surface scouring of the underlying soils. [District Rules 2201 and 4102]

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (209) 557-6400 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of all other governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

Arnaud Marjollet, Director of Permit Services

N-472-84-0 Jun 20 2016 4:12PM -- KATILONJ Joint Inspection NOT Required

8. Prior to each detonation, the permittee shall inspect the firing table, concrete-lined berm, and surrounding areas and shall resurface the firing table pad, replace any displaced gravel, and resurface the concrete-lined berm as necessary to prevent the explosion from disturbing the underlying soils and the surface soils beyond the perimeter of the Building 851 complex. [District Rules 2201 and 4102]

9. Emissions shall not exceed any of the following limits: NOx (as NO2) - 0.031 lb/lb of explosive detonated; SOx (as SO2) - 0.00004 lb/lb of explosive detonated, PM10 - 0.167 lb/lb of explosive detonated, CO - 0.0048 lb/lb of explosive detonated, VOC - 0.0156 lb/lb of explosive detonated. [District Rules 2201 and 4102]

10. The quantity of explosives detonated shall not exceed any of the following limits: 1,000 lb/day and 7,500 lb/year. [District Rule 2201]

11. Sulfur hexafluoride emissions shall not exceed 21.6 lb/year. [California Environmental Quality Act]

12. No more than one explosive detonation shall be conducted during any one day. [District Rule 2201]

13. The explosives shall be discharged toward the berm facing the firing table. [District Rule 2201]

14. The permittee shall keep sufficient records of each detonation and the subsequent inspections of the firing table pad, berm, gravel bed, and the surrounding areas to demonstrate that each detonation has not disturbed the surface soils beyond 121 feet from the firing table. [District Rules 2201 and 4102]

15. The permittee shall maintain records of the following items: (1) Date, (2) Time of detonation, (3) Amount of explosive detonated (lb/day), (4) Total amount of explosive detonated (lb/year) in a rolling 12 consecutive month period, and (5) Total amount of sulfur hexafluoride (lb/year) emissions in a rolling 12 consecutive month period. [District Rule 2201 and California Environmental Quality Act]

16. {3246} All records shall be maintained and retained on-site for a period of at least 5 years and shall be made available for District inspection upon request. [District Rule 1070]

Appendix B
BACT Analysis

San Joaquin Valley
Unified Air Pollution Control District
Best Available Control Technology (BACT) Guideline X.Y.Z

Emission Unit:	Explosive Detonation – When unrestrained detonations or outdoor environmental conditions are required	**Industry Type:**	National Laboratory
Equipment Rating:	≤ 1,000 lb/day and 7,500 lb/yr of explosive detonation	**Last Update:**	June 26, 2018

Pollutant	Achieved in Practice or contained in SIP	Technologically Feasible	Alternate Basic Equipment
NOx	None	Contained firing facility large enough to safely enclose the explosives detonation operation without compromising the experimental objectives due to interference effects from the containment walls, and route the captured emissions to appropriate emission control equipment (90% overall emission reductions for NOx).	
PM_{10}	Use of an open air firing table consisting of at least a 3-foot-deep gravel bed covered with concrete or a metal pad; use clean gravel over surrounding ground that could potentially be affected by the explosion shockwave (i.e. skirt area); use concrete-reinforced protrusion (e.g., berm, or similar other object(s)) surrounding the skirt area	Contained firing facility large enough to safely enclose the explosives detonation operation without compromising the experimental objectives due to interference effects from the containment walls, and route the captured emissions to appropriate emission control equipment (99% overall emission reductions for PM10).	
VOC	None	Contained firing facility large enough to safely enclose the explosives detonation operation without compromising the experimental objectives due to interference effects from the containment walls, and route the captured emissions to appropriate emission control equipment (99% overall emission reductions for VOC).	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

***This is a Summary Page for this Class of Source - Permit Specific BACT Determinations on Next Page(s)**

San Joaquin Valley
Unified Air Pollution Control District

Best Available Control Technology (BACT) Guideline X.Y.Z

Emission Unit:	Explosive Detonation – When unrestrained detonations or outdoor environmental conditions are required	**Equipment Rating:**	≤ 1,000 lb/day and 7,500 lb/yr of explosive detonation
Facility:	Lawrence Livermore National Lab	**References:**	N-472-84-0
Location:	Corral Hollow Road, Tracy, CA	**Determination:**	June 26, 2018

Pollutant	BACT Requirements
NOx	None
PM_{10}	Use of an open air firing table consisting of at least a 3-foot-deep gravel bed covered with concrete or a metal pad; use clean gravel over surrounding ground that could potentially be affected by the explosion shockwave (i.e. skirt area); use concrete-reinforced protrusion (e.g., berm, or similar other object(s)) surrounding the skirt area
VOC	None

BACT Status:

__ Achieved in practice __ Small Emitter __ T-BACT

__ Technologically feasible BACT

__ At the time of this determination achieved in practice BACT was equivalent to technologically feasible BACT

__ Contained in EPA approved SIP

X The following technologically feasible options were not cost effective:

- Contained firing facility large enough to safely enclose the explosives detonation operation without compromising the experimental objectives due to interference effects from the containment walls, and route the captured emissions to appropriate emission control equipment

__ Alternate Basic Equipment

__ The following alternate basic equipment was not technologically feasible:

BACT ANALYSIS

Facility Name:	Lawrence Livermore National Lab	Date: June 26, 2018
Mailing Address:	PO Box 808 L-627 Livermore, CA 94551	
Contact Person:	Wilfred Montemayor	
Telephone:	(925) 423-1152	
Application #:	N-472-84-0	
Project #:	N-1173492	

I. Proposal

Lawrence Livermore National Lab (LLNL) is requesting an Authority to Construct (ATC) permit to conduct open-air detonations of non-radioactive, conventional explosive material on an existing outdoor 7,057 square-foot firing table in a secured existing Department of Energy/National Nuclear Security Administration (DOE/NNSA) testing facility, known as the Site 300 Building 851 complex. The proposed operation will use up to 1,000 pounds per day and 7,500 pounds per year of explosive material. Since the proposed material usage rate is greater than District's permit exemption thresholds of 100 pounds per day and 1,000 pounds per year, the proposed operation is subject to the San Joaquin Valley Air Pollution Control District's (District) permitting requirements. According to LLNL, the proposed increase in conventional explosives is necessary so they can conduct experiments, each with its own objective, design, and execution, to gather research data vital to the United States counterterrorism and counterproliferation program and stockpile stewardship program missions detailed in the DOE/NNSA's Final Environmental Assessment report DOE/EA-2076 .

II. Process Description

The existing outdoor firing table at the Building 851 complex has been in operation since 1962, and has been used since that time to conduct various experiments related to research objectives involving outdoor explosives detonations. According to LLNL, this firing table is designed to conduct tests for "shape charge" explosives, which are directional explosives. The explosives are discharged toward an existing, 35-foot-high soil berm on the Northwest side of the firing table, which is designed to contain fragments from the explosion. The explosives experiments at this existing firing table have historically not used more than 100 pounds of explosives per day or 1,000 pounds of explosives per year, so this explosives testing operation was exempt from District permit requirements.

Under this project, LLNL is proposing to increase the explosives used for these experiments to a maximum of 1,000 pounds per day and 7,500 pounds per year, which

will make the operation subject to District permit requirements. As mentioned earlier, LLNL claims this increase in explosives usage is necessary to accomplish research objectives to support the DOE/NNSA's counterterrorism and counterproliferation and stockpile stewardship program missions, which are described below.

As mentioned earlier, the proposed project will support the DOE/NNSA's counterterrorism, counterproliferation, and stockpile stewardship program missions. According to LLNL, the counterterrorism and counterproliferation program missions require the design and execution of experiments to better understand the impacts of improvised explosives, explosive devices, and similar weapons commonly used in terrorist activities under real life conditions. The data from these experiments will be used to develop countermeasures against those real life terrorist threats. Likewise, LLNL states the stockpile stewardship program mission requires the design and execution of experiments to obtain a better understanding of the performance characteristics of the existing nuclear weapons stockpile without having to test those nuclear weapons. To support this mission, LLNL will design and conduct "hydrodynamic" and "equation of state" experiments. Hydrodynamic experiments investigate the fluid-like movement of solid materials at the center of an explosion, and equation of state experiments investigate the relationships between pressure, volume, and temperature for a given substance. The data gathered from the hydrodynamic and equation of state experiments will be used to develop and enhance the computer models used to predict nuclear weapon performance over a wide range of conditions and scenarios without having to actually test those weapons.

Furthermore, LLNL claims these experiments must be conducted outdoors, and cannot be conducted in their existing confined firing facility (CFF) or in any reasonably sized temporary or permanent enclosure. For instance, their existing permitted CFF has a structural limitation of no more than 132 pounds of explosive material detonation per experiment, so LLNL's existing CFF is not suitable for the proposed experiments necessary to meet their mission requirements.

According to LLNL, a primary component of these experiments is the high-speed photographic analysis of the explosion shockwave and evaluation of incremental pathways and interactions of the materials as they are being transformed during and immediately after the explosion. When total data collection time needs extend beyond 20 milliseconds, such experiments must be conducted outdoors to avoid shockwave reflections and interferences from deflected accelerating materials during the explosion. A permanent or temporary containment of a reasonably achievable size would obscure this vital experimental data; therefore, it is not practically feasible to conduct these experiments in a reasonably sized CFF. Please refer to the District's Best Available Control Technology (BACT) analysis in this document for a more detailed analysis of options to control emissions from the proposed operation.

For each experiment, once the necessary experiment appurtenances and instruments are installed, LLNL will install and align a firing stand above the firing table. The explosive assembly will then be loaded onto the firing stand. On the day of the

detonation, LLNL will conduct a final inspection of the entire setup to ensure that fragment shields, instrumentation, etc. are all properly placed. Upon completing these steps, the assembly will be detonated on the firing stand. Instrumentation is used to observe and gather data on the pressures, temperatures, and shockwaves generated from the unconstrained detonation of conventional explosives in an open-air environment.

As mentioned earlier, neither the proposed explosive compounds nor the test assemblies will contain any radioactive materials. LLNL states that the explosive detonations will be directed toward the protective berm. In order to accommodate the proposed project, LLNL will prepare the site by reinforcing the existing 3-foot-deep gravel firing table by placing a concrete pad or metal plate on top, placing clean gravel over the ground within a 121 foot (37 meter) radius of the firing table, and reinforcing the existing 35-foot-high, soil berm facing the firing table with concrete. The berm is located at the edge of the gravel bed on the Northwest side of the firing table, so the ground around the firing table and between the firing table and the berm will be completely covered with clean gravel. Together, the reinforced firing table, clean gravel bed, and reinforced berm will prevent disturbance of the underlying soils and will control propagation of the explosion shockwave sufficiently to prevent any of the surface soils beyond 121 feet of the firing table from being disturbed and entrained into the air by the explosion shockwave.

Prior to each detonation, LLNL staff will inspect the firing table, gravel bed, and concrete-reinforced berm and will make any repairs necessary to ensure the structural integrity of the firing table and berm. LLNL will also replace any displaced gravel with new, clean gravel.

III. Emission Control Technology Evaluation

A. BACT Applicability:

BACT requirements are triggered on a pollutant-by-pollutant basis and on an emissions unit-by-emissions unit basis. Unless specifically exempted by Rule 2201, BACT shall be required for the following actions*:

a. Any new emissions unit with a potential to emit exceeding two pounds per day for any Affected Pollutant,
b. The relocation from one Stationary Source to another of an existing emissions unit with a potential to emit exceeding two pounds per day for any Affected Pollutant,
c. Modifications to an existing emissions unit with a valid Permit to Operate resulting in an Adjusted Increase in Permitted Emissions (AIPE) exceeding two pounds per day for any Affected Pollutant, and/or
d. Any new or modified emissions unit, in a stationary source project, which results in an SB 288 Major Modification or a Federal Major Modification, as defined by the rule.

*Except for CO emissions from a new or modified emissions unit at a Stationary Source with an SSPE2 of less than 200,000 pounds per year of CO.

Per section VIII.C.2 of the application review prepared under project N-1173492, BACT is triggered for NOx, PM_{10} and VOC emissions.

B. BACT Policy:

The District's BACT Clearinghouse was surveyed for BACT guidelines for explosives detonation operations.

BACT guideline 8.3.8 applies to an Explosive Detonation Chamber, which is applicable to a contained explosives detonation operation. As discussed in Section II of this document, the proposed project requires open-air detonation of explosives as a primary research objective. Therefore, this guideline cannot be used for the proposed project. Therefore, pursuant to the District's BACT policy, a Top-Down BACT analysis will be performed for inclusion of a **new determination** in the District's BACT Clearinghouse for explosive detonation when unrestrained detonations or outdoor environmental conditions are required.

C. Top-Down BACT Analysis

The proposed open-air explosives detonation operation triggers BACT for NOx, PM_{10} and VOC emissions.

NOx and VOC emissions:

Step 1: Identify All Possible Control Technologies

The USA Environmental Protection Agency (USEPA) RACT/BACT/LAER Clearinghouse was searched using process keywords "detonation" or "explosive". No facilities or permits were found.

The California Air Resources Board (CARB) BACT Clearinghouse (https://www.arb.ca.gov/bact/bactnew/rptpara.htm) was reviewed. None of the categories are applicable to the open-air detonation of explosives.

Bay Area Air Quality Management District (BAAQMD) BACT guidelines available, at http://www.baaqmd.gov/permits/permitting-manuals/bact-tbact-workbook, were reviewed. No relevant BACT guideline was found.

South Coast Air Quality Management District (SCAQMD) BACT guidelines available under various sections, at http://www.aqmd.gov/home/permits/bact/guidelines, were reviewed. No relevant BACT guideline was found.

Sacramento Metropolitan Air Quality Management District BACT guidelines, available at, http://airquality.org/StationarySources/Documents/BACT%20Clearinghouse.pdf, were reviewed. No relevant BACT guideline was found.

San Diego Air Pollution Control District BACT guideline document available at, https://www.sandiegocounty.gov/content/dam/sdc/apcd/PDF/Misc/APCD_bact.pdf, were reviewed. No relevant BACT guideline was found.

Santa Barba Air Pollution Control District BACT guideline document available at, https://www.ourair.org/bact/, were reviewed. No relevant BACT guideline was found.

