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*Title:* A Summary of LANSCE Radioactive Air Emissions during  
Calendar Year 2005

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ENV-MAQ

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## **A Summary Of LANSCE Radioactive Air Emissions During Calendar Year 2005**

This report is intended to document in part the events of 2005, detailing how the Meteorology and Air Quality group (ENV-MAQ) interacted with LANSCE operations personnel in tracking and reporting emissions. The emissions management plan for TA-53 operations, documented in procedure ENV-MAQ-610, provided a communications and reporting framework that proved to be quite effective. One unanticipated situation was the ever-increasing rate of radioactive air emissions through late 2005; this meant that the trigger points called out in procedure -610 were being reached weeks apart instead of months apart. The various calculations and reports that were required needed to be generated much more rapidly than originally anticipated, with less time for facility operations to evaluate the situation and plan appropriate responses.

For CY2005, we estimate the off-site dose from LANSCE emissions to be approximately 6.3 millirem, with the Lab as a whole (including LANSCE) to be 6.7 millirem.

Subsequent documents in this report.

- a) Memo ENV-MAQ-344, December 1, 2005, describing emissions to-date and anticipated levels after the successful implementation of emissions controls. [3 pages]
- b) A brief narrative of operations and emissions rates from LANSCE [2 pages]
- c) Plot of emissions from the LANSCE ES-2 stack, showing both daily curies emitted as well as cumulative curies for 2005. [1 page]
- d) Table and plot of the rolling 12-month total off-site dose from LANSCE emissions. [1 page table, 1 page plot.]
- e) Memo ENV-MAQ:05-292, October 16, 2005. Documentation as the first trigger from procedure -610 is met. [2 pages]
- f) Memo ENV-MAQ:05-324. November 14, 2005, describing emissions rates and projected levels as measured and anticipated in mid-November. These projections did not reflect planned emissions controls that were installed that month. [2 pages]
- g) Memo ENV-MAQ:05-021, January 20, 2005. Pre-operational projection of emissions, dose estimate, and ALARA review. [2 pages]
- h) Procedure ENV-MAQ-610, R2, the emissions management plan for LANSCE. [10 pages]

Note that in addition to these more formal communications, additional discussions, phone calls, and meetings took place on this issue, between ENV-MAQ, LANSCE operations personnel, the DOE/NNSA Los Alamos Site Office, and the EPA Region 6 Rad-NESHAP liaison.

The information contained here is current through the end of December 2005. At this time, the non-point emissions from LANSCE are still approximate, as are the particulate & vapor activation product emissions. However, we have no reason to believe that these emissions will be significantly in excess of anticipated levels. This summary report will be updated if conflicting information comes available.

David Fuehne, CHP  
ENV-MAQ Rad-NESHAP compliance team leader  
January 17, 2006

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## STATUS OF LANSCE EMISSIONS AND OFF-SITE DOSE – December 1, 2005

The last week in November, additional emissions controls systems were installed on the output of the LANSCE 1L Target water coolant system and a faulty valve was replaced on this system. As of December 1, stack measurements indicate that these improvements have reduced the emissions rate from the Building 7 stack by a factor of 10. As a result, it appears that LANSCE will **not** exceed the administrative limit of 7.5 millirem for the year. We estimate the year-end LANSCE dose to be approximately 7 millirem, with the Laboratory as a whole (including LANSCE) to be about 7.5 millirem.

The table below contains current emissions status and projections for the remainder of the 2005 beam operations cycle at TA-53. These emissions are radioactive gases from the Building 7 stack, unless otherwise noted.

Report Period (month)	Emissions (Ci)	Off-site dose (mrem)	Rolling 12-month dose
September 2005 (actual)	2585	1.15	3.06
October 2005 (actual)	4664	1.81	4.87
November 2005 (estimated, not final)	4810	1.80	6.67
December 2005 (projected)	800	0.29	6.96
Non-point emissions (evaluated annually; projected)	247	0.17	7.13

### Per guidance in ENV-MAQ-610, the following actions will take place:

- Up-to-date emissions and off-site dose information, as well as projected emissions and doses for the remainder of the run cycle, are distributed to LANSCE operations and the Department of Energy Los Alamos Site Office liaison. This memo meets this requirement.
- Curie projections corresponding to a 12-month dose of 7.5 mrem have been generated (see below). Note that it is now **not** likely that 7.5 mrem will be exceeded for the year.
- On November 30, a meeting was held between ENV-MAQ and LANSCE operations to discuss the plans for the remainder of the year. Given the success of the valve replacement at reducing emissions, there should be no restriction on operations for the remainder of the year.

*(continued)*

- Informal notifications to DOE LASO and EPA Region 6 have taken place throughout this issue's development. Formal weekly reports of emissions are required after emissions are projected to exceed 7 millirem during the "current operating month." As of this time, we do not expect to trigger this requirement, as 7 millirem will be exceeded only after the annual assessment of non-point emissions are included in the 12-month total.
- Note that per the agreement in MAQ-610, LANSCE is limited to 7.5 millirem for the year. Emissions in excess of this level need to be approved by DOE LASO and the appropriate Laboratory Associate Directors. It is anticipated that this approval will **not** be needed for 2005 operations.

#### **A summary of recent emissions controls efforts**

- Prior to the start of the 2005 run cycle in January, the 1L Target water system was equipped with a 600-foot long delay line, designed to hold up emissions and allow for decay of short-lived radioactive gases prior to emissions. As the run cycle continued, the emissions levels began to rise.
- In May 2005, the control system was expanded from a 600-foot delay line to 1200 feet, in response to a rise in emissions levels. The controls immediately reduced emissions to very low levels. After a month, beam levels started to slowly rise again.
- On November 16, a new emissions delay system was installed. The delay system consists of a delay tank and 480' of ½" delay line down stream of the tank. No immediate affects were noted on the emissions levels at maximum beam operations.
- On November 22, the beam current was reduced to 100 uA (approximately 87% of maximum) to reduce emissions.
- On Monday, November 28, an additional 1200' of ¼" delay line was installed to further reduce the level of emissions. The beam was held at 100 uA to observe how emission rates were affected. No reductions were observed.
- On Wednesday November 30, an inspection revealed a potentially faulty valve in the outlet of the target water coolant system. This valve was replaced, and emissions immediately dropped by the factor of ten mentioned above.
- Beam current will be slowly raised to the full-power level, starting on December 1, 2005. Affects on emissions will be noted and reported if significant changes to this memo's projections are anticipated.

