

Letter Report

Air Monitoring Network at Tonopah Test Range: Network Description and Capabilities

prepared by

Jeffrey Tappen, George Nikolich, Ken Giles,
David Shafer and Tammy Kluesner

submitted to

Nevada Site Office
National Nuclear Security Administration
U.S. Department of Energy
Las Vegas, Nevada

March 2010

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LIST OF ACRONYMS

CAU	Corrective action unit
CEMP	Community Environmental Monitoring Program
CS III	Clean Slate III
DOE	U.S. Department of Energy
GOES	Geostationary Operational Environmental Satellite
PEMS	Portable Environmental Monitoring Station
PIC	Pressurized ion chamber
ROC	Range Operations Center
RSL	Radiological Services Laboratory
SNL	Sandia National Laboratories
SPAS-MT	Solar Powered Air Sampler and Meteorological Tower
TTR	Tonopah Test Range
NNSA/NSO	National Nuclear Security Administration, Nevada Site Office
NTTR	Nevada Test and Training Range
WRCC	Western Regional Climate Center

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INTRODUCTION

During the period April to June 2008, at the behest of the U.S. Department of Energy (DOE) National Nuclear Security Administration, Nevada Site Office (NNSA/NSO); the Desert Research Institute (DRI) constructed and deployed two portable environmental monitoring stations at the Tonopah Test Range (TTR) as part of the Environmental Restoration Project Soils Sub-Project. The TTR is located within the boundaries of the Nevada Test and Training Range (NTTR) near the northern edge, and covers an area of approximately 725.20 km² (179,200 acres). The primary objective of the monitoring stations is to evaluate whether and under what conditions there is wind transport of radiological contaminants from one of the three Soil Sub-Project Corrective Action Units (CAUs) associated with Operation Roller Coaster on TTR. Operation Roller Coaster was a series of tests, conducted in 1963, designed to examine the stability and dispersal of plutonium in storage and transportation accidents. These tests did not result in any nuclear explosive yield. However, the tests did result in the dispersal of plutonium and contamination of surface soils in the surrounding area.

One station is located in the general vicinity of the Range Operations Center (ROC) and other located on the north edge of Clean Slate III (CS III). The ROC station measures potential radionuclide concentration at the closest location where there are regular site workers. The station at CS III is located at the perimeter of the largest of the three TTR Soils Sub-Project CAUs. CS III covers an area of approximately 1.82 km² (450 acres), of which, 0.404685 km² (100 acres) is estimated to contain soils with plutonium concentrations around 200 pCi/g. This station measures the radionuclide concentration at the boundary of the site in one of the predominant downwind directions.

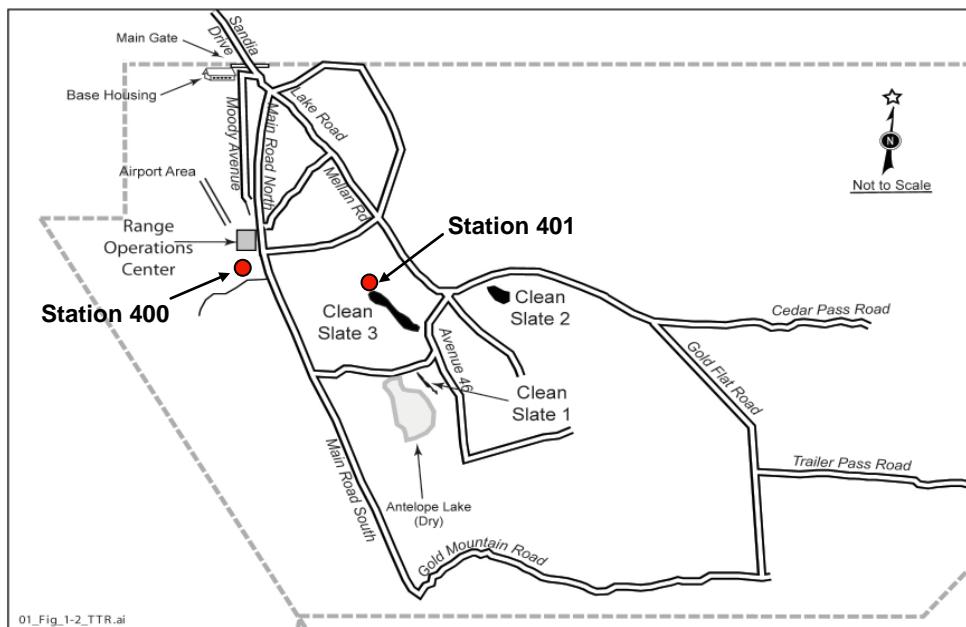
The fundamental design of these stations is similar to that used in the Community Environmental Monitoring Program (CEMP). The TTR stations collect data on selected meteorological and environmental parameters, e.g. wind speed and direction, airborne particulate concentration as a function of particulate size. In addition, airborne particulate samplers are deployed at each location to collect particulate samples for radiological analyses. Data are provided to the Western Regional Climatic Center (WRCC) for management and incorporation in to a TTR-specific database that is under development. Both stations have been in continuous operations since July 2008. This letter report provides a general summary of these monitoring activities.