SJVAPCD

A search of the District's PAS database did not reveal any open-air detonation of explosives operations permitted within the San Joaquin Valley Air Pollution Control District.

In order to effectively reduce emissions of NOx and VOC from explosive detonations, the emissions must be captured or contained and then treated using appropriate emission control equipment. Use of following potential containment technologies is evaluated for this project:

1. Use of an existing contained firing facility
2. Building a new permanent containment facility
3. Temporary containment tent

Step 2: Eliminate Technologically Infeasible Options

1. Use of existing contained firing facility

   LLNL has a Contained Firing Facility (CFF) in Building 801 operating under permit N-472-62. Discharge from this CFF is vented to a sodium hydroxide scrubber and a HEPA filtration system. LLNL states the structural limit of this CFF is such that no more than 132 pounds of explosives can be detonated in a day; consequently, this CFF cannot sustain the pressures generated from detonation of 1,000 pounds of explosives.

   Furthermore, according to LLNL, a primary research goal of the proposed operation is the observation and measurement of explosives detonation in an open-air environment using high-speed photographic analysis of the explosion shockwave propagation and evaluation of incremental pathways and interactions of the materials as they are being transformed during and immediately after the explosion. When total data collection time needs extend beyond 20 milliseconds, such experiments must be conducted outdoors to avoid shockwave reflections and interferences from deflected accelerating

materials during the explosion, which can obscure the experimental data and interfere with the data gathering processes.

Therefore, the existing CFF cannot be utilized for conducting the experiments under this project.

2. Building a new permanent Containment Facility:
According to LLNL, one of the research goals for the proposed operation is to study the transformations and interactions of materials in the presence of an explosion. As mentioned earlier, for the types of experiments conducted under the proposed project, shockwave pressure reflections from the walls and ceiling of reasonable sized containment structures can obscure the observance and measurement of experimental data when the data collection times extend beyond 20 milliseconds. LLNL claims the types of experiments necessary to meet the DOE/NNSA program mission needs often require data collection times in excess of 20 milliseconds. For this reason, a reasonably sized containment structure is not feasible for the proposed operation.

However, it may be theoretically possible to build an extremely large containment facility such that there is enough distance between the experimental apparatuses and the structure's walls and ceiling that shockwave reflections from the walls and ceiling would not interfere with the data collection process for the data collection times necessary for the proposed experiments. The cost effectiveness of such a containment facility will be evaluated in Step 4 below.

3. Temporary Containment Tent
The use of temporary containment tent is not technologically feasible. The tent would be destroyed by overpressures or perforated by blast fragments, and is therefore, removed from the technologically feasible options.

Step 3: Rank Remaining Control Technologies by Control Effectiveness

1. Contained firing facility large enough to safely enclose the explosives detonation operation without compromising the experimental objectives due to interference effects from the containment walls, and route the captured emissions to appropriate emission control equipment (90% overall emission reductions for NOx, 99% overall emissions reduction for PM10, 99% overall emission reductions for VOC).

Step 4: Cost Effectiveness Analysis

Option 1 from Step3:
The applicant has provided a budgetary cost of $100-200 million to build a new permanent containment facility (see e-mail dated November 14, 2017) that would conform to DOE/NNSA standards. Conservatively, the lower bound of this cost

is used to conduct the cost-effectiveness analysis. Note that this cost does not the cost associated with appropriate emission control equipment such as scrubber, baghouse, SCR, or oxidizer, etc. that must be required in order to abate the captured emissions.

Per guidance in District Policy APR-1305, the capital cost is annualized over 10 years assuming 10% interest. The annualized cost would be:

$$Annualized\ Cost = (100{,}000{,}000)\left[\frac{(0.1)(1+0.1)^{10}}{(1+0.1)^{10}-1}\right] = \frac{\$16{,}274{,}539}{yr}$$

The permanent containment facility will capture NOx, VOC and PM_{10} emissions. Therefore, annualized cost must be compared with Multi-Pollutant Cost Effectiveness Threshold (MCET) threshold. If the annual cost exceeds the MCET, the control technology or equipment under review cannot be required as BACT.

MCET = Σ(PE2 (lb/yr) x (ton/2,000 lb) x Overall reduction (%) x Cost effectiveness threshold ($/ton)

Pollutant	PE2 (lb/yr)	Overall reduction (%)	Cost-effectiveness threshold ($/ton)	Cost Effectiveness ($/yr)
NOx	233	90	24,500	2,569
PM_{10}	1,324	99	11,400	7,471
VOC	117	99	17,500	1,014
			MCET ($/yr):	11,054

The annualized cost to build a new permanent containment facility alone, not including costs associated emissions control equipment, is 16.27 million dollars. Since this annual cost is more than the MCET threshold, this technologically feasible option is not cost-effective and cannot be required as BACT.

Step 5: Select BACT

None of the NOx and VOC emissions capture and control technologies identified in Step 3 are cost effective for the proposed open-air explosives detonation operation. Therefore, no NOx and VOC emission controls are required.

PM10:

The proposed open-air explosives detonation operation triggers BACT for PM10 emissions.

Step 1: Identify All Possible Control Technologies

The USA Environmental Protection Agency (USEPA) RACT/BACT/LAER Clearinghouse was searched using process keywords "detonation" or "explosive". No facilities or permits were found.

Source categories were reviewed California Air Resources Board (CARB) BACT Clearinghouse (https://www.arb.ca.gov/bact/bactnew/rptpara.htm) None of the categories addresses open-air detonation of explosives.

Bay Area Air Quality Management District (BAAQMD) BACT guidelines available, at http://www.baaqmd.gov/permits/permitting-manuals/bact-tbact-workbook, were reviewed. No relevant BACT guideline was found.

South Coast Air Quality Management District (SCAQMD) BACT guidelines available under various sections, at http://www.aqmd.gov/home/permits/bact/guidelines, were reviewed. No relevant BACT guideline was found.

Sacramento Metropolitan Air Quality Management District BACT guidelines, available at, http://airquality.org/StationarySources/Documents/BACT%20Clearinghouse.pdf, were reviewed. No relevant BACT guideline was found.

San Diego Air Pollution Control District BACT guideline document available at, https://www.sandiegocounty.gov/content/dam/sdc/apcd/PDF/Misc/APCD_bact.pdf, were reviewed. No relevant BACT guideline was found.

Santa Barba Air Pollution Control District BACT guideline document available at, https://www.ourair.org/bact/, were reviewed. No relevant BACT guideline was found.

SJVAPCD
A search of the District's PAS database did not reveal any permitted open-air detonation of explosive operation within the San Joaquin Valley Air Pollution Control District.

To reduce PM_{10} emissions from explosive detonations, the emissions can potentially be captured and treated using appropriate PM_{10} emission control technologies, or emissions can be reduced by using various techniques while they

are being released into the atmosphere. Use of following potential containment technologies is evaluated for this project:

1. Use of existing contained firing facility
2. Building a new permanent containment facility
3. Temporary containment tent
4. Use of water and chelating agents
5. Application of foam or gypsum board to capture solid materials
6. Use of concrete or metal pad on the firing table, surface gravel surrounding the firing table, and a concrete-reinforced berm or equivalent

Step 2: Eliminate Technologically Infeasible Options

1. Use of existing contained firing facility
   This containment option is not technically feasible for the proposed operation (refer to the discussion in above BACT analysis for NOx and VOC emissions).

2. Building a new permanent containment facility
   According to LLNL, one of the research goals for the proposed operation is to study the transformations and interactions of materials in the presence of an explosion. As mentioned earlier, for the types of experiments conducted under the proposed project, shockwave pressure reflections from the walls and ceiling of reasonable sized containment structures can obscure the observance and measurement of experimental data when the data collection times extend beyond 20 milliseconds. LLNL claims the types of experiments necessary to meet the DOE/NNSA program mission needs often require data collection times in excess of 20 milliseconds. For this reason, a reasonably sized containment structure is not feasible for the proposed operation.

   However, it may be theoretically possible to build an extremely large containment facility such that there is enough distance between the experimental apparatuses structure's walls and ceiling that shockwave reflections from the walls and ceiling would not interfere with the data collection process for the data collection times necessary for the proposed experiments. The cost effectiveness of such a containment facility will be evaluated in Step 4 below.

3. Temporary containment tent
   This containment option is not technically feasible for the proposed operation (refer to the discussion in above BACT analysis for NOx and VOC emissions).

4. Use of water and chelating agents
Under this method, a temporary enclosure would be placed around the experimental assembly and filled with water and chelating agents. While this method may be suitable for a small, contained detonation operation, it would not be feasible for the proposed open-air detonation since the enclosure would be destroyed in a matter of milliseconds. Furthermore, the water solution would interfere with the measurement of experimental data (pressure, volume, temperatures, etc.) and it would interfere with experimental objectives involving evaluation of shockwave propagation in open air. For these reasons, the use of water and chelating agents is not technically feasible for the proposed operation.

5. Application of foam or gypsum board to capture solid materials
Use of foam application directly to the experiment is not technically feasible, as the foam would interfere with experimental objectives involving evaluation of shockwave propagation in open air. Furthermore, direct application of foam would make assembling instruments directly into the experiment impossible, and the foam would interfere with the measurement of experimental data (pressure, volume, temperatures, etc.). Finally, it would be impossible to perform a diagnostic alignment of the high speed cameras and other instrumentation after the foam is applied to the experiment. Therefore, application of foam to the experiment is not technically feasible.

Creating a foam-lined enclosure or gypsum board enclosure over the experiment is also not feasible for the reasons discussed above; namely, that the enclosure would be destroyed in a matter of milliseconds, negating the capture effectiveness of the enclosure. Furthermore, the temperatures generated by the explosion would cause volatilization of the foam, causing additional emissions to be released. Finally, conducting the proposed operation would interfere with experimental objectives involving evaluation of shockwave propagation in open air. Therefore, use of foam-lined enclosure or a gypsum board enclosure is not technologically feasible for the proposed operation.

6. Use of concrete or metal pad on the firing table, surface gravel surrounding the firing table, and a concrete-reinforced berm or equivalent
This method is considered practically feasible and has been proposed for the project.

Step 3: Rank Remaining Control Technologies by Control Effectiveness

1. Contained firing facility large enough to safely enclose the explosives detonation operation without compromising the experimental objectives due to interference effects from the containment walls, and route the captured emissions to appropriate emission control equipment (90% overall emission

reductions for NOx, 99% overall emissions reduction for PM10, 99% overall emission reductions for VOC).

2. Use of concrete or metal pad on the firing table, surface gravel surrounding the firing table, and a concrete-reinforced berm or equivalent

Step 4: Cost Effectiveness Analysis

Option 1 from Step 3:
LLNL has provided a budgetary cost of $100-200 million to build a new permanent containment facility (see e-mail dated November 14, 2017) that would conform to DOE/NNSA standards. Conservatively, the lower bound of this cost is used to conduct the cost-effectiveness analysis. Note that this cost does not the cost associated with appropriate emission control equipment such as scrubber, baghouse, SCR, or oxidizer, etc. that must be required in order to abate the emissions.

Per guidance in District Policy APR-1305, the building cost is annualized over 10 years assuming 10% interest. The annualized cost would be:

$$Annualized\ Cost = (100{,}000{,}000)\left[\frac{(0.1)(1+0.1)^{10}}{(1+0.1)^{10}-1}\right] = \frac{\$16{,}274{,}539}{yr}$$

The permanent containment facility would capture NOx, VOC and PM_{10} emissions. Therefore, annualized cost must be compared with Multi-Pollutant Cost Effectiveness Threshold (MCET) threshold. If the annual cost exceeds the MCET, the control technology or equipment under review cannot be required as BACT.

MCET = Σ(PE2 (lb/yr) x (ton/2,000 lb) x Overall reduction (%) x Cost effectiveness threshold ($/ton)

Pollutant	PE2 (lb/yr)	Overall reduction (%)	Cost-effectiveness threshold ($/ton)	Cost Effectiveness ($/yr)
NOx	233	90	24,500	2,569
PM_{10}	1,324	99	11,400	7,471
VOC	117	99	17,500	1,014
			MCET ($/yr):	11,054

The annualized cost to build a new permanent containment facility alone, not including costs associated emissions control equipment, is 16.27 million dollars. Since this annual cost is more than the MCET threshold, this technologically feasible option is not cost-effective and cannot be required as BACT.

Option 2 from Step 3:
LLNL has proposed to use the following:

- A 3-foot-deep gravel firing table covered with concrete or a metal plate thick enough to prevent particulate matter emissions from surface cratering of the underlying soils;
- Place a clean gravel bed on the ground surrounding the firing table out to a radius of 121 feet (the expected area affected by the explosion shockwave, called the skirt area) from the firing table to prevent particulate matter emissions from surface scouring of the underlying soils;
- A concrete-reinforced berm area facing the firing table to prevent particulate matter emissions from surface scouring of the underlying soils and to control propagation of the explosion shockwave.

Therefore, cost-effectiveness analysis is not required for this option.

Step 5: Select BACT

BACT for PM10 emissions is satisfied by the following:

- A 3-foot-deep gravel firing table covered with concrete or a metal plate thick enough to prevent particulate matter emissions from surface cratering of the underlying soils;
- Place a clean gravel bed on the ground surrounding the firing table out to a radius of 121 feet (the expected area affected by the explosion shockwave, called the skirt area) from the firing table to prevent particulate matter emissions from surface scouring of the underlying soils;
- A concrete-reinforced berm area facing the firing table to prevent particulate matter emissions from surface scouring of the underlying soils and to control propagation of the explosion shockwave.

LLNL has proposed these techniques, so their proposal meets BACT requirements for PM10 emissions.

Appendix C
Potential to Emit Calculations

Potential to Emit Calculations

Assumptions:
The potential emissions are determined using master worksheet (shown below) using the following assumptions:

- Combustion of explosives:
  - All "organic" substances are counted as VOC.
  - Nitric oxide and nitrogen dioxide are counted as NOx.
  - Carbon monoxide is counted as CO.
  - Sulfur dioxide is counted as SOx.
  - $PM_{2.5}$ is a subset of PM_{10}. Therefore, only PM_{10} emissions are counted.
  - Individual emissions are shown for ammonia, hydrogen chloride, hydrogen cyanide, nitric acid, phosphine, hydrogen fluoride, as these are not typical criteria pollutants (i.e., NOx, SOx, PM10, CO or VOC).
- Destruction and fragmentation of the assembly:
  - All metals, glass, phosphorus, sulfur and zirconinum are assumed to release as PM_{10} and are counted as PM_{10}.
- Assembly Purge:
  - Sulfur hexafluoride (SF_6), inert gas, used as dielectric to protect instrumentation, is presumed to emitted as SF_6.
- Surface cratering and surface scouring
  - $PM_{2.5}$ is a subset of PM_{10}. Therefore, only PM_{10} emissions are counted.