#### **Emissions projections and assumptions**

- The November estimate is based on measured data through November 28, the end of that reporting period. Dose assessment from these emissions is not yet final. The value of 1.80 millirem is the best estimate at this time.
- December projections of approximately 30 curies per day are conservative estimates based on observed emission rates immediately following the valve replacement noted above. The beam will not be operational to the 1L target every day. The December projection also includes 1.5 days of higher emissions before the leaking valve was replaced.
- Off-site doses are calculated by the EPA's mandated dispersion modeling/dose assessment program, CAP88. December projected dose impacts are based on multiple-year averages of December weather patterns.  
(continued)
- Per procedures ESH-17-608 and -609, a daily curie limit was established that would result in the facility meeting the 7.5 millirem threshold. This limit was over 100 curies per day. Given the current estimated levels of 30 curies per day, this is no longer a concern for the facility.

### **Future operations**

The EPA has defined its annual limits for radioactive air emissions on a rolling 12-month cycle. One month's emissions is removed from the "balance" of the 12-month cycle as a new month is added. Therefore, a significant percentage of the 2005 off-site dose will remain in the balance as operations start up in 2006. ENV-MAQ will work with LANSCE facility representatives, according to procedure ENV-MAQ-610, to track and appropriately report 2006 emissions.

### **Additional comments**

Questions may arise regarding repair efforts and the timing of emissions controls installation. It is possible that overall off-site dose might have been reduced, if these significant troubleshooting efforts and the controls systems were installed earlier in the year. Two points should be made on this issue.

First, emissions were tracked per ENV-MAQ's quality program, and communications took place with facility operations, LASO, and Laboratory management per ENV-MAQ-610. This procedure establishes an acceptable administrative limit and interim milestones below this level which trigger various actions. The quality system worked as expected for this situation. The only point of concern is the rapid rate toward the end of the operations cycle, meeting the different milestones in a matter of weeks rather than months as expected when the procedure was developed. Calculations, communications and meetings must take place much more rapidly than originally anticipated.

Second, the area around the 1L target is considered a "Very High Radiation Area." Any work in this area during the scheduled operating cycle is tightly controlled, and no workers are allowed in this area during beam operations. Given the fact that all target system components are inspected prior to installation and annual tests take place, significant troubleshooting efforts in the high radiation area did not seem to be the best investment of resources. Thus, serious efforts on improving the emissions controls system and conducting more advance system tests were initiated only after it became apparent that the emissions were rapidly worsening and the milestones in ENV-610 began to be met.

The efforts by LANSCE operations personnel to install, test, and troubleshoot the controls system resulted in various individuals collectively receiving over 500 millirem in radiation dose in the month of November alone. Laboratory management is concerned with radiation doses to both workers and to the public when making these types of decisions. One must balance actual dose to workers with the dose to a "theoretical member of the public" as conservatively calculated by CAP88.

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## **A brief narrative on LANSCE operations and the emissions levels from TA-53 Building-7 Exhaust Stack-2.**

In the early 1990s, the primary focus of the Los Alamos Neutron Science Center (LANSCE) at TA-53 was the high-intensity beam line, dubbed Line A. With the cessation of Line A beam operations in December 1998, the experimental areas on the south side of LANSCE became the focal point for research operations at TA-53. These experimental areas consist of the Lujan Neutron Scattering Center (centered around the 1L Target), the Proton Storage Ring, the Weapons Neutron Research facility (Targets 2 and 4), and the associated experiment stations and flight paths for targets 1L, 2, and 4. Emissions from these areas are ventilated through Exhaust Stack (ES-) 2 of Building 7.

As mentioned, targets on Line A received high-intensity beam, up to 1000 microamperes. Targets 2 and 4 only receive low-intensity beam, less than 10 microamperes. Beam operations to the 1L Target are “medium intensity,” about 60 microamperes through 1999. Starting in 2000, however, a new, more robust target was installed at 1L and beam currents were raised to 100 microamperes and above. By 2005, full power beam delivery was about 120 microamperes.

Of these areas, the major source of radioactive air emissions is the 1L Target and its cooling water systems. The emissions are primarily short-lived radioactive gases, isotopes of carbon, nitrogen, and oxygen with half-lives of 20 minutes or less. These are similar species as those measured from Area A but with a different generation mechanism. At the Area A targets, radioactive gases were generated by interactions of the beam and secondary particles with ambient air near the target cells and at the beam stop. The improved design at the 1L target keeps the target cryot under a tight vacuum, preventing this type of air activation that was observed at Area A. Instead, at the 1L target, the beam’s primary and secondary particles can cause gas generation (via radiolysis) in the target water coolant system, and cause the water system pressure to increase. This pressure is relieved by use of an air eliminator, which allows these gases to escape from the water system and out the exhaust stack. A portion of these gases are radioactive species, measured by the real-time instruments on the ES-2 stack.

As mentioned, beam currents through 1999 were only about 60 microamperes to the 1L target. Off-site doses from these operations, vented through the ES-2 stack, were less than 0.25 millirem – a small fraction of the doses from Area A operations. As beam power increased, however, ES-2 emissions increased as well, with off-site doses in the 1-2 millirem range in 2001 and 2002. The facility operations group installed an emissions controls system in late 2002, designed to hold up the gas and allow the nuclides to decay away before emission from the stack. This system successfully reduced emissions for calendar year 2003 to below the one millirem level. Degradation of these controls resulted in higher emissions in 2004, again over one millirem after only four months of beam operation. This upward trend continued in 2005, with the rate of emissions increasing as the run cycle continues. For 2005, the beam operated for almost 10 months of the year, and the overall off-site dose from LANSCE operations to be between six and seven millirem.

The increasing rate of emissions can be attributed to several factors. First, the facility is operating at higher currents than historically seen, over 120 microamperes, with less “beam down” time. Also, the facility is operating for a longer duration each year – 10 months in 2005 vs. a typical four month cycle in the 1990s. The reduced maintenance time prevents change-out of coolant water filtration system, and the buildup of contaminants in this water can lead to increased levels of radioactive gas generation in the coolant water system. This larger volume of

radioactive gas moves through the control system more rapidly, not allowing for as much radioactive decay. And water leaks in the beam target area, resulting from the harsh radioactive environment in which the cooling systems operate, can cause additional generation of radioactive gases as the beam interacts with water vapor.