Monitoring Station Locations and Capabilities

As part of its work under the Soils Subproject, DRI deployed two portable monitoring stations at TTR. The Station 400 Portable Environmental Monitoring Station (PEMS) is located south of the ROC at: 37° 45' 25" N, 116° 45' 26" W. This station was located to provide data at the ROC where there is the greatest concentration of personnel associated with Sandia National Laboratories (SNL), who manages TTR for the DOE NNSA. In addition, Station 400 was located where line power was available to operate the instruments. The second, Station 401, Solar Powered Air Sampler and Meteorological Tower (SPAS-MT), consists of two components: 1) the air sampler located at 37° 45' 39" N, 116° 40' 58" W and 2) the auxiliary meteorological tower at 37° 45' 41" N, 116° 40' 59" W. These components are located along the fenced perimeter of the north end of CS III. Their locations were selected based on a review of wind speed and direction data collected at the Tonopah Airport

(Engelbrecht, et. al, 2008) as well as for ease of access. Although these data are of limited time duration, they are continuous and less influenced by local topography than the Community Environmental Monitoring Program in Tonopah, NV. Figure 1 shows the location of the monitoring stations at TTR.

Both stations are equipped with continuous low volume air samplers (flow rate approximately 0.05663 m^3 (2 ft^3) per minute whose filters are collected, routinely, every two weeks. These filters are delivered to the Radiological Services Laboratory (RSL) at the University of Nevada, Las Vegas for analyses. Standard analyses include gross alpha/beta measurements, and gamma spectral analysis; samples may undergo alpha spectral analysis if initial gamma spectral analyses indicated the presence of Americium (Am)-241, which could indicate that plutonium particles are being transported.



Abstracted from SAND2008 5070P, September 2008.

Figure 1. Location of monitoring stations on TTR.

Station 400: Range Operations Center

Station 400 is a portable station with all monitoring and sampling systems mounted on a 7' X 14' trailer. The station is located approximately 91.44 m (100 yards) south-southwest of the ROC. Figure 2 shows the station configuration as currently deployed. Sensors include an anemometer, wind direction, pyranometer, tipping rain bucket, temperature/relative humidity probe, barometric pressure, soil temperature probe, pressurized ion chamber (PIC), and a ambient air particulate size profiler. Data from these sensors are collected and stored on a Campbell ScientificTM data logger. These data are then transmitted through a Geostationary Operational Environmental Satellite (GOES) transmitter to the WRCC. Regular quality assurance procedures include checking the PIC response and air volume throughput on the air sampler on a month basis. In addition to the real-time instruments, this station is equipped with two low volume air samplers (AirMetrics MiniVolsTM) that can collect air samples on quartz and Teflon filter media, which allows for

different types of chemical and elemental analysis. These air samplers are intended to run in case of nearby wild fire or in conditions of extreme dust storms in which there may be value in distinguishing the relative contribution of organics and inorganic constituents. In addition, the station is equipped with an ambient air particulate size profiler (DustTrakTM). The DustTrakTM measures the concentration of suspended particulates in real time. Data can be used to determine whether high wind events are always associated with higher concentrations, and whether there are correlations between particulate concentrations and radionuclide concentration. Station 400 began operations on May 21, 2008, and has operated continuously since that time. As of September 10, 2009, this station has transmitted over 11,200 hourly data records to the WRCC.

The station is also equipped with a continuous air particulate sampler from which 4" air filter samples are collected every two weeks. Between May 2008 and May 2009, 27 air particulate filter samples were collected and analyzed by gamma spectroscopy and for gross alpha/beta activity. Only naturally occurring radionuclides have been identified and measured on these samples. Beryllium (Be)-7 and Potassium (K)-40 were the most frequently measured radionuclides followed by Lead (Pb)-210, Lead (Pb)-212, and Bismuth (Bi)-214. No anthropogenic gamma emitting radionuclides, e.g. Cesium (Cs)-137, Cobalt (Co)-60, or ²⁴¹Am have been detected on any sample.



Figure 2. Station 400 (PEMS) near ROC.

Station 401: Clean Slate III

Station 401 consists of a solar powered air sampler (sampler and solar panels) mounted on a 7' X 14' trailer, plus a portable meteorological tower, with an anemometer, a temperature/relative humidity probe, and a DustTrak™. The station is located on the north end of CS III. Working with Hi-Q Products Inc., DRI constructed this mobile version of a solar powered air sampler based on a design currently being used by the USAF on the NTTR. Internal airflow monitoring and self-adjustment capabilities allow the air sampler to maintain a near constant flow rate. An internal totalizer is used to collect and store airflow data. Data from the sensors are collected and stored on a Campbell Scientific data logger, and periodically downloaded to a personal computer and transmitted to the WRCC. WRCC personnel are in the process of entering this information into the TTR database. Solar panels, with battery assist, provide power for the air sampler and the meteorological station. Figures 3 and 4 show the configuration of the solar powered air sampler and the location and configuration of the portable meteorological station.