Potential to Emit:

Pollutant	PE2 (lb/day)*	PE2 (lb/year)	Notes (Refer to item # column in the Master worksheet on the following pages)
NO_X	31.0	233	Sum of Item #81 and Item #82
SO_X	0.0	0	Item #86
PM_{10}	167.0	1,324	Sum of Item #84, Item #95 through item #120, Item #125
CO	4.8	36	Item #80
VOC	15.6	117	Sum of Item #2 through Item #78
Ammonia (NH_3)	22.0	165	Item #87
Hydrogen chloride (HCl)	26.0	195	Item # 88
Hydrogen cyanide (HCN)	13.5	101	Item #89
Nitric acid (HNO_3)	0.5	3	Item #90
Phosphine (PH_3)	3.6	27	Item #91
Hydrogen Fluoride (HF)	38.7	291	Item #92
Hydrogen sulfide (H_2S)	0.2	2	Item #93

*The hourly emissions are set equal to daily emissions, as only one detonation will occur in a given day.

Master Worksheet

Item#	CAS_No	SUBSTANCE	TYPE	Emission Factor	Units	Emission Factor Basis	Maximum Emission Rate (lbs/hr)	Maximum Emission Rate (lbs/yr)
1	*Combustion of Explosives*							
2	67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran	Organic	1.80E-12	lb/lb Explosive	AP-42[1]	1.80E-09	1.35E-08
3	35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	Organic	1.50E-11	lb/lb Explosive	AP-42[1]	1.50E-08	1.13E-07
4	55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran	Organic	5.50E-13	lb/lb Explosive	AP-42[1]	5.50E-10	4.13E-09
5	57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran	Organic	4.40E-13	lb/lb Explosive	AP-42[1]	4.40E-10	3.30E-09
6	60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran	Organic	5.40E-13	lb/lb Explosive	AP-42[1]	5.40E-10	4.05E-09
7	39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran	Organic	3.40E-12	lb/lb Explosive	AP-42[1]	3.40E-09	2.55E-08
8	3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin	Organic	2.20E-10	lb/lb Explosive	AP-42[1]	2.20E-07	1.65E-06
9	57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran	Organic	7.00E-13	lb/lb Explosive	AP-42[1]	7.00E-10	5.25E-09
10	51207-31-9	2,3,7,8-Tetrachlorodibenzofuran	Organic	8.60E-13	lb/lb Explosive	AP-42[1]	8.60E-10	6.45E-09
11	106-99-0	1,3-Butadiene	Organic	9.00E-06	lb/lb Explosive	OBODM[2]	9.00E-03	6.75E-02
12	106-98-9	1-Butene	Organic	3.10E-05	lb/lb Explosive	OBODM[2]	3.10E-02	2.33E-01
13	592-41-6	1-Hexene	Organic	2.40E-05	lb/lb Explosive	OBODM[2]	2.40E-02	1.80E-01
14	109-67-1	1-Pentene	Organic	1.40E-05	lb/lb Explosive	OBODM[2]	1.40E-02	1.05E-01
15	121-14-2	2,4-Dinitrotoluene	Organic	1.50E-06	lb/lb Explosive	AP-42[1]	1.50E-03	1.13E-02
16	83-32-9	Acenaphthene	Organic	9.20E-09	lb/lb Explosive	AP-42[1]	9.20E-06	6.90E-05
17	208-96-8	Acenaphthylene	Organic	1.00E-07	lb/lb Explosive	AP-42[1]	1.00E-04	7.50E-04
18	75-07-0	Acetaldehyde	Organic	1.22E-04	lb/Experiment	footnote (14)	1.22E-04	9.77E-04
19	74-86-2	Acetylene	Organic	1.30E-04	lb/lb Explosive	OBODM[2]	1.30E-01	9.75E-01
20	107-02-8	Acrolein	Organic	1.93E-06	lb/Experiment	footnote (14)	1.93E-06	1.54E-05
21	79107	Acrylic acid	Organic	5.51E-07	lb/Experiment	footnote (14)	5.51E-07	4.41E-06
22	107-13-1	Acrylonitrile	Organic	3.10E-07	lb/lb Explosive	AP-42[1]	3.10E-04	2.33E-03
23	120-12-7	Anthracene	Organic	1.20E-08	lb/lb Explosive	AP-42[1]	1.20E-05	9.00E-05
24	71-43-2	Benzene	Organic	1.10E-04	lb/lb Explosive	OBODM[2]	1.10E-01	8.25E-01
25	117-81-7	bis(2-Ethylhexyl)phthalate	Organic	9.90E-06	lb/lb Explosive	AP-42[1]	9.90E-03	7.43E-02
26	85-68-7	Butylbenzylphthalate	Organic	1.70E-06	lb/lb Explosive	AP-42[1]	1.70E-03	1.28E-02
27	56-23-5	Carbon Tetrachloride	Organic	4.50E-06	lb/lb Explosive	OBODM[2]	4.50E-03	3.38E-02
28	67-66-3	Chloroform	Organic	3.80E-07	lb/lb Explosive	OBODM[2]	3.80E-04	2.85E-03
29	627-20-3	cis-2-Pentene	Organic	8.30E-07	lb/lb Explosive	OBODM[2]	8.30E-04	6.23E-03
30	110-82-7	Cyclohexane	Organic	7.50E-06	lb/lb Explosive	OBODM[2]	7.50E-03	5.63E-02
31	287-92-3	Cyclopentane	Organic	1.70E-06	lb/lb Explosive	OBODM[2]	1.70E-03	1.28E-02
32	142-29-0	Cyclopentene	Organic	3.70E-06	lb/lb Explosive	OBODM[2]	3.70E-03	2.78E-02
33	84-74-2	Dibutyl phthalate	Organic	2.90E-06	lb/lb Explosive	AP-42[1]	2.90E-03	2.18E-02
34	75-71-8	Dichlorodifluoromethane	Organic	1.00E-09	lb/lb Explosive	AP-42[1]	1.00E-06	7.50E-06

Master Worksheet

Item#	CAS_No	SUBSTANCE	TYPE	Emission Factor	Units	Emission Factor Basis	Maximum Emission Rate (lbs/hr)	Maximum Emission Rate (lbs/yr)
35	74-84-0	Ethane	Organic	3.00E-05	lb/lb Explosive	OBODM[2]	3.00E-02	2.25E-01
36	75-00-3	Ethyl chloride	Organic	6.90E-07	lb/lb Explosive	OBODM[2]	6.90E-04	5.18E-03
37	100-41-4	Ethylbenzene	Organic	2.50E-06	lb/lb Explosive	OBODM[2]	2.50E-03	1.88E-02
38	74-85-1	Ethylene	Organic	3.90E-04	lb/lb Explosive	OBODM[2]	3.90E-01	2.93E+00
39	86-73-7	Fluorene	Organic	2.10E-08	lb/lb Explosive	AP-42[1]	2.10E-05	1.58E-04
40	50-00-0	Formaldehyde	Organic	5.80E-05	lb/lb Explosive	AP-42[3,12]	5.82E-02	4.37E-01
41	75-28-5	i-Butane	Organic	1.60E-06	lb/lb Explosive	OBODM[2]	1.60E-03	1.20E-02
42	115-11-7	i-Butene	Organic	2.40E-05	lb/lb Explosive	OBODM[2]	2.40E-02	1.80E-01
43	78-78-4	i-Pentane	Organic	9.10E-06	lb/lb Explosive	OBODM[2]	9.10E-03	6.83E-02
44	98-82-8	i-Propylbenzene	Organic	7.30E-07	lb/lb Explosive	OBODM[2]	7.30E-04	5.48E-03
45	74-82-8	Methane	Organic	2.40E-03	lb/lb Explosive	OBODM[2]	2.40E+00	1.80E+01
46	74-87-3	Methyl Chloride	Organic	7.50E-07	lb/lb Explosive	OBODM[2]	7.50E-04	5.63E-03
47	71-55-6	Methyl chloroform	Organic	3.80E-07	lb/lb Explosive	OBODM[2]	3.80E-04	2.85E-03
48	108-87-2	Methylcyclohexane	Organic	7.00E-06	lb/lb Explosive	OBODM[2]	7.00E-03	5.25E-02
49	96-37-7	Methylcyclopentane	Organic	9.10E-06	lb/lb Explosive	OBODM[2]	9.10E-03	6.83E-02
50	75-09-2	Methylene Chloride	Organic	8.70E-04	lb/lb Explosive	OBODM[2]	8.70E-01	6.53E+00
51	78933	MEK	Organic	1.45E-04	lb/Experiment	footnote (14)	1.45E-04	1.16E-03
52	620-14-4	m-Ethyltoluene	Organic	4.80E-07	lb/lb Explosive	OBODM[2]	4.80E-04	3.60E-03
53	91-20-3	Naphthalene	Organic	2.60E-07	lb/lb Explosive	AP-42[1]	2.60E-04	1.95E-03
54	106-97-8	n-Butane	Organic	3.10E-06	lb/lb Explosive	OBODM[2]	3.10E-03	2.33E-02
55	124-18-5	n-Decane	Organic	5.20E-06	lb/lb Explosive	OBODM[2]	5.20E-03	3.90E-02
56	142-82-5	N-Heptane	Organic	5.00E-06	lb/lb Explosive	OBODM[2]	5.00E-03	3.75E-02
57	110-54-3	n-Hexane	Organic	1.90E-05	lb/lb Explosive	OBODM[2]	1.90E-02	1.43E-01
58	111-84-2	n-Nonane	Organic	1.90E-06	lb/lb Explosive	OBODM[2]	1.90E-03	1.43E-02
59	109-66-0	n-Pentane	Organic	1.30E-05	lb/lb Explosive	OBODM[2]	1.30E-02	9.75E-02
60	111-65-9	Octane	Organic	3.60E-06	lb/lb Explosive	OBODM[2]	3.60E-03	2.70E-02
61	78-11-5	Pentaerythritol tetranitrate (PETN)	Organic	5.60E-04	lb/lb Explosive	OBODM[2]	5.60E-01	4.20E+00
62	622-96-8	p-Ethyltoluene	Organic	7.60E-06	lb/lb Explosive	OBODM[2]	7.60E-03	5.70E-02
63	85-01-8	Phenanthrene	Organic	1.30E-07	lb/lb Explosive	AP-42[1]	1.30E-04	9.75E-04
64	74-98-6	Propane	Organic	4.70E-06	lb/lb Explosive	OBODM[2]	4.70E-03	3.53E-02
65	115-07-1	Propylene	Organic	7.30E-05	lb/lb Explosive	OBODM[2,13]	7.30E-02	5.48E-01
66	121-82-4	RDX	Organic	7.40E-03	lb/lb Explosive	OBODM[2]	7.40E+00	5.55E+01
67	100-42-5	Styrene	Organic	4.20E-05	lb/lb Explosive	OBODM[2]	4.20E-02	3.15E-01

Master Worksheet

Item#	CAS_No	SUBSTANCE	TYPE	Emission Factor	Units	Emission Factor Basis	Maximum Emission Rate (lbs/hr)	Maximum Emission Rate (lbs/yr)
68	127-18-4	Tetrachloroethylene	Organic	1.80E-05	lb/lb Explosive	OBODM[2]	1.80E-02	1.35E-01
69	108-88-3	Toluene	Organic	2.60E-05	lb/lb Explosive	OBODM[2]	2.60E-02	1.95E-01
70		Total Alkanes (Paraffins)	Organic	1.60E-04	lb/lb Explosive	OBODM[2]	1.60E-01	1.20E+00
71		Total Alkenes (Olefins)	Organic	6.90E-04	lb/lb Explosive	OBODM[2]	6.90E-01	5.18E+00
72		Total Aromatics	Organic	1.00E-04	lb/lb Explosive	OBODM[2]	1.00E-01	7.50E-01
73		Total Non-Methane Hydrocarbons	Organic	2.00E-03	lb/lb Explosive	OBODM[2]	2.00E+00	1.50E+01
74		Total Unidentified Hydrocarbons	Organic	2.50E-04	lb/lb Explosive	OBODM[2]	2.50E-01	1.88E+00
75	624-64-6	trans-2-Butene	Organic	4.50E-06	lb/lb Explosive	OBODM[2]	4.50E-03	3.38E-02
76	646-04-8	trans-2-Pentene	Organic	5.00E-06	lb/lb Explosive	OBODM[2]	5.00E-03	3.75E-02
77	75-69-4	Trichlorofluoromethane	Organic	5.80E-10	lb/lb Explosive	AP-42[1]	5.80E-07	4.35E-06
78	75-01-4	Vinyl Chloride	Organic	1.30E-06	lb/lb Explosive	OBODM[2]	1.30E-03	9.75E-03
79	124-38-9	Carbon Dioxide	Inorganic	1.20E+00	lb/lb Explosive	AP-42[3]	1.20E+03	9.00E+03
80	630-08-0	Carbon Monoxide	Criteria Pollutant	4.80E-03	lb/lb Explosive	AP-42[3]	4.80E+00	3.60E+01
81	10102-43-9	Nitric Oxide	Inorganic	1.80E-02	lb/lb Explosive	OBODM[2]	1.80E+01	1.35E+02
82	10102-44-0	Nitrogen Dioxide	Criteria Pollutant	1.30E-02	lb/lb Explosive	AP-42[3]	1.30E+01	9.75E+01
83		PM-2.5	Criteria Pollutant	1.40E-02	lb/lb Explosive	AP-42[3]	1.40E+01	1.05E+02
84		PM-10	Criteria Pollutant	2.50E-02	lb/lb Explosive	AP-42[3]	2.50E+01	1.88E+02
85		Total Suspended Particulate	Inorganic	3.20E-02	lb/lb Explosive	AP-42[3]	3.20E+01	2.40E+02
86	7446-09-5	Sulfur Dioxide	Criteria Pollutant	4.00E-05	lb/lb Explosive	AP-42[3]	4.00E-02	3.00E-01
87	7664-41-7	Ammonia	Inorganic\Acid Gas	2.20E-02	lb/lb Explosive	AP-42[4]	2.20E+01	1.65E+02
88	7647-01-0	Hydrogen Chloride	Inorganic\Acid Gas	2.60E-02	lb/lb Explosive	Conversion[6]	2.60E+01	1.95E+02
89	74-90-8	Hydrogen Cyanide	Inorganic\Acid Gas	1.35E-02	lb/lb Explosive	AP-42[5]	1.35E+01	1.01E+02
90	7697-37-2	Nitric acid	Inorganic\Acid Gas	4.50E-04	lb/lb Explosive	AP-42[1]	4.50E-01	3.38E+00
91	7803-51-2	Phosphine	Inorganic\Acid Gas	3.57E-03	lb/lb Explosive	Conversion[6]	3.57E+00	2.68E+01
92	7664-39-3	Hydrogen Fluoride	Inorganic\Acid Gas	(6)	(6)	Conversion[6]	3.87E+01	2.91E+02
93	7783-06-4	Hydrogen Sulfide	Inorganic\Acid Gas	2.33E-01	lb/Experiment	Conversion[6]	2.33E-01	1.87E+00
94	***Destruction and Fragmentation of the Assembly***							
95	7429-90-5	Aluminum	Metal	5.21E+00	lb/Experiment	Release Fraction[7,14]	5.21E+00	4.17E+01
96	1344-28-1	Aluminum Oxide	Metal	3.14E-01	lb/Experiment	Release Fraction[7,14]	3.14E-01	2.51E+00
97	7440-41-7	Beryllium	Metal	3.78E-03	lb/Experiment	Release Fraction[7,14]	3.78E-03	3.02E-02
98	7440-47-3	Chromium	Metal	3.30E+00	lb/Experiment	Release Fraction[7,14]	3.30E+00	2.64E+01
99	7440-50-8	Copper	Metal	2.44E+01	lb/Experiment	Release Fraction[7,14]	2.44E+01	1.95E+02