The facility management and facility operations directors were continually kept informed of emissions trends, and took efforts to reduce the emissions on several occasions. These are summarized in memo ENV-MAQ-344, attached. By the end of November, emissions were back down to pre-2000 levels, while maintaining higher beam currents of over 100 microamperes. While 2005 emissions will be quite high, the goal is to maintain low emissions rates in future years without sacrificing facility performance.

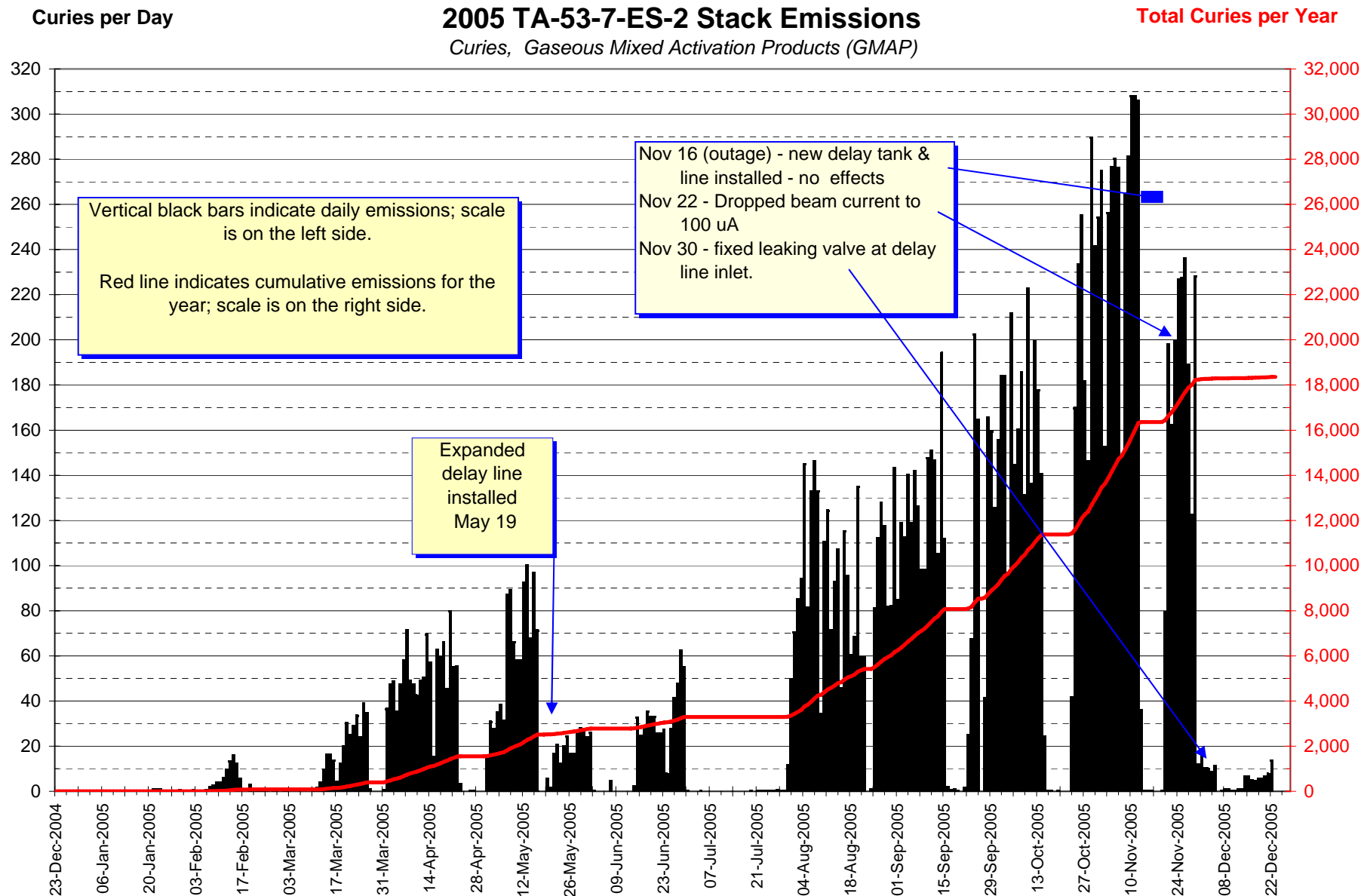
#### Notes on NEWNET

The Neighborhood Environmental Watch NETwork (NEWNET) is a series of environmental monitoring instruments placed throughout Northern New Mexico and other locales. Each of these stations record meteorological data as well as a gamma radiation data at the station. This data is available to the general public over the Internet, at <http://newnet.lanl.gov>

There is a NEWNET station located directly downwind and across Los Alamos Canyon at “East Gate.” This is the location of the Laboratory’s Maximally Exposed Individual (MEI). Gamma measurements from this East Gate station provide an independent verification on the LANSCE emissions measurements. Other NEWNET stations can also measure effects from the LANSCE plume when wind conditions are correct.

NEWNET shows the same trending in emissions as the stack – the gradual rise in emissions over the years, maximum emissions in November, with a factor-of-ten drop on December 1<sup>st</sup> as the emissions controls system was fixed. NEWNET measurements made in early November 2005 show the actual measured dose at East Gate is about half of what CAP88 predicts. This is consistent with previous assessments of CAP88, which indicate a the model is conservative by about factor of two.

Since the “driver” for NEWNET’s is for public outreach rather than for regulatory compliance, NEWNET has experienced funding limitations over the past several years. Events of this year have demonstrated the value of NEWNET as a completely independent check on LANSCE stack emissions, and also have shown the conservative nature of CAP88 dose assessments. These contributions should be considered when evaluating NEWNET program decisions in the future.



