

July, 1990

Air Quality Monitoring Summary for Craters of the Moon National Monument

INTRODUCTION:

Craters of the Moon National Monument is a Class I area. Monument staff have been actively monitoring air quality for almost 20 years. This paper will summarize these monitoring activities as a prelude to evaluation of the current monitoring program and establishment of a long-term monitoring plan for the Monument.

POTENTIAL LOCAL/REGIONAL SOURCES OF AIR POLLUTION:

The Idaho National Engineering Laboratory (INEL), a Department of Energy facility, is located approximately 15 miles to the east of the Monument. The site is a nuclear research facility. This operation is the primary local facility requesting PSD permits. At the present time, INEL has approximately ten PSD permits pending with the State Air Quality Bureau. NOx, visibility impacts, and radionuclides are the main concerns. The INEL Annual Environmental Monitoring Program Reports list airborne emissions for the site in metric tonnes:

<u>Year</u>	<u>NO</u>	<u>NO2</u>	<u>SO2</u>
1985	63	92	367
1986	56	45	195
1987	106	320	174
1988	141	611	200

Two large mineral and chemical plants, FMC and Simplot, are located in the Pocatello area, approximately 60 miles southeast of the monument. A concern, in addition to that of "normal" industrial air pollution, is that fluorides are emitted as a result of fertilizer production.

The proposed Thousand Springs Coal-fired power plant is located in Nevada. The site is approximately 150 miles southwest of Craters of the Moon. Eight 250 megawatt generating units are proposed for this site.

The grass seed industry in the Twin Falls, Idaho area plan annual burning of approximately 6,000 acres of bluegrass. The fields are burned to increase yield and to control weeds, pests, and diseases. Twin Falls is about 65 miles southwest of the monument.

Impacts are also caused by activities in Southern Idaho, such as agricultural practices and increased mining exploration. Burning stubble off fields is a common practice for farmers in this area. Dust generated from plowing fields and use of dirt roads can also be significant.

Urbanization and industrialization throughout the Western United States cause regional impacts on Craters of the Moon's air quality. NPS Air

Quality Division estimates indicate that the Southern California area has a high probability of impacting air quality at Craters of the Moon. These impacts can only be expected to increase in the future. One pollutant of concern is ozone.

AMBIENT MONITORING:

No ambient monitoring has been conducted at Craters of the Moon to date. As a result, no baseline for this data has been established.

In 1989, INEL proposed a cooperative monitoring station for NO_x to be located at Craters of the Moon. Under the proposal, DOE would provide monitoring equipment, analysis, and a trailer to house the station. NPS would provide personnel to operate the site and supplies. This proposal is currently on hold pending completion of negotiations between the NPS Air Quality Division, DOE and Craters of the Moon personnel. At current park funding and staffing, we are unable to provide personnel and supplies for this project. However, it appears that Air Quality Division funding is available to assist in the monitoring program.

It would be desirable to establish baseline ozone, and possibly also SO₂, data for the monument.

VISIBILITY:

In 1987, park ranger Mary Laspina conducted statistical analysis of Craters of the Moon visibility data collected to that point in time. Reference will be made throughout this section to conclusions from that report.

A manual teleradiometer was operated at Craters of the Moon from June, 1982 until June, 1985. The manual instrument was replaced with an automatic teleradiometer which was operated until May, 1986.

A plume from the INEL Idaho Chemical Processing Plant was monitored using an automatic 35 mm camera from October, 1987 until June, 1988. An automatic 8mm time lapse camera monitored the plume from July, 1988 until September, 1989. INEL has supplied data on past operation dates for this plant to enable correlation with the photo record. Unfortunately, due to inappropriate equipment used on this monitoring project, we have no usable film record.

NPS has operated a 35 mm camera to monitor visibility since 1982. From June, 1982 until June, 1985, the camera was manually operated. Photographs were taken daily at 0900 and 1500. Monitoring was primarily conducted during summer months when personnel was available. The mandatory targets were Big Southern Butte and the Caribou Mountains. In 1985, the manual camera was replaced with an automatic system that is still in place. The target for this camera is Big Southern Butte, located southeast of the park.

Laspina concluded that although mean standard visual ranges at Craters of the Moon were higher than nationally-calculated median summer visibility

ranges for this area, there was a significant decrease in mean summer visual range during the period from 1982 to 1986.

Information received from Air Resource Specialists in 1987 indicated the following seasonal 10-50-90 standard visual range values for Craters of the Moon:

Spring, 1986:	10% = 104 km	Summer, 1986:	10% = 69 km
	50% = 167 km		50% = 124 km
	90% = 270 km		90% = 222 km
Fall, 1986:	10% = 115 km	Winter, 1987:	10% = 96 km
	50% = 201 km		50% = 212 km
	90% = 391 km*		90% = 359 km

*theoretical max.

The Idaho Air Quality Bureau and the National Park Service have operated a hi-volume gravimetric sampler for total suspended particulates (TSP) at Craters of the Moon since 1974. The bureau provides the equipment, supplies and analysis. NPS provides personnel to operate the sampler. The most recent data available is for 1988. The arithmetic mean value for 1988 was 17 ug/m³, with a range from 2 to 43 ug/m³. 1988 values may be elevated because of the effects of smoke from the Yellowstone area. As a comparison, Laspina found that for the period July, 1983 - December, 1986, the mean TSP value was 13.3 ug/m³, with a maximum value of 76 ug/m³. Data for the period 1975 through 1988 seems to indicate that the annual mean is relatively constant. The annual maximum appears to fluctuate widely.