Master Worksheet

Item#	CAS_No	SUBSTANCE	TYPE	Emission Factor	Units	Emission Factor Basis	Maximum Emission Rate (lbs/hr)	Maximum Emission Rate (lbs/yr)
100		Glass	Glass	1.57E+00	lb/Experiment	Release Fraction [7,14]	1.57E+00	1.26E+01
101	7440-57-5	Gold	Metal	3.97E-03	lb/Experiment	Release Fraction [7,14]	3.97E-03	3.18E-02
102	7440-58-6	Hafnium	Metal	1.89E-01	lb/Experiment	Release Fraction [7,14]	1.89E-01	1.51E+00
103	7439-89-6	Iron	Metal	6.28E+00	lb/Experiment	Release Fraction [7,14]	6.28E+00	5.03E+01
104	7439-89-6	Lead	Metal	2.27E-01	lb/Experiment	Release Fraction [7,14]	2.27E-01	1.82E+00
105	7439-95-4	Magnesium	Metal	1.89E-01	lb/Experiment	Release Fraction [7,14]	1.89E-01	1.51E+00
106	7439-96-5	Manganese	Metal	9.57E-01	lb/Experiment	Release Fraction [7,14]	9.57E-01	7.66E+00
107	7439-98-7	Molybdenum	Metal	1.19E+00	lb/Experiment	Release Fraction [7,14]	1.19E+00	9.50E+00
108	7440-02-0	Nickel	Metal	5.57E-02	lb/Experiment	Release Fraction [7,14]	5.57E-02	4.46E-01
109	7723-14-0	Phosphorus	Inorganic	9.29E-01	lb/Experiment	Release Fraction [7,14]	9.29E-01	7.43E+00
110		Plastic		2.76E+01	lb/Experiment	Release Fraction [7,14]	2.76E+01	2.20E+02
111	7440-21-3	Silicon	Metal	1.10E+00	lb/Experiment	Release Fraction [7,14]	1.10E+00	8.81E+00
112	7440-22-4	Silver	Metal	3.97E-03	lb/Experiment	Release Fraction [7,14]	3.97E-03	3.18E-02
113	7704-34-9	Sulfur	Inorganic	1.95E-01	lb/Experiment	Release Fraction [7,14]	1.95E-01	1.56E+00
114	7440-25-7	Tantalum	Metal	8.32E+00	lb/Experiment	Release Fraction [7,14]	8.32E+00	6.66E+01
115	7440-32-6	Titanium	Metal	1.05E+00	lb/Experiment	Release Fraction [7,14]	1.05E+00	8.41E+00
116	7440-33-7	Tungsten	Metal	2.28E+01	lb/Experiment	Release Fraction [7,14]	2.28E+01	1.82E+02
117	12070-12-1	Tungsten Carbide		3.14E-01	lb/Experiment	Release Fraction [7,14]	3.14E-01	2.51E+00
118	7440-62-2	Vanadium	Metal	6.03E+00	lb/Experiment	Release Fraction [7,14]	6.03E+00	4.82E+01
119	7440-66-6	Zinc	Metal	2.94E-02	lb/Experiment	Release Fraction [7,14]	2.94E-02	2.35E-01
120	7440-67-7	Zirconium	Inorganic	2.79E+00	lb/Experiment	Release Fraction [7,14]	2.79E+00	2.23E+01
121	***Assembly Purge***							
122	2551-62-4	Sulfur Hexafluoride	Inorganic	3.00E+00	lb/Experiment	Mass Balance [8,14]	3.00E+00	2.16E+01
123	***Surface Cratering and Surface Scouring***							
124		PM-2.5 (from concrete, gravel and shotcrete)	Criteria Pollutant	1.70E+00	lb/1000 lb Explosive	COMBIC [9,10,14]	1.70E+00	1.36E+01
125		PM-10 (from concrete, gravel and shotcrete)	Criteria Pollutant	2.71E+01	lb/1000 lb Explosive	COMBIC [9,11,14]	2.71E+01	2.17E+02

Master Worksheet

Notes:

[1] Emission factors obtained from AP-42, Section 15.9 (Blasting Caps, Demolition Charges, and Detonators), Table 15.9.4-2, TNT (USEPA, 2009b)

[2] Emission factors obtained from the OBODM model (SERDP, 1998c) and based on the highest open detonation emissions factor for each organic substance from the following materials:

40 mm HEI Cartridge	Explosive D (ammonium picrate)	TNT (2,4,6-Trinitrotoluene)
Amatol (50% TNT, 50% Ammn. Nitrate)	HBX (48/31/17/4 RDX-TNT-Al-WAX)	Tritonal (79% TNT, 21% Aluminum)
Composition B (56/38/6 RDX-TNT-WAX)	RDX (cyclotrimethylenetrinitramine)	Tritonal with 2.5% Calcium Stearate
Detonating train		

[3] Emission factors obtained from AP-42, Section 15.9 (Blasting Caps, Demolition Charges, and Detonators), Table 15.9.4-1, TNT (USEPA, 2009a)

[4] Emission factors obtained from AP-42 Section 13.3 (Explosives Detontation), RDX (USEPA, 1995a)

[5] Emission factors obtained from AP-42 Section 13.3 (Explosives Detontation), TNT (USEPA, 1995a)

[6] Emission factors based on stoichiomteric conversion for the following gases:

Hydrogen Chloride: conversion of chlorine in binding agents used in explosive such as PBX 9407

Phosphine: complete conversion of phosphorous in binding agents used in explosive such as PBX 9404

Hydrogen Fluoride (HF): complete conversion of fluorine in binding agents used in explosives such as LX-17 and complete conversion of fluorine in one pound (eight pounds annually) of sulfur hexafluoride (SF6) used as an assemble purge gas. LX-04 with a higher HF emission factor than LX-17 may be used in much smaller amounts (e. g., 100 lbs); however, maximum hourly and annual HF emissions would not exceed the values presented.

LX-17 HF emission factor = 3.79E-02 lb HF/lb Explosive

SF6 HF emission factor = 8.22E-01 lb HF/lb SF6

LX-04 HF emission factor = 1.00E-01 lb HF/lb Explosive

Hydrogen Sulfide: complete conversion of sulfur in 1 lb of SF6 purge gas in an experiment assembly decomposing to H2S after detonation.

H2S emission factor = 2.33E-01 lb H2S/lb SF6.

[7] Emission factor based on the maximum amount of metal/inorganic in a large experiment assembly mutiplied by the appropriate release fraction for that substance.

[8] Up to 3 lbs of SF6 may be used as a purge gas in large experiments. Assume all 3 lbs are emitted to the atmosphere.

[9] Emissions factors obtained from the Combined Obscurant Model for Battlefield Induced Contaminants (COMBIC) for a 1,000 lbs cased detonation with the following results:

Small particulate (20 µm or less) that remain suspended - 107 lbs

Large particulate (20 µm - 200 µm) that fall out on-site - 2,366 lbs

Ballistic concrete/shotcrete and large agglomerates that fall out on-site - 4,027 lbs

[10] The PM-2.5 emission factor was obtained by multiplyng the COMBIC PM-20 result of 107 lbs by the PM-20 to PM-2.5 cumulative mass percent ratio of 0.54/34 found in AP-42, Section 11.6 (Portland Cement Manufacturing), Table 11.6-6 (USEPA, 1995b).

[11] The PM-10 emission factor was obtained by multiplyng the COMBIC PM-20 result of 107 lbs by the PM-20 to PM-10 cumulative mass percent ratio of 8.6/34 found in AP-42, Section 11.6 (Portland Cement Manufacturing), Table 11.6-6 (USEPA, 1995b).

[12] The maximum houly and annual formaldehyde emission rates include the contribution from burned plastics in the assembly materials.

[13] The maximum houly and annual propylene emission rates include the contribution from burned plastics in the assembly materials.

[14] The maximum houly emission rate is based on the upper bound mass of materials in the largest experiment. The annual emission rate would not exceed eight times the hourly rate.

Appendix D
SSPE1 Calculations

SSPE1 Calculations

Summary:

SSPE1 (lb/year)					
Permit Unit/ERC	NO_X	SO_X	PM_{10}	CO	VOC
N-472-1-1	0	0	2,957	0	9,000
N-472-7-1	0	0	8,425	0	0
N-472-13-3	0	0	0	0	770
N-472-17-1 N-472-18-1 N-472-19-1 N-472-20-1	0	0	0	0	2,190
N-472-30-0	124	0	9	27	10
N-472-31-0	89	0	6	19	7
N-472-32-0	79	0	6	17	6
N-472-33-0	124	0	9	27	10
N-472-34-0	162	0	12	35	13
N-472-35-0	0	0	85	0	0
N-472-36-0	114	0	16	47	18
N-472-38-0	114	0	16	47	18
N-472-39-5	0	0	0	0	569
N-472-40-0	83	0	11	35	13
N-472-41-1	0	0	0	0	71
N-472-45-2	0	0	0	0	437
N-472-54-2	0	0	0	0	437
N-472-55-2	0	0	0	0	437
N-472-57-0	63	0	4	14	5
N-472-58-0	42	0	3	9	3
N-472-60-0	11	0	61	1	1
N-472-61-0	5	0	35	1	0
N-472-62-1	133	5	1	1990	105
N-472-63-0	175	0	6	117	44
N-472-64-0	163	0	52	163	81
N-472-65-1	0	0	0	0	1204
N-472-67-0	0	0	0	0	949
N-472-76-0	81	0	3	16	6
N-472-78-0	36	0	0	0	0
N-472-79-0	72	0	0	0	0
N-472-81-0	91	0	3	28	5
*N-472-82-0	--	--	--	--	--
**N-472-83-0	--	--	--	--	--
Total without ERCs - $SSPE2_{Permit\ Unit}$	1,761	5	11,720	2,593	16,409

SSPE1 (lb/year) – Continue...					
Permit Unit/ERC	**NO_X**	**SO_X**	**PM_{10}**	**CO**	**VOC**
ERC N-464-1	0	0	0	0	4
ERC N-464-2	175	0	0	0	0
ERC N-464-3	0	0	0	43	0
ERC N-464-4	0	0	17	0	0
ERC N-464-5	0	63	0	0	0
$Total_{ERC}$	175	63	17	43	4
SSPE1	**1,936**	**68**	**11,737**	**2,636**	**16,413**

*ATC N-472-82-0 is not implemented; this permit unit will replace permit unit N-472-40; Since the PE of N-472-40 is greater than that of the N-472-82, PE of N-472-40 are counted in the above table rather than the PE of N-472-80.
**ATC N-472-83-0 is not implemented; this permit unit will replace permit unit N-472-34; Since the PE of N-472-34 is greater than that of the N-472-83, PE of N-472-34 are counted in the above table rather than the PE of N-472-80.

N-472-1-1: COATING OPERATION SERVED BY AN OPEN-FACED WATER WASH TYPE PAINT BOOTH AND HVLP APPLICATION EQUIPMENT (B-872)

This permit limits VOC to 9,000 lb/yr. Therefore,

PE = 9,000 lb-VOC/yr

This permit limits PM10 emissions to 8.1 lb/day. Using worst-case operating scenario of 365 days/yr, the potential emissions are:

PE = 8.1 lb-PM10/day x 365 days/yr = 2,957 lb-PM10/yr

N-472-7-1: WOODWORKING OPERATION (BLDG B-873) SERVED BY A SAWDUST COLLECTION SYSTEM WITH A 2,200 CFM AGET MODEL #30SN90-D1 CYCLONE (SERIAL #7684)

This permit limits PM10 concentration to 0.051 grains/scf. Using 2,200 cfm, the potential emissions would be:

PE = 0.051 grains-PM10/scf x 2,200 cf/min x 60 min/hr x 8,760 hr/yr x lb/7,000 grains
PE = 8,425 lb-PM10/yr

N-472-13-3: SINGLE BAFFLED POLYETHYLENE BUBBLER TANK SYSTEM (#4) FOR GROUNDWATER REMEDIATION SERVED BY A CARBON ADSORPTION SYSTEM OR CATALYTIC OXIDIZER

This permit limits effluent gas flow rate to 705 scfm, and effluent VOC concentration to 6.0 ppmv. Molecular weight of the gas is 131.4 g/mol

PE = 6×10^{-6} x 705 ft^3-gas/min x 131.4 lb/lb-mol x 1/379.5 ft^3-gas/lb-mol x 60 min/hr x 8,760 hr/yr
= 770 lb-VOC/yr

N-472-17-1: CHEMISTRY DRYING OVEN #1
N-472-18-1: CHEMISTRY DRYING OVEN #2
N-472-19-1: CHEMISTRY DRYING OVEN #3
N-472-20-1: CHEMISTRY DRYING OVEN #4

The total VOC emissions from permit units N-472-17, 18, 19 and 20 are limited to 6.0 lb/day. Thus,

PE = 6.0 lb-VOC/day x 365 days/yr
= 2,190 lb-VOC/yr

N-472-30-0: 200 BHP UNITED STATES MOTOR MODEL #T1071A-AG (SERIAL #340839-1) DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

This permit limits non-emergency operation of the engine to 20 hr/year. The permit does not contain emission factors (EFs) for this engine. Therefore, except for SOx, EFs from EPA's AP-42 Table 3.3-1 (10/96) will be used. SOx EF is calculated using maximum sulfur content of 15 ppm by weight in ultra-low sulfur diesel fuel.