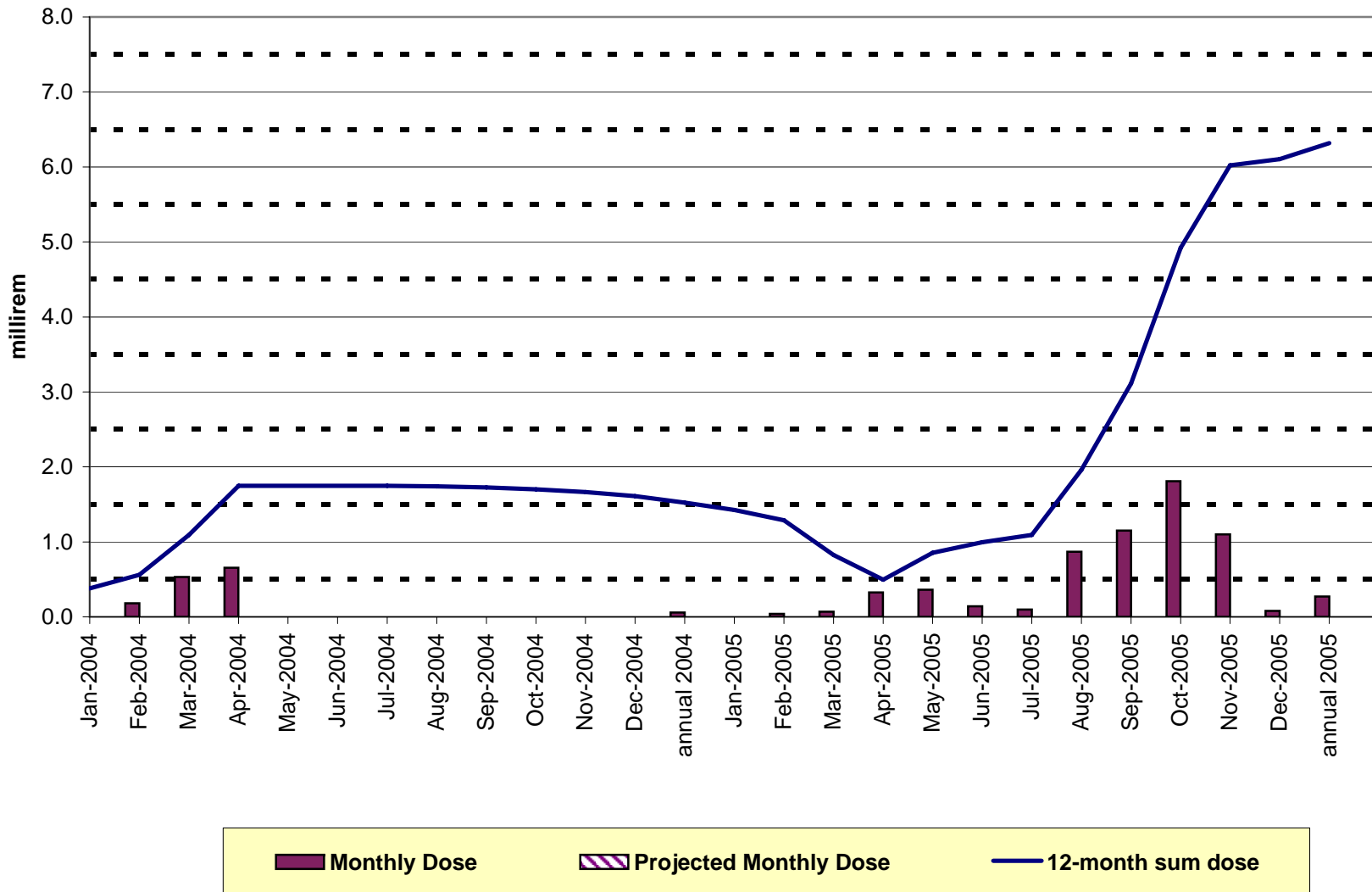
This plot is "unofficial." Monthly emissions reports are the only official emissions data.  
3000 curies = 1 millirem to off-site receptor (approx.)



**Air Pathway Radiation Dose to Maximally Exposed Individual Member of the Public  
Due to LANSCE Accelerator Operations**

Report Period	Monthly dose	Rolling 12 Month Dose	contribution by stack	
			ES-2	ES-3
Jan-2004	0.0972	0.38	9.72E-02	4.15E-05
Feb-2004	0.1820707	0.56	0.182	7.07E-05
Mar-2004	0.5320746	1.09	0.532	7.46E-05
Apr-2004	0.655157	1.75	0.655	1.57E-04
May-2004	0.0000	1.75	x	x
Jun-2004	0.0000	1.75	x	x
Jul-2004	0.0000	1.75	x	x
Aug-2004	0.0000	1.74	x	x
Sep-2004	0.0000	1.72	x	x
Oct-2004	0.0000	1.70	x	x
Nov-2004	0.0000	1.67	x	x
Dec-2004	0.0000	1.61	x	x
2004 non-CAP88	9.42E-04	annual	9.42E-04	x
2004 PVAP	3.44E-04	annual	3.12E-04	3.17E-05
2004 diffuse: SY	1.49E-02	annual	x	x
2004 diffuse: 1LSA	4.04E-02	annual	x	x
2004 diffuse: IPF2	9.63E-06			
sum 2004 annual contrib	0.0566			
end-of-year 2004		1.52	mrem	
Jan-2005	0.0012	1.43	1.13E-03	3.05E-05
Feb-2005	0.0414589	1.29	0.0414	5.89E-05
Mar-2005	0.0698349	0.82	0.0698	3.49E-05
Apr-2005	0.3250675	0.49	0.325	6.75E-05
May-2005	0.3601	0.85	3.60E-01	6.61E-05
Jun-2005	0.1410	1.00	1.41E-01	4.77E-05
Jul-2005	0.0992	1.09	9.91E-02	9.55E-05
Aug-2005	0.8680	1.96	8.68E-01	3.13E-06
Sep-2005	1.1500	3.11	1.15E+00	stack off
Oct-2005	1.8100	4.92	1.81E+00	stack off
Nov-2005	1.1000	6.02	1.10E+00	stack off
Dec-2005	0.0812	6.10	8.12E-02	stack off
2005 non-CAP88	0.00E+00	annual	December dose not finalized	
2005 PVAP	0.00E+00	annual		
2005 diffuse: SY		annual	x	X
2005 diffuse: 1LSA		annual	x	x
2005 diffuse: IPF2		annual		
sum 2005 annual contrib	0.27	estimated		
end-of-year 2005		6.32	mrem	

### 2004-2005 Dose from LANSCE Emissions





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## **TA-53 RADIOACTIVE AIR EMISSIONS: CURRENT STATUS AND ALARA REVIEW**

As of October 2, 2005, the emissions from Technical Area 53, Building 7, Exhaust Stack (ES)-2 stack for calendar year 2005 have reached 3 mrem to the maximally exposed off-site individual. Per procedure MAQ- 610, "Radioactive Air Emissions Management Plan for LANSCE", when off-site doses meet specific thresholds, certain steps must be taken to notify and engage escalating levels of line management in the decision-making process regarding LANSCE operations. This procedure will also ensure that Laboratory emissions do not exceed the 10 millirem standard in the Clean Air Act (40 CFR 61, Subpart H).