Air samples are collected every two weeks from Station 401 as well and delivered to the laboratory on a quarterly basis for batch processing. Between August 2008 and May 2009, 21 air particulate filter samples were collected and analyzed. Only naturally occurring radionuclides were measured on the samples. Be-7, K-40 and Pb-210 were the most frequently measured radionuclides followed by Pb-212, and Bi-214. No anthropogenic gamma emitting radionuclides have been detected on any sample.



Figure 3. Station 401, solar powered air sampler.

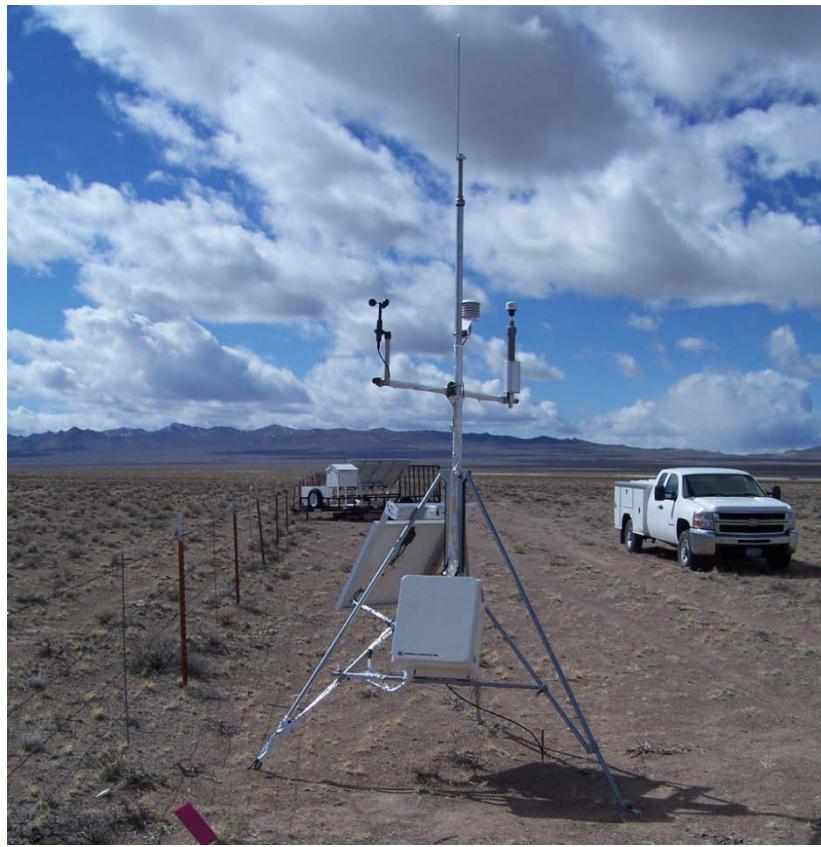


Figure 4. Station 401 portable meteorological station.

TTR Air Monitoring Network Database

Data from the network at TTR are stored and managed via a database currently under development at the WRCC in Reno, Nevada. A beta-version of the database can be accessed via the web at <http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?nvctr> for Station 400 data and <http://www.wrcc.dri.edu/cgi-bin/rawMAIN.pl?nvctcs> for Station 401 data. Available data includes:

- Solar radiation
- Wind speed and direction
- Ambient air temperature (minimum, maximum, and average)
- Relative humidity (minimum, maximum, and average)
- Barometric pressure
- Precipitation (hourly and cumulative)
- At Station 400, ambient gamma exposure rate (minimum, maximum, and average)
- Soil temperature @ 4" depth (minimum, maximum, and average)
- Air particulate counts by size (0.3, 0.5, 0.7, 1, 2, 2.5, and 10 micrometers) as a function of time

When complete, the database will contain the data from sensors and equipment at both stations and the results of the radiometric analyses of the air filter samples.

FY 2010 Planned Activities

During FY 2010, DRI will expand Station 401 capabilities to include wind direction and ambient gamma exposure monitoring using a PIC, and remote data transmission capabilities by GOES. All current monitoring, sampling and analytical activities will be maintained. The GOES will speed population of the database for Station 401 by having data by the majority of instruments feed directly into it, eliminating the need to separately download the data in the field. The GOES transmissions will also allow the operation of the instruments to be monitored remotely at both stations. If data from an instrument appears spurious or is absent, personnel can be deployed to make repairs or change instruments quickly to minimize data loss.

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