PE = EF (lb/bhp-hr) x 200 bhp x 20 hr/yr

Pollutant	EF (lb/bhp-hr)	PE (lb/yr)
NOx	0.031	124
*SOx	1.13×10^{-5}	0
PM10	2.2×10^{-3}	9
CO	6.68×10^{-3}	27
VOC	2.51×10^{-3}	10

$$* \frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1\ lb-fuel}{gallon} \times \frac{2\ lb-SO_2}{1\ lb-S} \times \frac{1\ gal}{137{,}000\ Btu} \times \frac{1\ bhp\ input}{0.35\ bhp\ out} \times \frac{2{,}542.5\ Btu}{bhp-hr} = 1.13 \times 10^{-5}\ \frac{lb-SO2}{bhp-hr}$$

N-472-31-0: 140 BHP CATERPILLAR MODEL 3304 PC (S/N: 04B25277) DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

This permit limits non-emergency operation of the engine to 20 hr/year. The permit does not contain emission factors (EFs) for this engine. Therefore, except for SOx, EFs from EPA's AP-42 Table 3.3-1 (10/96) will be used. SOx EF is calculated using maximum sulfur content of 15 ppm by weight in ultra-low sulfur diesel fuel.

PE = EF (lb/bhp-hr) x 140 bhp x 20 hr/yr

Pollutant	EF (lb/bhp-hr)	PE (lb/yr)
NOx	0.031	89
*SOx	1.13×10^{-5}	0
PM10	2.2×10^{-3}	6
CO	6.68×10^{-3}	19
VOC	2.51×10^{-3}	7

$$* \frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1\ lb-fuel}{gallon} \times \frac{2\ lb-SO_2}{1\ lb-S} \times \frac{1\ gal}{137{,}000\ Btu} \times \frac{1\ bhp\ input}{0.35\ bhp\ out} \times \frac{2{,}542.5\ Btu}{bhp-hr} = 1.13 \times 10^{-5}\ \frac{lb-SO2}{bhp-hr}$$

N-472-32-0: 128 BHP PAVID MODEL #D4800T/D4800X130 (SERIAL #401254) DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

This permit limits non-emergency operation of the engine to 20 hr/year. The permit does not contain emission factors (EFs) for this engine. Therefore, except for SOx, EFs from EPA's AP-42 Table 3.3-1 (10/96) will be used. SOx EF is calculated using maximum sulfur content of 15 ppm by weight in ultra-low sulfur diesel fuel.

PE = EF (lb/bhp-hr) x 128 bhp x 20 hr/yr

Pollutant	EF (lb/bhp-hr)	PE (lb/yr)
NOx	0.031	79
*SOx	1.13×10^{-5}	0
PM10	2.2×10^{-3}	6
CO	6.68×10^{-3}	17
VOC	2.51×10^{-3}	6

$$* \frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1\ lb-fuel}{gallon} \times \frac{2\ lb-SO_2}{1\ lb-S} \times \frac{1\ gal}{137{,}000\ Btu} \times \frac{1\ bhp\ input}{0.35\ bhp\ out} \times \frac{2{,}542.5\ Btu}{bhp-hr} = 1.13 \times 10^{-5} \frac{lb-SO2}{bhp-hr}$$

N-472-33-0: 200 BHP UNITED STATES MOTOR MODEL #TID71A-AG (SERIAL #340839-2) DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

This permit limits non-emergency operation of the engine to 20 hr/year. The permit does not contain emission factors (EFs) for this engine. Therefore, except for SOx, EFs from EPA's AP-42 Table 3.3-1 (10/96) will be used. SOx EF is calculated using maximum sulfur content of 15 ppm by weight in ultra-low sulfur diesel fuel.

PE = EF (lb/bhp-hr) x 200 bhp x 20 hr/yr

Pollutant	EF (lb/bhp-hr)	PE (lb/yr)
NOx	0.031	124
*SOx	1.13×10^{-5}	0
PM10	2.2×10^{-3}	9
CO	6.68×10^{-3}	27
VOC	2.51×10^{-3}	10

$$* \frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1\ lb-fuel}{gallon} \times \frac{2\ lb-SO_2}{1\ lb-S} \times \frac{1\ gal}{137{,}000\ Btu} \times \frac{1\ bhp\ input}{0.35\ bhp\ out} \times \frac{2{,}542.5\ Btu}{bhp-hr} = 1.13 \times 10^{-5} \frac{lb-SO2}{bhp-hr}$$

N-472-34-0: 262 BHP CATERPILLAR MODEL #HEC-200-D (SERIAL #55 B 1172) DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

This permit limits non-emergency operation of the engine to 20 hr/year. The permit does not contain emission factors (EFs) for this engine. Therefore, except for SOx, EFs from EPA's

AP-42 Table 3.3-1 (10/96) will be used. SOx EF is calculated using maximum sulfur content of 15 ppm by weight in ultra-low sulfur diesel fuel.

PE = EF (lb/bhp-hr) x 262 bhp x 20 hr/yr

Pollutant	EF (lb/bhp-hr)	PE (lb/yr)
NOx	0.031	162
*SOx	1.13×10^{-5}	0
PM10	2.2×10^{-3}	12
CO	6.68×10^{-3}	35
VOC	2.51×10^{-3}	13

$$* \frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1\ lb-fuel}{gallon} \times \frac{2\ lb-SO_2}{1\ lb-S} \times \frac{1\ gal}{137{,}000\ Btu} \times \frac{1\ bhp\ input}{0.35\ bhp\ out} \times \frac{2{,}542.5\ Btu}{bhp-hr} = 1.13 \times 10^{-5} \frac{lb-SO2}{bhp-hr}$$

N-472-35-0: MACHINING EQUIPMENT SERVED BY A DUST FILTER

The proposal for this permit was evaluated on April 26, 1991, and does not contain information to estimate the potential emissions.

Per application under AP 90-397, the dust collector is rated at 1,883 cfm. The grain loading is estimated to be 0.0006 grains/ft3. It is presumed that all PM emitted from the dust collector would be PM10. Thus,

PE = 0.0006 grains/ft3 x 1,883 ft3/min x 60 min/hr x 8,760 hr/yr x lb/7,000 grains
= 85 lb-PM10/yr

N-472-36-0: 355 BHP DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

This permit limits non-emergency operation of the engine to 20 hr/year. Except for NOx and SOx, the permit does not contain emission factors (EFs) for this engine. Therefore, EFs from EPA's AP-42 Table 3.3-1 (10/96) will be used. Note that SOx EF is calculated using maximum sulfur content of 15 ppm by weight in ultra-low sulfur diesel fuel.

PE = EF (lb/bhp-hr) x 355 bhp x 20 hr/yr

Pollutant	EF (lb/bhp-hr)	PE (lb/yr)
*NOx	0.016	114
**SOx	1.13×10^{-5}	0
PM10	2.2×10^{-3}	16
CO	6.68×10^{-3}	47
VOC	2.51×10^{-3}	18

*7.2 g-NOx/bhp-hr x lb/453.6 g = 0.016 lb-NOx/bhp-hr

$$** \frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1\ lb-fuel}{gallon} \times \frac{2\ lb-SO_2}{1\ lb-S} \times \frac{1\ gal}{137{,}000\ Btu} \times \frac{1\ bhp\ input}{0.35\ bhp\ out} \times \frac{2{,}542.5\ Btu}{bhp-hr} = 1.13 \times 10^{-5} \frac{lb-SO2}{bhp-hr}$$

N-472-38-0: 355 BHP DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

This permit limits non-emergency operation of the engine to 20 hr/year. Except for NOx and SOx, the permit does not contain emission factors (EFs) for this engine. Therefore, EFs from EPA's AP-42 Table 3.3-1 (10/96) will be used. Note that SOx EF is calculated using maximum sulfur content of 15 ppm by weight in ultra-low sulfur diesel fuel.

PE = EF (lb/bhp-hr) x 355 bhp x 20 hr/yr

Pollutant	EF (lb/bhp-hr)	PE (lb/yr)
*NOx	0.016	114
**SOx	1.13×10^{-5}	0
PM10	2.2×10^{-3}	16
CO	6.68×10^{-3}	47
VOC	2.51×10^{-3}	18

*7.2 g-NOx/bhp-hr x lb/453.6 g = 0.016 lb-NOx/bhp-hr

** $\frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1\ lb-fuel}{gallon} \times \frac{2\ lb-SO_2}{1\ lb-S} \times \frac{1\ gal}{137{,}000\ Btu} \times \frac{1\ bhp\ input}{0.35\ bhp\ out} \times \frac{2{,}542.5\ Btu}{bhp-hr} = 1.13 \times 10^{-5}\ \frac{lb-SO2}{bhp-hr}$

N-472-39-5: GASOLINE DISPENSING OPERATION WITH ONE 15,000 GALLON UNDERGROUND STORAGE TANK SERVED BY OPW PHASE I VAPOR RECOVERY SYSTEM, SINGLE FILL CONFIGURATION (VR-102-E), AND TWO FUELING POINTS WITH TWO GASOLINE DISPENSING NOZZLES SERVED BY HEALY EVR PHASE II VAPOR RECOVERY SYSTEM NOT INCLUDING IN-STATION DIAGNOSTICS (ISD) SYSTEM (VR-201-G)

Per application review under project N-1092402, PE = 569 lb-VOC/yr

N-472-40-0: 260 BHP JOHN DEERE MODEL #1242F (SERIAL #038278RG) DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

This permit limits non-emergency operation of the engine to 20 hr/year. Except for NOx and SOx, the permit does not contain emission factors (EFs) for this engine. Therefore, EFs from EPA's AP-42 Table 3.3-1 (10/96) will be used. Note that SOx EF is calculated using maximum sulfur content of 15 ppm by weight in ultra-low sulfur diesel fuel.

PE = EF (lb/bhp-hr) x 260 bhp x 20 hr/yr

Pollutant	EF (lb/bhp-hr)	PE (lb/yr)
*NOx	0.016	83
**SOx	1.13×10^{-5}	0
PM10	2.2×10^{-3}	11
CO	6.68×10^{-3}	35
VOC	2.51×10^{-3}	13

*7.2 g-NOx/bhp-hr x lb/453.6 g = 0.016 lb-NOx/bhp-hr

** $\frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1\ lb-fuel}{gallon} \times \frac{2\ lb-SO_2}{1\ lb-S} \times \frac{1\ gal}{137{,}000\ Btu} \times \frac{1\ bhp\ input}{0.35\ bhp\ out} \times \frac{2{,}542.5\ Btu}{bhp-hr} = 1.13 \times 10^{-5}\ \frac{lb-SO2}{bhp-hr}$

N-472-41-1: GROUNDWATER REMEDIATION SYSTEM WITH A SHALLOW TRAY MODEL #2331 AIR STRIPPER SERVED BY TWO CARBTROL MODEL #G-3 140 LB CARBON CANISTERS CONNECTED IN SERIES

This permit limits effluent gas flow rate to 300 scfm, and effluent VOC concentration to 1.3 ppmv as trichloroethylene (TCE). Molecular weight of TCE is 131.4 g/mol

PE = 1.3 x 10^{-6} x 300 ft^3-gas/min x 131.4 lb/lb-mol x 1/379.5 ft^3-gas/lb-mol x 60 min/hr x 8,760 hr/yr
= 71 lb-VOC/yr

N-472-45-2: SOIL REMEDIATION PROJECT SERVED BY TCE VAPOR EXTRACTION SYSTEM #1, TWO CARBON CANISTERS CONNECTED IN SERIES OR BY CATALYTIC OXIDIZER

This permit limits effluent gas flow rate to 400 scfm, and effluent VOC concentration to 6.0 ppmv. Molecular weight of the effluent gas is 131.4 g/mol

PE = 6 x 10^{-6} x 400 ft^3-gas/min x 131.4 lb/lb-mol x 1/379.5 ft^3-gas/lb-mol x 60 min/hr x 8,760 hr/yr
= 437 lb-VOC/yr

N-472-54-2: SOIL REMEDIATION PROJECT SERVED BY TCE VAPOR EXTRACTION SYSTEM #2, TWO CARBON CANISTERS CONNECTED IN SERIES OR BY A CATALYTIC OXIDIZER

This permit limits effluent gas flow rate to 400 scfm, and effluent VOC concentration to 6.0 ppmv. Molecular weight of the effluent gas is 131.4 g/mol

PE = 6 x 10^{-6} x 400 ft^3-gas/min x 131.4 lb/lb-mol x 1/379.5 ft^3-gas/lb-mol x 60 min/hr x 8,760 hr/yr
= 437 lb-VOC/yr

N-472-55-2: SOIL REMEDIATION PROJECT SERVED BY TCE VAPOR EXTRACTION SYSTEM #3, TWO CARBON CANISTERS CONNECTED IN SERIES OR BY A CATALYTIC OXIDIZER

This permit limits effluent gas flow rate to 400 scfm, and effluent VOC concentration to 6.0 ppmv. Molecular weight of the effluent gas is 131.4 g/mol

PE = 6 x 10^{-6} x 400 ft^3-gas/min x 131.4 lb/lb-mol x 1/379.5 ft^3-gas/lb-mol x 60 min/hr x 8,760 hr/yr
= 437 lb-VOC/yr

N-472-57-0: 102 BHP JOHN DEERE MODEL #4039T DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR (LOCATED NORTH OF B-892 CENTRAL CONTROL POST)

This permit limits non-emergency operation of the engine to 20 hr/year. The permit does not contain emission factors (EFs) for this engine. Therefore, except for SOx, EFs from EPA's AP-42 Table 3.3-1 (10/96) will be used. SOx EF is calculated using maximum sulfur content of 15 ppm by weight in ultra-low sulfur diesel fuel.