As a first step, ENV-MAQ personnel performed a projection of emissions for the remainder of the 2005 operational cycle, based on recent and anticipated operation levels, emissions trends, stack flow rates, etc. The latest projection has LANSCE exceeding 5 millirem for the 2005 calendar year and the rolling 12 month cycles. This information was provided to LANSCE and ENV-MAQ division management, as well as the DOE Site Office.

Second, ENV-MAQ and LANSCE staff met to discuss the current and projected level of emissions elevated reporting requirements under ENV-610 and ALARA concerns. This meeting was held on Thursday, September 29, 2005.

The ALARA issue was first addressed in January 2005, at the LANSCE Radiation Safety Committee meeting. At this time, ENV-MAQ projections for 2005 LANSCE dose was estimated to be 3.3 millirem. This estimate incorporated certain emissions and control measures that were planned for 2005. Specifically, new ion exchange resin bottles were installed on the target cooling water filtration system, which minimizes the potential for production of radioactive gases from contaminants in the water. Also, the emissions delay system on the 1L Target cooling water system was expanded in early May 2005, allowing for more of the radioactive gases generated by beam operations to decay away before their emission from the Building 7 stack. These controls showed initial promise, with emissions reduced by about 66% for the weeks immediately following the installation of the improved delay system. However, emissions levels have increased over time and again reached levels of concern in August and September.

To address this concern, the LANSCE Operations Group plans to install a delay tank system on the 1L Target air eliminator system in the coming weeks, to further increase the delay time. The 1L Target air eliminator system is the primary source of radioactive gases at LANSCE, and delaying these short-lived gases prior to their entering the stack exhaust system can significantly reduce emissions levels. It is anticipated that the delay tank system could be installed as early as the week of October 17<sup>th</sup>, during the facility's schedule maintenance outage. If this target date cannot be met, the next available opportunity for installation is the maintenance outage the week of November 14<sup>th</sup>.

ENV-MAQ also reviewed the reporting requirements of MAQ-610 at this recent meeting, explaining how the facility's reporting requirements change as the emission levels increase to 5 mrem, 7 mrem, and 7.5 mrem. This meeting met the action criteria in procedure MAQ-610 for the current level of LANSCE emissions. ENV-MAQ will now begin forecasting emissions and off-site dose per that procedure.

Individuals in attendance at the September 29, 2005 meeting were:

- Dave Fuehne, Rad-NESHAP Team Leader, ENV-MAQ
- Kevin Anderson, Rad-NESHAP ENV-MAQ member assigned to TA-53
- Floyd Gallegos, LANSCE Deputy Division Leader, Operations
- Glen Johns, LANSCE Accelerator Operations Group Leader (LANSCE-OPS)
- Mike Baumgartner, LANSCE Accelerator Operations Deputy Group Leader (LANSCE-OPS)
- Dan Seely, LANSCE Technical Mission Support Group Leader (LANSCE-TMS)

For your information, a copy of procedure MAQ-610 is available on the web at:  
<http://www.airquality.lanl.gov/QADocs/P610-R2.pdf>

If you have questions or need further information, please contact David Fuehne at [davef@lanl.gov](mailto:davef@lanl.gov) or by phone at (505) 665-3850.

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## PROJECTED STACK EMISSIONS AND OFF-SITE DOSE FROM LANSCE STACK ES-2

The table below contains current emissions status and projections for the remainder of the 2005 beam operations cycle at TA-53. These emissions are radioactive gases from the Building 7 stack, unless otherwise noted.

Report Period (month)	Emissions (Ci)	Off-site dose (mrem)	Rolling 12-month dose
September 2005 (actual emissions)	2585	1.15	3.06
October 2005 (actual emissions)	4664	1.81	4.87
November 2005 (projected emissions)	6000	2.44	7.31
December 2005 (projected emissions)	5100	1.89	9.2
Non-point (diffuse) emissions (evaluated annually; projected)	247	0.166	9.37

Per guidance in ENV-MAQ-610, the following actions will take place:

- Up-to-date emissions and off-site dose information, as well as projected emissions and doses for the remainder of the run cycle, distributed to LANSCE operations and the Department of Energy Los Alamos Site Office liaison.
- Curie projections corresponding to 7.5 mrem have been generated. Note that it is likely that 7.5 mrem will be exceeded for the year.
- A meeting has taken place between ENV-MAQ and LANSCE operations. Further discussion will take place, after the installation of emissions controls devices in mid-November (~ 11/16/2005). After beam restart on 11/21/05, we will need to evaluate emissions levels.
- We will begin weekly reporting of emissions to DOE LASO.
- Informal emissions summaries are on the LANL internal web, updated each workday, at:

**[http://airquality.lanl.gov/Sources%20and%20Requirements/Source/xls/ES2\\_Ci\\_Chart.pdf](http://airquality.lanl.gov/Sources%20and%20Requirements/Source/xls/ES2_Ci_Chart.pdf)**

Note that per the agreement in MAQ-610, LANSCE is limited to 7.5 millirem for the year. Emissions in excess of this level need to be approved by DOE LASO and the appropriate Laboratory Associate Directors.

The projections are based on a conservative value of 300 curies per day for November and December, due to the fact that the Curies per day continue to trend upward.

The projections are based on a conservative assumption of 100% beam delivery for 20 days in November and 17 days in December.