PE = EF (lb/bhp-hr) x 102 bhp x 20 hr/yr

Pollutant	EF (lb/bhp-hr)	PE (lb/yr)
NOx	0.031	63
*SOx	1.13×10^{-5}	0
PM10	2.2×10^{-3}	4
CO	6.68×10^{-3}	14
VOC	2.51×10^{-3}	5

$$* \frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1\ lb-fuel}{gallon} \times \frac{2\ lb-SO_2}{1\ lb-S} \times \frac{1\ gal}{137{,}000\ Btu} \times \frac{1\ bhp\ input}{0.35\ bhp\ out} \times \frac{2{,}542.5\ Btu}{bhp-hr} = 1.13 \times 10^{-5}\ \frac{lb-SO2}{bhp-hr}$$

N-472-58-0: 68 BHP CUMMINS MODEL #4B3.9-G (SERIAL #J950588409) DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

This permit limits non-emergency operation of the engine to 20 hr/year. The permit does not contain emission factors (EFs) for this engine. Therefore, except for SOx, EFs from EPA's AP-42 Table 3.3-1 (10/96) will be used. SOx EF is calculated using maximum sulfur content of 15 ppm by weight in ultra-low sulfur diesel fuel.

PE = EF (lb/bhp-hr) x 68 bhp x 20 hr/yr

Pollutant	EF (lb/bhp-hr)	PE (lb/yr)
NOx	0.031	42
*SOx	1.13×10^{-5}	0
PM10	2.2×10^{-3}	3
CO	6.68×10^{-3}	9
VOC	2.51×10^{-3}	3

$$* \frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1\ lb-fuel}{gallon} \times \frac{2\ lb-SO_2}{1\ lb-S} \times \frac{1\ gal}{137{,}000\ Btu} \times \frac{1\ bhp\ input}{0.35\ bhp\ out} \times \frac{2{,}542.5\ Btu}{bhp-hr} = 1.13 \times 10^{-5}\ \frac{lb-SO2}{bhp-hr}$$

N-472-60-0: WASTE EXPLOSIVE MATERIAL DISPOSAL OPERATION SERVED BY A 1.2 MMBTU/HR NATURAL GAS-FIRED SPINKS/WHITEHORSE THERMAL TREATMENT UNIT

This permit limits the use of explosives to 260 lb/day (including water), and number of burns to 100 burns/yr. Presuming one burn per day and using the EFs from the application review under project N-980244, the potential emissions would be:

Explosives:
PE = EF (lb/lb-explosive) x 260 lb/day x day/burn x 100 burns/yr

Explosives		
Pollutant	EF (lb/lb-explosive)	PE (lb/yr)
NOx	3.4×10^{-4}	9
SOx	4.0×10^{-6}	0
PM10	2.3×10^{-3}	60
CO	3.4×10^{-5}	1
VOC	3.7×10^{-6}	0

Thermal treatment unit:
PE = EF (lb/MMBtu) x 1.2 MMBtu/hr x 1 hr/day x day/burn x 100 burns/yr

Thermal treatment unit		
Pollutant	EF (lb/MMBtu)	PE (lb/yr)
NOx	0.014	2
SOx	0.0015	0
PM10	7.2×10^{-3}	1
CO	0.0014	0
VOC	6.0×10^{-3}	1

Summary (total):

Pollutant	PE (lb/yr)
NOx	11
SOx	0
PM10	61
CO	1
VOC	1

N-472-61-0: WASTE EXPLOSIVE MATERIAL DISPOSAL OPERATION SERVED BY A BURN PAN AND AN ELECTRICAL SPARK TYPE EXPLOSIVES DETONATING DEVICE

This permit limits the use of explosives to 150 lb/day and number of burns to 100 burns/yr. Presuming one burn per day and using the EFs from the application review under project N-980244, the potential emissions would be:

Explosives:
PE = EF (lb/lb-explosive) x 150 lb/day x day/burn x 100 burns/yr

Explosives		
Pollutant	EF (lb/lb-explosive)	PE (lb/yr)
NOx	3.4×10^{-4}	5
SOx	4.1×10^{-6}	0
PM10	2.3×10^{-3}	35
CO	3.4×10^{-5}	1
VOC	2.9×10^{-5}	0

N-472-62-1: EXPLOSIVES DETONATION CHAMBER SERVED BY A SODIUM HYDROXIDE SCRUBBER AND A HEPA FILTRATION UNIT

This permit contains emission factors and processing rate. This information will be utilized to determine the potential emissions for this permit unit.

PE = EF (lb/lb-explosive) x 5,000 lb/yr

Pollutant	EF (lb/lb-explosive)	PE (lb/yr)
NOx	0.0265	133
SOx	0.001	5
PM_{10} (excluding lead)	6.0E-05	0
CO	0.398	1,990
VOC	0.021	105
Lead	2.7E-04	1
H_2S	0.0155	78
HF	0.001	5
NH_3*	0.0218	109

*NH3 emission factor taken from the application review under project N-990585

N-472-63-0: 349 BHP CATERPILLAR MODEL #3306 BDITA DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

This permit limits non-emergency operation of the engine to 50 hr/year. Except for NOx, SOx and PM10 emissions, the permit does not contain emission factors (EFs) for this engine. Therefore, EFs from EPA's AP-42 Table 3.3-1 (10/96) will be used. Note that SOx EF is calculated using maximum sulfur content of 15 ppm by weight in ultra-low sulfur diesel fuel. NOx and PM10 emission factors are listed in the permit.

PE = EF (lb/bhp-hr) x 349 bhp x 50 hr/yr

Pollutant	EF (lb/bhp-hr)	PE (lb/yr)
*NOx	0.01	175
**SOx	1.13×10^{-5}	0
PM10	3.31×10^{-4}	6
CO	6.68×10^{-3}	117
VOC	2.51×10^{-3}	44

*4.53 g-NOx/bhp-hr x lb/453.6 g = 0.01 lb-NOx/bhp-hr

** $\frac{0.000015\ lb-S}{lb-fuel} \times \frac{7.1\ lb-fuel}{gallon} \times \frac{2\ lb-SO_2}{1\ lb-S} \times \frac{1\ gal}{137{,}000\ Btu} \times \frac{1\ bhp\ input}{0.35\ bhp\ out} \times \frac{2{,}542.5\ Btu}{bhp-hr} = 1.13 \times 10^{-5}\ \frac{lb-SO2}{bhp-hr}$

***0.15 g-PM10/bhp-hr x lb/453.6 g = 3.31×10^{-4} lb-PM_{10}/bhp-hr

N-472-64-0: 370 BHP CUMMINS MODEL #GTA14G1 PROPANE-FIRED EMERGENCY STANDBY IC ENGINE EQUIPPED WITH NON-SELECTIVE CATALYTIC CONVERTER POWERING AN ELECTRICAL GENERATOR

This permit limits non-emergency operation of the engine to 100 hr/year. Hourly emissions are taken from the application review under project N-1000130.

PE = PE (lb/hr) x 100 hr/yr

Pollutant	PE (lb/hr)	PE (lb/yr)
NOx	1.63	163
SOx	0.004	0
PM10	0.52	52
CO	1.63	163
VOC	0.81	81

N-472-65-1: SOIL REMEDIATION PROJECT SERVED BY UP TO FOUR 140 LB VAPOR PHASE GRANULAR ACTIVATED CARBON CANISTERS CONNECTED IN SERIES (VARIOUS LOCATIONS)

Per application review under project N-1054342, VOC emissions are 1,204 lb/yr. Thus,

PE = 1,204 lb-VOC/yr

N-472-67-0: TRANSPORTABLE SOIL REMEDIATION PROJECT SERVED BY THREE 250 LB CARBON CANISTERS CONNECTED IN SERIES

Per application review under project N-1031550, VOC emissions from this operation are 949 lb/year. Thus,

PE = 949 lb-VOC/yr

N-472-76-0: 315 BHP JOHN DEERE MODEL 6068HF485 TIER 3 CERTIFIED DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

Per application review under project N-1073599,

Pollutant	PE (lb/yr)
NOx	81
SOx	0
PM10	3
CO	16
VOC	6

N-472-78-0: 314 BHP (INTERMITTENT) CUMMINS MODEL QSB7-G6 TIER 4I CERTIFIED DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

Per application review under project N-1133145,

Pollutant	PE (lb/yr)
NOx	36
SOx	0
PM10	0
CO	0
VOC	0

N-472-79-0: TRANSPORTABLE 314 BHP (INTERMITTENT) CUMMINS MODEL QSB7-G6 TIER 4I CERTIFIED DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR

Per application review under project N-1133488,

Pollutant	PE (lb/yr)
NOx	72
SOx	0
PM10	0
CO	0
VOC	0

N-472-81-0: 315 BHP PERKINS/CATERPILLAR MODEL 1106D-ETA/C7.1 TIER 3 CERTIFIED DIESEL-FIRED EMERGENCY STANDBY IC ENGINE POWERING AN ELECTRICAL GENERATOR (REPLACEMENT FOR N-472-34)

Per application review under project N-1153669,

Pollutant	PE (lb/yr)
NOx	91
SOx	0
PM10	3
CO	28
VOC	5

N-472-82-0: 130 BHP PERKINS/CATERPILLAR MODEL C4.4 DIESEL-FIRED (TIER 3 CERTIFIED) EMERGENCY ENGINE POWERING AN ELECTRICAL GENERATOR.

This ATC permit is not implemented. The ATC requires cancellation of N-472-40-0. Per application review under project N-1171901,

Pollutant	PE (lb/yr)
NOx	38
SOx	0
PM10	2
CO	14
VOC	2

N-472-83-0: 324 BHP CUMMINS MODEL QSB7-G5 NR3 DIESEL-FIRED EMERGENCY ENGINE (TIER 3 CERTIFIED) POWERING AN ELECTRICAL GENERATOR.

This ATC permit is not implemented. The ATC requires cancellation of N-472-34-0. Per application review under project N-1172624,

Pollutant	PE (lb/yr)
NOx	92
SOx	0
PM10	2
CO	25
VOC	5

Appendix E
HRA and AAQA Summary

San Joaquin Valley Air Pollution Control District
Risk Management Review

To:	Jag Kahlon – Permit Services
From:	Yu Vu – Technical Services
Date:	December 14, 2017
Facility Name:	Lawrence Livermore National Laboratory
Location:	Corral Hollow Road, Tracy, CA
Application #(s):	N-472-84-0
Project #:	N-1173492

A. RMR SUMMARY

RMR Summary						
Units	**Prioritization Score**	**Acute Hazard Index**	**Chronic Hazard Index**	**Maximum Individual Cancer Risk**	**T-BACT Required?**	**Special Permit Requirements?**
N-472-84-0	1.49	2.89E-01	1.27E-04	3.95E-10	No	No
Project Totals	1.49	2.89E-01	1.27E-04	3.95E-10		
Facility Totals	>1	2.93E-01	5.23E-03	1.54E-05		

Proposed Permit Requirements

To ensure that human health risks will not exceed District allowable levels; the following shall be included as requirements for:

Unit # 84-0

No special requirements are required.

B. RMR REPORT

I. Project Description

Technical Services received a request on December 4, 2017, to perform an Ambient Air Quality Analysis and a Risk Management Review for an open detonation operation. Lawrence Livermore National Laboratory (LLNL) is proposing to increase the amount of non-radioactive explosive materials used to conduct open detonation at their Site 300, Building 851 complex. The proposed increase is for up to 1,000 lb/day and 7,500 lb/yr of explosive material.

II. Analysis

Toxic emissions for this proposed unit were calculated using emission factors from AP-42 (Sections 13.3 and 15.9), the Open Burn-Open Detonation Model, the Combined Obscurant

Model for Battlefield Induced Contaminants, Stoichiometric Conversions and the District profile for concrete emissions. The emissions were then entered into the San Joaquin Valley APCD's Hazard Assessment and Reporting Program (SHARP). In accordance with the District's Risk Management Policy for Permitting New and Modified Sources (APR 1905, May 28, 2015), risks from the proposed unit's toxic emissions were prioritized using the procedure in the 1990 CAPCOA Facility Prioritization Guidelines. The prioritization score for this proposed facility was greater than 1.0 (see RMR Summary Table). Therefore, a refined health risk assessment was required. The AERMOD model was used, with the parameters outlined below and onsite meteorological data for 2012 provided by LLNL to determine the dispersion factors (i.e., the predicted concentration or X divided by the normalized source strength or Q) for a receptor grid. These dispersion factors were input into the SHARP Program, which then used the Air Dispersion Modeling and Risk Tool (ADMRT) of the Hot Spots Analysis and Reporting Program Version 2 (HARP 2) to calculate the chronic and acute hazard indices and the carcinogenic risk for the project.

The following parameters were used in the modeling runs:

Analysis Parameters Unit 84-0					
Source Type	Volume		**Location Type**		Rural
Emission Rate (hr/day)	See Ems File		**Closest Receptor (m)**		~3200
Emission Rate (yr/year)	See Ems File		**Type of Receptor**		Worker
Volumes	**1**	**2**	**3**	**4**	**5**
Release Height (m)	0	86	155	207	241
Length of Side (m)	735.3	589.1	442.9	292.4	146.2
Initial Lateral Dimension (m)	171	137	103	68	34
Initial Vertical Dimension (m)	86	69	52	34	17
Emission Rate (%)	20	35	25	16	4

*Note: The source was modeled as a single volume source consisting of five separate volume sources. This was achieved by using the ALL source group and scaling the normalized emission rate (1 g/s) of each volume source to match their respective % emission rate. That is, Volume 1 had an emission rate of 0.2 g/s, Volume 2 had an emission rate of 0.35 g/s and so on an so forth. The entire volume's emission rate is thus 1 g/s.

Technical Services also performed modeling for criteria pollutants CO, NO_x, SO_x, and PM_{10} with the emission rates below:

Unit #	**NO_x (Lbs.)**		**SO_x (Lbs.)**		CO (Lbs.)		**PM_{10} (Lbs.)**	
	Hr.	Yr.	Hr.	Yr.	Hr.	Yr.	Hr.	Yr.
84-0	31	233	0.04	0.3	4.80	36	167	1,324

The results from the Criteria Pollutant Modeling are as follows:

Criteria Pollutant Modeling Results*

	Background Site	1 Hour	3 Hours	8 Hours	24 Hours	Annual
CO	Stockton-Hazelton	Pass	X	Pass	X	X
NO_x	Stockton-Hazelton	Pass[1]	X	X	X	Pass
SO_x	Fresno – Garland (2015)	Pass	Pass	X	Pass	Pass
PM_{10}	Stockton-Hazelton	X	X	X	Pass[2]	Pass[2]
$PM_{2.5}$	Stockton-Hazelton	X	X	X	Pass[3]	Pass[3]

*Results were taken from the attached PSD spreadsheet.
[1]The project was compared to the 1-hour NO2 National Ambient Air Quality Standard that became effective on April 12, 2010 using the District's approved procedures.
[2]The criteria pollutants are below EPA's level of significance as found in 40 CFR Part 51.165 (b)(2).
[3]The court has vacated EPA's $PM_{2.5}$ SILs. Until such time as new SIL values are approved, the District will use the corresponding PM_{10} SILs for both PM_{10} and $PM_{2.5}$ analyses.

III. Conclusion

The acute and chronic indices are below 1.0 and the cancer risk factor associated with the project is less than 1.0 in a million. **In accordance with the District's Risk Management Policy, the project is approved without Toxic Best Available Control Technology (T-BACT).**

These conclusions are based on the data provided by the applicant and the project engineer. Therefore, this analysis is valid only as long as the proposed data and parameters do not change.

The emissions from the proposed equipment will not cause or contribute significantly to a violation of the State and National AAQS.

IV. Attachments

A. RMR request from the project engineer
B. Additional information from the applicant/project engineer
C. Facility Summary

Appendix F
Quarterly Net Emissions Change

Quarterly Net Emissions Change (QNEC)

The Quarterly Net Emissions Change is used to complete the emission profile screen for the District's PAS database. The QNEC shall be calculated as follows:

QNEC = PE2 - PE1, where:

QNEC = Quarterly Net Emissions Change for each emissions unit, lb/qtr.
PE2 = Post Project Potential to Emit for each emissions unit, lb/qtr.
PE1 = Pre-Project Potential to Emit for each emissions unit, lb/qtr.

Using the values in Sections VII.C.2 and VII.C.1 in the evaluation above, quarterly PE2 and quarterly PE1 can be calculated as follows:

$PE2_{quarterly} = PE2_{annual} \div 4$ quarters/year
$PE1_{quarterly} = PE1_{annual} \div 4$ quarters/year

N-472-84-0:

Quarterly NEC [QNEC]			
Pollutant	**PE2 (lb/qtr)**	**PE1 (lb/qtr)**	**QNEC (lb/qtr)**
NO_X	58.25	0	58.25
SO_X	0	0	0
PM_{10}	331	0	331
CO	9	0	9
VOC	29.25	0	29.25

Appendix G
Correspondence with EPA Region 9

Jag Kahlon

From: Basinger, David <Basinger.David@epa.gov>
Sent: Tuesday, May 1, 2018 8:18 AM
To: Jag Kahlon
Subject: FW: Jag at SJVAPCD: LLNL Site 300 compliance status Q
Attachments: NESHAPs_CY16_Final_DIST.PDF

Jag,

I enjoyed talking with you yesterday.

I reached out to Ryder Freed, our region's Air Radiation Program Coordinator, and she sent the following email, with a copy of LLNL's latest report.

Please call/email if you have further questions.

Dave Basinger
Environmental Engineer, Air & TRI Enforcement
Enforcement Division, Mail Code ENF-2-1
U.S. Environmental Protection Agency, Region 9
75 Hawthorne Street
San Francisco, CA 94105-3901
office 415.972.3506
fax 415.947.3519 (include name and mail code)

From: Freed, Rachel
Sent: Monday, April 30, 2018 3:12 PM
To: Basinger, David <Basinger.David@epa.gov>
Cc: Chew, Andrew <Chew.Andrew@epa.gov>; BANDROWSKI, MIKE <Bandrowski.Mike@epa.gov>
Subject: RE: Jag at SJVAPCD: LLNL Site 300 compliance status Q

Hi Dave,

We receive the rad NESHAP annual reports and I review them every year. We receive reports by the end of June for the previous calendar year. LLNL's most recent report showed that they are incompliance with the 10mrem/year limit. Their calculations were:

Livermore Site: 2.8×10^{-3} mrem (2.8×10^{-2} μSv)
Site 300: 2.2×10^{-4} mrem (2.2×10^{-3} μSv)

Let me know if you need any more information, I also attached their report if you need to reference anything.

Ryder Rachel Freed
Air Radiation Program Coordinator
US Environmental Protection Agency Region 9
75 Hawthorne Street
San Francisco, CA 94105
415.972.3267

Appendix H
CEQA Notice of Exemption Assessment

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

District Project No. N-1173492

Lawrence Livermore National Laboratory (LLNL) Experimental Test Site, Site 300

County of San Joaquin

Notice of Exemption Assessment

Prepared by: Michael Corder, Air Quality Specialist
Reviewed by: Patia Siong, Supervising Air Quality Specialist
Reviewed by: Brian Clements, Program Manager

June 21, 2018

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Page Number

I. PROJECT BACKGROUND INFORMATION

1. **Project Title:**

   LLNL Experimental Test Site 300 Project N-1173492

2. **Lead Agency Name and Address:**

   San Joaquin Valley Unified Air Pollution Control District
   1990 E. Gettysburg Avenue
   Fresno CA 93726-0244

3. **Contact Person:**

   CEQA: Michael Corder
   (559) 230-5818

   Permits: Jag Kahlon
   (559) 230-6452

4. **Project Location:**

   The project is located about 15 miles southeast of the LLNL Livermore Site in Livermore, California and 6 miles southwest of Tracy, California in San Joaquin County, which is within the boundaries of the San Joaquin Valley Unified Air Pollution Control District (District).

5. **Project Sponsor's Name and Address:**

   San Joaquin Valley Unified Air Pollution Control District
   1990 E. Gettysburg Avenue
   Fresno CA 93726-0244

6. **General Plan Designation/Zoning:**

   This site is designated for hazardous industrial operations using explosives and zoned General Agriculture in which such use is an allowed use.

7. **Project Description:**

   The applicant, U.S. Department of Energy National Nuclear Security Administration for Lawrence Livermore National Laboratory (LLNL), is proposing to increase the cumulative weight of open-air detonations of non-radioactive, conventional explosive material on an existing outdoor 7,057 square-foot firing table in a secured existing Department of Energy/National Nuclear Security Administration (DOE/NNSA) testing facility Site 300 Building 851 complex. The proposed operation will go from 100

pounds per day to up to 1,000 pounds per day and from 1,000 pounds per year to up to 7,500 pounds per year of explosive material. Per LLNL, the proposed increase in conventional explosives is necessary so they can conduct experiments, each with its own objective, design, and execution, to gather research data vital to the United States counterterrorism and counterproliferation program and stockpile stewardship program missions detailed in the DOE/NNSA's Final Environmental Assessment report DOE/EA-2076[1].

According to LLNL, the counterterrorism and counterproliferation program missions require the design and execution of experiments to better understand the impacts of improvised explosives, explosive devices, and similar weapons commonly used in terrorist activities under real life conditions. The data from these experiments will be used to develop countermeasures against those real life terrorist threats. Likewise, LLNL states the stockpile stewardship program mission requires the design and execution of experiments to obtain a better understanding of the performance characteristics of the existing nuclear weapons stockpile without having to test those nuclear weapons. To support this mission, LLNL will design and conduct "hydrodynamic" and "equation of state" experiments. Hydrodynamic experiments investigate the fluid-like movement of solid materials at the center of an explosion, and equation of state experiments investigate the relationships between pressure, volume, and temperature for a given substance. The data gathered from the hydrodynamic and equation of state experiments will be used to develop and enhance the computer models used to predict nuclear weapon performance over a wide range of conditions and scenarios without having to actually test those weapons.

8. Other Agencies Whose Approvals Are Required and Permits Needed:

The District confirmed with the City of Tracy that the project site is not in the City of Tracy's jurisdiction. The District also confirmed with the County of San Joaquin that the County does not have approval authority over the project because the project is on federal land. Additionally, per LLNL no other agencies (e.g. Department of Water Resources, Department of Toxic Substances Control, and etc.) have claimed authority or required permits during the National Environmental Quality Act (NEPA) Environmental Assessment (EA) public comment period. Therefore, there are no other agencies with approval authority over the project.

[1] https://www.energy.gov/sites/prod/files/2018/03/f49/EA-2076_FINAL%20EA.pdf

II. INTRODUCTION

The California Environmental Quality Act (CEQA) requires each public agency to adopt objectives, criteria, and specific procedures consistent with CEQA Statutes and the CEQA Guidelines for administering its responsibilities under CEQA, including the orderly evaluation of projects and preparation of environmental documents. The District adopted its *Environmental Review Guidelines* (ERG) in 2001. The basic purposes of CEQA are to:

- Inform governmental decision-makers and the public about the potential, significant environmental effects of proposed activities.
- Identify the ways that environmental damage can be avoided or significantly reduced.
- Prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible.
- Disclose to the public the reasons why a governmental agency approved the project in the manner the agency chose if significant environmental effects are involved.

III. PRELIMINARY REVIEW OF ENVIRONMENTAL IMPACT

The District is the Lead Agency under CEQA for this project because there is no other agency with broader statutory authority over this project. The District performed an assessment (this document) to determine whether or not any potential environmental impacts for this project are significant under CEQA. Further details of this analysis are presented below.

A. Impact on Air Quality

Criteria Pollutants - Operational Emissions: Permitted Sources

The denotation of explosives is an emission source that is permitted by the District. District implementation of New Source Review (NSR) ensures that there are no net increase in emissions above specified thresholds from New and Modified Stationary Sources for all nonattainment pollutants and their precursors from stationary source emissions that require District-issued permits. The District has determined that use of District Rule 2201 NSR Offset thresholds as the District thresholds of significance for criteria pollutants under CCR §15064.7 is an appropriate and effective means of promoting consistency in significance determinations within the environmental review process. After complying with NSR requirements, the project-related stationary source criteria pollutant emissions are below the District CEQA thresholds of significance for annual emissions for criteria pollutants (see table below):

Pollutant	CEQA Significance Thresholds for Permitted Equipment and Activities (tpy)	Proposed Project Potential to Emit (tpy)	Significant Annual Criteria Emissions Under CEQA?
CO	100	0.02	**NO**
NOx	10	0.12	**NO**
ROG	10	0.06	**NO**
SOx	27	0.00	**NO**
PM10	15	0.67	**NO**
PM2.5	15	0.67	**NO**

The detonation of explosives result in emissions of criteria pollutant directly caused by the explosion, as well as secondary emissions caused by surface cratering and surface scouring. Surface cratering occurs immediately below the explosion from the air pressure and the surface scouring results from air pressure changes immediately outside of the crater area but within Site 300 Building 851 complex.

Several project design elements are implemented to prevent any possible entrainment and dispersion of surrounding soils at Site 300 Building 851 complex. For example, the 7,057 square foot firing table shall be comprised of at least a 3-foot-deep gravel bed covered with a concrete cap or a metal plate thick enough to prevent particulate matter emissions from surface cratering of the underlying soils. LLNL will also shotcrete the protective berm area adjacent to the firing table and place gravel within 121 feet (37 meter) of the firing table, to prevent underlying soil from being disturbed from surface scouring.

LLNL will also be required by permit conditions to perform site preparation and inspection measures prior to each detonation event, and to prevent the proposed open-air explosives detonation operation from disturbing any soils either beneath the firing table or in the areas beyond the gravel bed and berm. Examples of permit conditions are:

- No radioactive materials to be used in the explosive detonation,
- Quantity of explosives detonated to not exceed 1,000 lb/day and 7,500 lb/year,
- No more than one explosion detonation per day,
- Explosives to be discharged toward the berm facing the firing table,
- The 7,057 square foot firing table to be comprised of at least a 3-foot-deep gravel bed covered with a concrete cap or a metal plate,

- The berm area facing the firing table to have at least a 6-inch thick concrete lining, clean gravel to be laid from the firing table pad out to at least a 121 foot (37 meter) radius from the center of the firing table,
- Explosive detonations to not disturb surface soils beyond a 121-foot radius from the center of the firing table,
- Inspection of the firing table and surrounding areas prior to each detonation and,
- To keep records of each inspection including any firing table resurfacing, berm resurfacing, and/or gravel replacement performed.

Because the proposed explosives operation will not disturb or entrain any of the underlying or surrounding soils into the atmosphere, the District is confident that the proposed operation will not pose a health risk to the public

Criteria Pollutants - Operational Emissions: Non-Permitted Sources

This project results in two additional one-way truck trips per year, needed for reapplication of shotcrete to the protective berm. For the operational trips associated with the project, besides the two one-way truck trips per year, the project will not result in any new mobile source emissions. The project is below the District's conservative significance screening threshold of 47 one-way truck trips per day for having a potential significant impact.

Therefore, the operational emissions from non-permitted sources will be well below the District's established levels of significance for non-permitted equipment and activities, which are the same thresholds as those identified above for Permitted equipment and activities (e.g. 10 tons of NOx per year).

Criteria Pollutants – Construction Emissions

The project will require preparing the existing Site 300 Building 851 complex. The Complex consists of the following three structures: building identified as "Building 851", a 7,057 square foot firing table, and an existing 37-foot high protective soil berm. The project will reinforce existing structures near the firing table with the application of a commercially available shotcrete, or similar material, or gravel. The existing protective soil berm used to contain blast fragments will be reinforced with approximately 81 cubic yards of wet mix shotcrete, applied approximately 125 feet by 35 feet and 0.5 feet deep. An existing dirt roadway approximately 62 feet long will be covered with gravel to a depth of 0.5 feet for a total of approximately 114 cubic yards of gravel. These modifications will prevent excessive suspension of dust during operations. It is estimated that a total of 10 truck trips will be needed to pour the shotcrete/gravel in the first year only for these areas.