The projections are also based on the existing configuration of the ventilation system. However, during the November maintenance outage, a delay tank will be installed on the air separator of the 1L target water cooling system, replacing a delay line that had been installed in May of 2005. The delay tank is being installed in efforts reduce the level of emissions. The projections above do NOT reflect any anticipated reductions in emissions; we are using "worst case" numbers with the existing setup.

Off-site doses are calculated by the EPA's mandated dispersion modeling/dose assessment program, CAP88. Projections are done using average met data for the month in question.

If you require further information, please contact David Fuehne at 505-665-3850 or at [davef@lanl.gov](mailto:davef@lanl.gov) by e-mail.

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## **EMISSIONS ESTIMATE FOR 2005 LANSCE OPERATIONS**

ENV-MAQ has performed an emissions projection for the 2005 LANSCE operations cycle. Operations information has been provided by Floyd Gallegos of LANSCE-DO. Emissions rate information (curies emitted per day) is based on 2004 operations. Due to the large variation in the 2004 emissions rate, this emissions projection will be performed again in late March 2005 to more accurately forecast the 2005 emissions potential.

The projection for 2005 operations is 9,880 curies of radioactive gases, which corresponds to about 3.3 millirem to the maximum off-site receptor. The off-site dose impact is based on historical CAP88 dose assessment and air dispersion modeling.

### **Note on emissions rate determination**

This emissions projection focused on radioactive gases, such as carbon-11, nitrogen-13, and oxygen-15. These gases are short-lived, with half lives of 20 minutes (for C-11) or less. The primary source of these gases is the target cooling water system, specifically the air remover which releases gases as they build up in the water system. The gases are generated from spallation of water molecules under bombardment by the ion beam and secondary particles. A delay system was installed on the air remover system to allow for radioactive decay of the short-lived gases before their emission from the stack. After release from the air remover, the gases have to proceed through the delay system before they enter the stack exhaust ductwork, and the resulting transit time allows for significant decay. The delay system was installed in two stages, one in October 2002 and the second stage in January 2003. This design was adequate for the rate of gas generation at that time. However, the rate of gas generation increased by a factor of four over the course of the 2003-2004 run cycles. One reason for this increase could be the slow saturation of the ion exchange resin beds, which remove particulates from the water system. These particulates can increase the amount of target atoms which generate spallation gases when in the ion beam flux. As a result, the daily emissions level increased from about 5 curies per day in the early 2003 run cycle to over 140 curies per day during maximum emission days late in the 2004 cycle.

The daily emissions factor used in this projection is 50 curies per day for full operations, and 20 curies per day for startup when beam current is ramping up to full power. The value of 50 curies per day reflects the emissions of late 2004, with two reducing factors. During the extended maintenance period, the ion exchange resin bottles were replaced, and a third stage to the delay system was added. These changes should reduce the radioactive air generation within the target cooling water, as well as provide additional decay time for the air that is generated. As a result, 50 curies per day should be a quite conservative value. As mentioned early-cycle emissions rates in 2003 were about 5 curies per day

**ALARA Review**

According to procedure MAQ-103, a process with an off-site dose projection in excess of 3 millirem per year requires a review to ensure that emissions are “as low as reasonably achievable” (ALARA). For these operations, additional emissions controls or operations changes should be reviewed. In this case, emissions control systems (a third delay stage) and process changes (fresh ion exchange resin bottles) have already been incorporated into the project. Given these changes, the estimate of 50 curies per day is likely a conservative number. No further action is needed at this time. When this emissions projection is revised to reflect the appropriate 2005 emissions rate, a subsequent ALARA review will be performed, if it is still necessary.

DF:db

Cy:

Steve Fong, LASO, A316  
Floyd Gallegos, LANSCE-DO, H850  
Ken Johnson, LANSCE-2, H811  
Michael Baumgartner, LANSCE-7, H840  
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Rad-NESHAP Files - 2005 Project Management  
ENV-MAQ File



## **RADIOACTIVE AIR EMISSIONS MANAGEMENT PLAN FOR LANSCE**

**Purpose** This Meteorology and Air Quality Group (MAQ) procedure specifies LANSCE operational and NESHAP dose milestones and LANL management actions to assure that LANL does not exceed the 10-mrem/year standard of 40 CFR 61, Subpart H.

**Scope** This procedure applies only to the dose from LANSCE (TA-53) gaseous airborne stack emissions and generally does not apply to other LANL airborne emissions, unless those other LANL emissions are likely to cause LANL to exceed 10 mrem/year.

**In this procedure** This procedure addresses the following major topics:

<b>Topic</b>	<b>See Page</b>
General information about this procedure	2
Introduction	3
Milestones, actions, and reports	4
Environmental ALARA Reviews	7
Records resulting from this procedure	9

**Hazard Control Plan** The hazard evaluation associated with this work is documented in MAQ-Office.

**Signatures**

Prepared by:  _____ Dave Fuehne, MAQ Rad-NESHAP Project Leader	Date:  <u>6/8/04</u>
Approved by:  _____ Terry Morgan, MAQ QA Officer	Date:  <u>6/8/04</u>
Approved by:  _____ Jean Dewart, MAQ Group Leader	Date:  <u>6/8/04</u>

09/23/04

### **CONTROLLED DOCUMENT**

This copy is uncontrolled if no red stamp is present on printed copies. Users are responsible for ensuring they work to the latest approved revision.

## General information about this procedure

**Attachments** This procedure has the following attachment:

Number	Attachment Title	No. of pages
1	DOE/LANL Agreement Signature Page	1

**History of revision**

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	6/27/95	Superseded agreement dated 1/12/93. Changed weekly reporting to monthly. Eliminated automatic cessation of operations at 8.5 mrem.
1	2/5/97	Required monthly report to DOE shifted to higher-dose milestone to reduce excessive reporting. Daily emissions reporting to DOE changed to weekly. LC/GL eliminated from receiving reports. Recast into ESH-17 procedure format.
2	9/17/04	Updated to reflect changes in organizations and personnel, and to include Environmental ALARA requirements; established lowered dose thresholds to compensate for increased emissions from other LANL facilities, including TA-53 RLW system; and added section pertaining to the impact of other LANL operations on this procedure.

**Who requires training to this procedure?**

The following personnel require training before implementing this procedure:

- MAQ group members assigned to perform calculations or prepare reports supporting this procedure.
- LANSCE personnel who provide emissions information to MAQ.