Overall, the project is below the District's conservative significance screening threshold of 47 one-way truck trips per day for having a potential significant impact.

Therefore, the construction-related emissions will be below the District's established levels of significance, which are the same thresholds as those identified above for Permitted equipment and activities (e.g. 10 tons of NOx per year).

Toxic Air Contaminants

As part of the application review process, the District performed a Risk Management Review (RMR). Conservative assumptions were utilized to determine the worst-case risk to all possible receptors from construction and operation activities. Please note that the values used to arrive at the project risk level have many safety factors built in. The purpose of those safety factors is to ensure that the most sensitive receptors (children, elderly, pregnant women, and people with weakened immune systems) are protected.

In 2015, the state Office of Environmental Health Hazard Assessment (OEHHA) adopted changes to *Air Toxics Hot Spots Program Guidance Manual for the Preparation of Risk Assessments* (Risk Assessment Guidelines). These revisions were mainly designed to provide enhanced protection of children and other sensitive receptors.

To ensure the greatest health protection, the District has incorporated all of OEHHA's suggested revisions that increased calculated risk, but did not incorporate those changes that decreased calculated risk. The District's revised risk management policies incorporated the following:

- More health protective 95th percentile breathing rate for both children AND adults, instead of OEHHA's proposed 95th percentile for children only and 80th percentile for adults,
- More health protective 70-year residential exposure instead of OEHHA's proposed 30-year, unless the expected project life is shorter,
- More health protective 40-year worker exposure instead of OEHHA's proposed 25-year, unless the expected project life is shorter,
- More health protective receptor (point-specific) impacts instead of OEHHA's spatial averaging method,
- All of the OEHHA changes that increase calculated risk for children.

The District's current thresholds of significance for toxic air contaminant (TAC) emissions from the operations of both permitted and non-permitted sources are combined and presented in the following table.

Maximally Exposed Individual risk Category	CEQA Significance Thresholds for Toxic Air Contaminant (TAC) Emissions	Proposed Project	Significant Toxic Air Contaminant Emissions Under CEQA?
Carcinogens	≥ 20 in one million	0.000395 in one million	**NO**
Non-Carcinogen (Acute)	≥ 1	0.289	**NO**
Non-Carcinogen (Chronic)	≥ 1	0.000127	**NO**

Evaluated under these new methodologies, the proposed project health risk values are within acceptable limits (see table below), and as such, are not expected to pose a significant health risk to any receptor.

Cumulative Air Impact

District Rule 2201 is a major component of the District's attainment strategy as it relates to economic growth. District Rule 2201 applies to new and modified stationary sources of air pollution and provides mechanisms, including emission offsets, by which Authority to Construct (ATC) applications for new and modified stationary sources may be granted without interfering with the attainment or maintenance of Ambient Air Quality Standards (AAQS). District implementation of District Rule 2201 ensures that there is no net increase in emissions above specified thresholds from new and modified stationary sources for all nonattainment pollutants and their precursors.

Future attainment of State and Federal AAQS is a function of successful implementation of District Rule 2201 for new and modified stationary sources and of the District's attainment plans to reduce emissions from existing sources in the San Joaquin Valley. These attainment plans account for the air quality that already exists throughout the San Joaquin Valley. Further, these attainment plans, by bringing about emission reductions throughout the San Joaquin Valley, allow that individual project emission increases that are below the District's NSR offset thresholds will necessarily have a less than significant impact on air quality for all residents in the San Joaquin Valley.

For the purposes of complying with the requirements of CEQA, the District uses the NSR offset thresholds as the thresholds of significance for criteria pollutants under 14 CCR § 15064.7. This is an appropriate and effective means of promoting consistency in significance determinations within the environmental review process, and is applicable to both stationary and non-stationary emissions sources.

Consequently, the District's application of thresholds of significance for criteria pollutants is relevant to the determination of whether a project's individual emissions

would have a cumulatively significant impact on air quality. The District's thresholds of significance for criteria pollutants are applied to evaluate regional impacts of project specific emissions of air pollutants.

In CEQA, a lead agency may determine that a project's incremental contribution to a cumulative effect is not cumulatively considerable if the project will comply with the requirements in a previously approved plan or mitigation program, including, but no limited to an air quality attainment or maintenance plan that provides specific requirements that will avoid or substantially lessen the cumulative problem within the geographic area in which the project is located [14 CCR § 15064(h)(3)]. Thus, if project specific emissions exceed the thresholds of significance for criteria pollutants, the project would be expected to result in a cumulatively considerable net increase of any criteria pollutant for which the District is in non-attainment under applicable Federal or State ambient air quality standards.

The increase in emissions associated with this project is 233 lb./year (0.12 tons/yr) of NOx, 36 lb./year (0.02 tons/yr) of CO, 117 lb./year (0.06 tons/yr) of ROG, 1,324 lb./year (0.67 tons/yr) of PM10, and 1,324 lb./year (0.67 tons/yr) of PM2.5, which is below the following thresholds of significance: 10 tons per year of NOx, 100 tons per year of CO, 10 tons per year of ROG, 15 tons per year of PM10, or 15 tons per year of PM2.5. Therefore, the project would not result in a cumulatively considerable impact.

B. Greenhouse Gases (GHGs)

The District's engineering evaluation demonstrates that the project result in an increase in project specific greenhouse gas emissions of 228 metric tons-CO2e/year. Per District Policy APR 2015, *Zero Equivalency Policy for Greenhouse Gases*, project specific greenhouse gas emissions less than or equal to 230 metric tons-CO2e/year are considered to be zero for District permitting and CEQA purposes. Policy APR 2015 establishes a level below which project specific increases in greenhouse gas emissions are so small that they are not subject to District prohibitory rules or District permit requirements, and as such considered equivalent to zero for District permitting purposes.

On December 17, 2009, the District's Governing Board adopted a policy, APR 2005, *Addressing GHG Emission Impacts for Stationary Source Projects Under CEQA When Serving as the Lead Agency,* for addressing GHG emission impacts when the District is Lead Agency under CEQA and approved the District's guidance document for use by other agencies when addressing GHG impacts as lead agencies under CEQA. Under this policy, the District's determination of significance of project-specific GHG emissions is founded on the principal that projects with GHG emission reductions consistent with AB 32 emission reduction targets are considered to have a less than significant impact on global climate change. Consistent with District Policy 2005, projects complying with an approved GHG emission reduction plan or GHG mitigation program, which avoids or substantially reduces GHG emissions

within the geographic area in which the project is located, would be determined to have a less than significant individual and cumulative impact for GHG emission.

The California Air Resources Board (ARB) adopted a Cap-and-Trade regulation as one of the strategies identified for AB 32. This Cap-and-Trade regulation is a statewide plan, supported by a CEQA compliant environmental review document, aimed at reducing or mitigating GHG emissions from targeted industries. Facilities subject to the Cap-and-Trade regulation must meet an industry-wide cap on overall GHG emissions. Any growth in emissions must be accounted for under that cap such that a corresponding and equivalent reduction in emissions must occur to allow any increase. Further, the cap decreases over time, resulting in an overall decrease in GHG emissions.

Under District policy APR 2025, *CEQA Determinations of Significance for Projects Subject to ARB's GHG Cap-and-Trade Regulation*, the District finds that the Cap-and-Trade regulation is an approved GHG emission reduction plan, consistent with AB32 emission reduction targets, and supported by a CEQA compliant environmental review document. As such, consistent with District Policy 2005, projects complying with Cap-and-Trade requirements are determined to have a less than significant individual and cumulative impact for GHG emissions.

LLNL is also a facility required to report greenhouse gases from stationary source combustion to the State under AB32. The GHG emissions increases associated with this project result from the combustion of fossil fuel(s), other than jet fuel, delivered from suppliers subject to the Cap-and-Trade regulation. In addition, LLNL purchased renewable energy credits to offset greenhouse gas emissions.

Therefore, as discussed above, consistent with District Policies, the District concludes that the GHG emissions increases associated with this project would have a less than significant individual and cumulative impact on global climate change.

C. Other Impacts (e.g. soil disturbance, water quality, noise, etc.)

The District also considered other possible environmental impacts, for example, hazards and hazardous/soil disturbance, water quality, noise, public services, utilities/services systems, etc.

As discussed above, emissions can result from surface scouring when detonating explosives, and surface scouring could potentially generate emissions from the underlying soil. So, to prevent underlying soil from being suspended from surface scouring, the LLNL used the modeling program Combined Obscuration Model for Battlefield Induced Contaminants (COMBIC), which is a software used by the Department of Defense to determine where the surface scouring emissions will occur. The model showed that within 37 meters of the experiment there is the potential for surface scouring emissions. The model results showed that

detonation of 1,000 pounds of explosives on the open-air firing table could affect an area up to 121 feet (37 meters) from the center of the firing table. This area includes firing table itself, concrete structures (instrument enclosures), berm, roads inside the complex, and other unpaved surfaces. To prevent surface scouring emissions from underlying soil, LLNL has proposed to prepare and reinforce all these areas prior to each detonation experiment. For instance, LLNL will prepare the site by reinforcing the existing 3-foot-deep gravel firing table by placing a concrete pad or metal plate on top, placing clean gravel over the ground within a 121 foot (37 meter) radius of the firing table, and reinforcing the existing 35-foot-high, soil berm facing the firing table with concrete. The berm is located at the edge of the gravel bed on the Northwest side of the firing table (the direction of the directional explosions), so the ground around the firing table and between the firing table and the berm will be completely covered with clean gravel. Together, the reinforced firing table, clean gravel bed, and reinforced berm will prevent any disturbance of the underlying soils and will control propagation of the explosion shockwave sufficiently to prevent any of the surface soils beyond 121 feet of the firing table from being disturbed and entrained into the air by the explosion shockwave. LLNL also proposes to inspect the firing table, gravel bed, concrete reinforced berm, and the areas beyond after each detonation and make any necessary repairs prior to the next detonation. Therefore, there will be no suspension of underlying soil. Anything outside of the 37 meters would be caused by wind driven resuspension and would happen whether or not the project existed. Additionally, LLNL is required in accordance with the National Emissions Standards for Hazardous Air Pollutants (NESHAP) to have air surveillance monitoring for radiological emissions performed at Site 300 to account for emissions site-wide. The results of air surveillance monitoring are submitted annually to the EPA and are available in the publicly-available Site Annual Environmental Reports located at https://www-envirinfo.llnl.gov/siteAnnualReports.php.

In addition, as discussed in Section A (Impact on Air Quality), LLNL will be required by permit conditions to cover the firing table with concrete or a metal plate, to cover the berm with at least 6-inches of concrete, to have clean gravel laid from the firing table to at least 121 feet out, and to inspect the firing table and surrounding area prior to each detonation to prevent underlying soil from being suspended. Therefore, under the described condition of operation of the site and the proposed explosive operation as required by stringent permit conditions, the proposed explosives operation will not disturb or entrain any of the underlying or surrounding soils into the atmosphere and will not pose a health risk to the public.

Regarding potential impacts from noise, LLNL has established a long-standing self-imposed one second averaged sound pressure level of 126 dB, not to be exceeded in nearby populated areas. It is an administrative measure to ensure LLNL prevents causing a nuisance to nearby residents and prevents damage to property from airborne vibrations. The 126 dB value is lower than OSHA legal limits for workers' exposure to noise in the workplace (140 dB per 29 CFR 1910.95), further supporting the safety of the 126 dB limit, which is applied to populated areas.

Furthermore, site preparation activities would not require installation of water wells, septic, or waste systems. Implementation of the project would not require any changes in operations impacting existing utilities infrastructure. Existing systems would be sufficient to accommodate activities under the project. No new roads or access routes would be needed. Electrical systems and diagnostic tools necessary for test detonation and analysis are already in place at Site 300 Building 851 complex and would remain in place through the duration of research.
In conclusion, substantial evidence demonstrates that the project will not have a potential significant environmental impact in these other areas and the proposed project is below all of the District's established screening levels of significance for non-permitted equipment and activities (*District Policy APR 2010 - CEQA Implementation*). As such, the District has concluded that the project will not have any significant adverse effects on the environment due to these other impacts.

IV. DETERMINATION

As discussed above, the District reviewed and assessed if there would be any potential significant impacts to the environment, and determined that the proposed project will not result in a potentially significant impact to the environment, nor will it have a considerably cumulative impact on air quality. CEQA has a general exemption rule that applies to projects which do not have the potential for causing a significant effect on the environment (e.g.: general CEQA "common sense" exemption.)

In addition, the project will not result in an increase in the size of Site 300 Building 851 complex. CEQA Guideline for Categorical Exemptions, specifically 15301(e) (Existing Facilities), allows for addition to existing structures that will not result in an increase in size by 50 percent or 2,500 square feet (whichever is less). The project has no increase in size and is within the scope of the exemption.

There is no evidence before the District that the project has the potential to have a significant effect on the environment. To the contrary, substantial evidence demonstrates that there is no possibility that the project will have a significant effect on the environment. Issuance of the ATC constitutes the final decision to approve the project. The District certifies that this project was independently reviewed and analyzed, and that this document reflects the independent judgment of the District.

District CEQA Findings:

The District finds that the project is categorically exempt from the provisions of CEQA pursuant to CEQA Guideline §15301(e) (Existing Facilities), and finds that the project is exempt from CEQA per the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment (CEQA Guidelines §15061(b)(3)), and Pursuant to CCR §15061(d) and §15062(c), a Notice of Exemption will be filed after the issuance of the ATC.

Signature: _____ Date: 6/27/18

Printed name: Brian Clements
Title: Program Manager

Appendix I
GHG Calculations

GHG Calculations

The proposed project is expected to release the following GHGs:

- Sulfur hexafluoride
- Methane
- Carbon dioxide

Sulfur hexafluoride = 21.6 lb/yr (**Appendix C** – Master worksheet, Item #122)
Global warming potential (GWP) = 22,800

Methane = 18 lb/yr (**Appendix C** – Master worksheet, Item #45)
GWP = 25

Carbon dioxide = 9,000 lb/yr (**Appendix C** – Master worksheet, Item #79)
GWP = 1

Carbon dioxide equivalent (CO2e) would be:

CO2e (metric tons/yr) = (21.6 lb-sulfur hexafluoride/yr x 22,800 + 18 lb-methane/yr x 25 + 9,000 lb-CO2/yr x 1) x m-ton/2,205 lb

=228 m-tons CO2e/yr