**Training method**

The training method for this procedure is “**self-study**” (**reading**) and is documented according to MAQ-024 or the LANSCE training procedure.

## General information about this procedure, continued

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### Definitions specific to this procedure

LANSCE operation: LANSCE is “operating” whenever accelerator beam of any magnitude is being delivered to the beam switchyard or beyond. This definition is appropriate because measurable gaseous emissions can not be produced until this condition is met.

Month: Contiguous time periods corresponding roughly to the calendar months but which may be as short as 2 weeks or as long as 6 weeks. MAQ will establish these reporting periods prior to each calendar year, identifying reporting months for LANSCE emissions. These assignments may be modified at any time provided all weeks are accounted for.

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### References

The following documents are referenced in this procedure:

- 40 CFR 61, Subpart H, “National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities”
  - MAQ-Office, “General Office Safety, Security, and Computer Responsibilities for All Employees”
  - MAQ-024, “Personnel Training”
  - MAQ-501, “Dose Assessment Using CAP88”
  - MAQ-608, “Monthly Curie Limit Projection for LANSCE”
  - MAQ-609 “Monthly Dose Projection for LANSCE”
  - DOE Order 5400.5, “Radiation Protection of the Public and the Environment,” changed January 7, 1993
- 

### Background

This procedure is intended to ensure that the Laboratory will not exceed the 10 millirem/year requirement established in 40CFR61, Subpart H. Historically, LANSCE stacks have been allowed 8.5 millirem, with 1.5 millirem remaining for other monitored stacks, non-monitored stacks, and non-point releases. With the changes to the TA-53 RLW system having a potential 1.0 millirem dose, and elevated emissions from cleanup of tritium facilities, the administrative limit for LANSCE stacks is being lowered to 7.5 millirem.

When evaluating LANSCE emissions relative to laboratory limits, all these sources shall be included in any analysis.

## Milestones, actions, and reports

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### Overview

This section provides the LANL actions at various operational and environmental dose points. The key management information reports and meetings used to administratively control emissions within 10 mrem are the following:

1. Preoperational LANSCE operating-cycle dose *projections*.
  2. Monthly dose *determinations* based on *actual* emissions.
  3. Monthly updated dose *projections*, if the *actual* 12-month dose exceeds 3 mrem for the most recent past month.
  4. Tracking of *actual* emissions against an administrative emission limit based on 7.5 mrem, if the 12-month dose is *projected* to exceed 5 mrem during the current or next month.
  5. A LANL internal meeting to evaluate maximum expected dose and proposed actions, if the 12-month dose is *projected* to exceed 7 mrem during the current or next month.
  6. A LANL/DOE meeting to determine actions, if the 12-month dose is *projected* to exceed 7.5 mrem during the current or next month,.
- 

### Milestones and actions

Based on each milestone below, carry out the specified actions.

Milestone	Action
Prior to LANSCE operating cycle	<ol style="list-style-type: none"> <li>a. MAQ generates estimated monthly emissions &amp; doses (based on established dose conversion factors) for the upcoming operating year, including likely operating scenarios (if applicable).</li> <li>b. MAQ notifies the LANSCE Deputy Division Leader for Operations and DOE, projecting the 12-month LANSCE dose by scenario for the operating cycle.</li> <li>c. If the projected dose is in excess of 3 millirem, consult the chapter on “Environmental ALARA Reviews.”</li> </ol>

## Milestones, actions, and reports, continued

Milestone	Action
LANSCE is operating.	<p>d. The MAQ staff assigned to LANSCE continuously monitors total stack emissions according to established MAQ procedures, and reports total stack emissions when available after the end of the month.</p> <p>e. Each month, after emissions data are available, MAQ calculates the LANSCE dose for the past 12 months using procedure MAQ-501 and provides the information to the MAQ-LANSCE staff and the LANSCE Deputy Division Leader for Operations, if requested.</p> <p>If the calculated dose is approaching or in excess of 3 millirem, proceed to the chapter <i>Environmental ALARA Reviews</i>.</p>
LANSCE 12-month MEI dose exceeds 3 mrem for the most recent past month.	<p>d-e. As above.</p> <p>f. MAQ provides LANSCE with an updated emissions projection for the current and following month (if scheduled to operate) based on operating schedules provided by LANSCE.</p> <p>g. Using MAQ-609, MAQ projects the 12 month doses for the remainder of the current month and the next month using available actual emissions data from prior months and the projected schedule of operations. MAQ provides the information to the LANSCE Deputy Division Leader for Operations.</p>
LANSCE 12-month MEI dose is <i>projected</i> to exceed 5 mrem during the current or next month .	<p>d-g. As above. DOE receives a copy of the projection specified in item g.</p> <p>h. Using MAQ-608, MAQ projects an emissions limit (in curies), corresponding to a 12-month dose of 7.5 mrem for the month following the month when the dose is projected to exceed 5 mrem and provides the information to LANSCE (if scheduled to operate).</p> <p>i. If scheduled to operate, MAQ tracks emissions to ensure emissions corresponding to 7.5-mrem are not exceeded during the month following the month when the dose is projected to exceed 5 mrem.</p>

## Milestones, actions, and reports, continued

Milestone	Action
<p>LANSCE 12-month MEI dose is <i>projected</i> to exceed 7 mrem during the current or next month.</p>	<p>d-i. As above. DOE receives at least a weekly copy of the emissions tracking data specified in item h.</p> <p>j. LANSCE, MAQ, and RRES-DO management representatives meet to determine if the 7.5 mrem administrative limit is likely to be exceeded and the appropriate proposed action if that condition occurs. DOE receives a copy of the meeting minutes.</p>
<p>LANSCE 12-month MEI dose is <i>projected</i> to exceed 7.5 mrem during the current or next month.</p>	<p>d-j. As above.</p> <p>(Item j above should have occurred already and would not be repeated.)</p> <p>k. LANSCE, MAQ, RRES-DO, LANL-DIR, and DOE management representatives meet to determine if continued LANSCE operation is appropriate.</p>

### Impact of other LANL operations on these milestones

As stated in the Background section, the milestones set forth here are designed to ensure that the Laboratory will not exceed the 10 mrem/yr requirement of 40 CFR61. To that end, the entire Laboratory exclusive of LANSCE is allocated a total of 1.5 mrem/yr of off-site dose due to operations. Since the milestones herein are designed in consideration of this non-LANSCE dose contribution, contingency plans are required should the non-LANSCE contribution to off-site dose be projected to exceed 1.5 mrem for any reason.

Therefore, if at any time in the calendar year, MAQ discovers that off-site doses from non-LANSCE sources are projected to exceed a total value of 1.5 mrem/yr, then the milestones established herein must be changed to ensure that the 10 mrem/yr site limit is not exceeded. The protocol for any such change is as follows:

For every 0.5 mrem that all non-LANSCE sources exceed 1.5 mrem, LANSCE milestones are each reduced by 0.5 mrem. For example, if the combined non-LANSCE dose is expected to be between 1.5 and 2.0 mrem, then instead of the first dose milestone being 3 mrem of actual dose in the preceeding 12 months, that milestone and consequent actions would be implemented at 2.5 mrem.

## Environmental ALARA Reviews

### Overview

DOE Order 5400.5 discusses ALARA requirements, as applied to the public and the environment. Implementation of this Order at the Los Alamos National Laboratory requires an ALARA review for operations that may produce a public dose impact of 3 millirem per year or more.

### Performing Environmental ALARA reviews

An Environmental ALARA review should be performed in conjunction with the applicable operating group for the operations under analysis.

The following steps should be used as a guideline for planned operations at Los Alamos National Laboratory.

Step	Action
1	<p>Determine if alternative processes could be used, such as different types of treatment to discharge air streams, different operational methods, or different or additional engineering controls.</p> <p>Examples of engineering controls can include the use of HEPA filtration to remove radioactive particulates, charcoal filtration or wet scrubbers to remove radioactive vapors, or delay systems to remove short-lived radioactive gases.</p> <p>One example of an operational change that has reduced LANSCE emissions in the past is establishing a time delay after “beam-off” prior to venting water systems.</p>
2	Determine relative doses to the maximally exposed off-site receptors for the different alternatives discussed in Step 1.
3	Determine relative cost differences for the different alternatives discussed in Step 1.
4	Determine changes in the societal impacts associated with the various alternatives discussed in Step 1. For example, are radioactive discharges to water systems preferable to airborne releases.
5	Compare the estimated emissions and dose impacts with the expected emissions from other operations throughout the Laboratory. Determine if changes to existing “allowed” levels of emissions need to be made at other LANL facilities, to ensure that LANL does not exceed the 10 millirem per year limit for emissions of radionuclides to the air.

*Steps continued on next page.*

## Environmental ALARA Reviews, continued

<b>Step</b>	<b>Action</b>
6	Fully document the decisions made by the operating group and MAQ representatives, and maintain records in the MAQ records center.
7	If possible, incorporate the opinions of public representatives in the decision making process to gauge their response to proposed alternatives. This can be done through public meetings, sampling of populace, the Citizen's Advisory Board, or other methods.



## Records resulting from this procedure

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### Records

The following MAQ records generated as a result of this procedure are to be submitted **within two weeks of generation** to the MAQ records coordinator:

- Preoperational dose projection memo and supporting data.
- Monthly reports of actual dose, projected dose, and supporting data.
- Meeting minutes associated with 7- and 7.5-mrem projections.

The following MAQ records generated as a result of this procedure are to be submitted **within two weeks of generation** to the MAQ records coordinator:


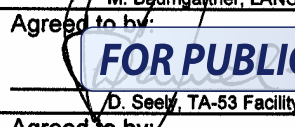
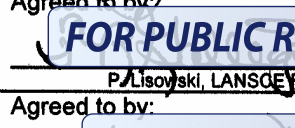
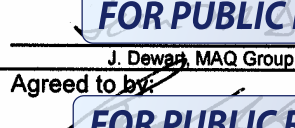
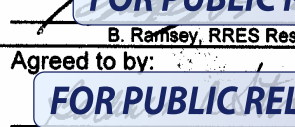
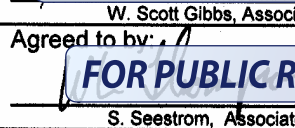

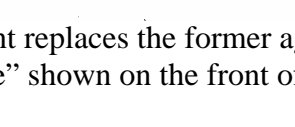
- Emissions projections before and during operation.
- Emissions measurement data.

[Click here to record “self-study” training to this document.](#)

## DOE/LANL AGREEMENT SIGNATURE PAGE

### RADIOACTIVE AIR EMISSIONS MANAGEMENT PLAN FOR LANSCE

The undersigned LANL and DOE managers agree to the milestones and planned actions specified in this MAQ-610, revision 2, procedure for managing LANSCE radioactive air emissions to assure LANL complies with the 10-mrem/year standard specified in 40 CFR 61.92 (Subpart H) for airborne radionuclide emissions.

Agreed to by:  <b>FOR PUBLIC RELEASE</b> M. Baumgartner, LANSCE Nuclear Operations Manager, LANL	Date: <u>8/18/04</u>
Agreed to by:  <b>FOR PUBLIC RELEASE</b> D. Seely, TA-53 Facility Manager, LANL	Date: <u>8/18/04</u>
Agreed to by:  <b>FOR PUBLIC RELEASE</b> P. Lisowski, LANSCE Responsible Division Leader, LANL	Date: <u>8/18/04</u>
Agreed to by:  <b>FOR PUBLIC RELEASE</b> J. Dewar, MAQ Group Leader, LANL	Date: <u>8/18/04</u>
Agreed to by:  <b>FOR PUBLIC RELEASE</b> B. Ramsey, RRES Responsible Division Leader, LANL	Date: <u>8/18/04</u>
Agreed to by:  <b>FOR PUBLIC RELEASE</b> W. Scott Gibbs, Associate Director Operations, LANL	Date: <u>8/19/04</u>
Agreed to by:  <b>FOR PUBLIC RELEASE</b> S. Seestrom, Associate Director Weapons Physics, LANL	Date: <u>8/20/04</u>
Agreed to by:  <b>FOR PUBLIC RELEASE</b> E. Wilmot, Manager, NNSA/TASO	Date: <u>8/29/04</u>

This agreement replaces the former agreement dated 2/5/97 and becomes effective on the "effective date" shown on the front of this procedure.