A series filtration sampler was operated from June, 1982 until May, 1986. This sampler was operated in conjunction with the NPS Air Quality Division and the University of California. Using data from this sampler, Laspina indicated that silicon was the major component of the coarse mass at Craters of the Moon. Coarse mass concentrations were highest in the summer months. This is likely due to wind spread of soil particles.

Laspina states that fine mass was composed of 25% sulfate compounds, 14% soil, 12% soot, and 49% "other" (including nitrates, hydrocarbons, and organic matter). She also states that Craters of the Moon exhibited high concentrations of fine sulfur.

In 1984, the monument participated in the Pacific Northwest Aerosol Mass Apportionment Study of regional haze in Washington, Oregon, and Idaho. A fine particle sampler was operated at Craters of the Moon from July 24 to September 23. Results indicate an average of 4.3 ug/m³ for the Craters of the Moon site, the lowest value of any of the 15 sites in the data summary.

ACID PRECIPITATION:

Craters of the Moon has been a sampling site in the National Acid Deposition Program (NADP) since August, 1980. This site is a joint effort with the BLM Idaho State Office. BLM provides equipment and supplies, while NPS provides operating personnel. Laspina's analysis of Craters of the Moon precipitation data indicates no significant change in mean annual pH during

the period from 1982 through 1987. During those years, the mean annual average pH ranged from 5.6 in 1987 to 5.8 in 1984. For 1989, the mean annual pH was 4.95 with a range from 4.01 to 6.59. This cursory evidence may point to an increase in precipitation acidity. Laspina did not include specific conductance data in her report. Conductance for 1989 averaged 4.27 with a range from 1.7 to 8.6.

BIOEFFECTS:

AQRVs/Visible Injury: In August, 1985, Dr. James Bennett (NPS AGD) visited Craters of the Moon to assist park personnel in identifying air quality related values (AQRV) and visual injury to vegetation. Dr. Bennett identified red-banded tip-burn on Limber Pine, dark stippling on choke cherry, and black bifacial necrosis on aspen. He felt these symptoms could have been caused by ozone and hydrogen fluoride pollution. Dr. Bennett also developed a list of biological AQRVs for the park:

Ozone: Pinus flexilis
 Populus tremula tremuloides
 Populus balsamifera trichocarpa
 Prunus virginiana

Hydrogen Fluoride: Pinus flexilis

Sulfur Dioxide: Populus tremula tremuloides
 Populus balsamifera trichocarpa
 Agropyron spicatum
 Oryzopsis hymenoides
 Acer glabrum
 Lichens
 Mosses

Heavy Metals: Lichens
 Mosses
 Deer

Limber Pine/Fluoride: Needles from Limber Pines were collected in April and August, 1986; in September, 1987; and in July, 1988 for fluoride analysis. Results from this small sample are inconclusive, but fluoride levels do not appear to be high enough to cause visible injury symptoms. The average fluoride levels for the samples are as follows:

May, 1986 - 20 ppm
 August, 1986 - 13 ppm
 September, 1987 - missing
 July, 1988 - 15 ppm

These levels seem to be slightly elevated, however research is needed to determine if these levels are naturally high.

Lichen: In July, 1988, Dr. Lorentz Pearson conducted a small scale study of lichens at Craters of the Moon. Electrolyte leakage was measured; Energy

dispersal spectrometry was used to evaluate toxic elements; a transmission electron microscope was used to examine specimens for abnormalities; and relative abundance and species diversity was examined. Dr. Pearson found slight indications of pollution damage in the campground area and along the state highway near the west boundary of the park. Overall, he concluded that lichens show "no evidence of even moderate levels of air pollution" at Craters of the Moon. However, Dr. Pearson indicated that annual monitoring of lichen to document any change in this condition would be desirable. He identified Letharia columbiana as an excellent biomonitoring species at the monument due to its abundance, high level of sensitivity, and favorable morphological features.

A proposal for Dr. Pearson to conduct lichen/air quality monitoring at Craters of the Moon in 1990 has been submitted to AQID. He has proposed "piggy backing" on a study he is conducting for INEL to provide NPS with an excellent price break. Funding is being arranged through Air Quality Denver.

Mule Deer: Thyroids from roadkilled mule deer are collected for radionuclide analysis at INEL. Although Craters of the Moon deer data is not included in the INEL Environmental Monitoring Program Annual Reports, communication with DOE personnel seems to indicate some elevated levels of iodine have been observed in thyroids collected at Craters of the Moon.

Other biological data: No data has been collected to date on soils or flora/fauna other than those specifically mentioned above.

METEOROLOGICAL:

CRMO Anemometer: In November, 1984, Craters of the Moon staff installed a wind speed and direction monitor at headquarters to determine wind data as related to air quality. This monitor is still in operation. Initial data analysis indicates that winds are predominately from the southwest, except during winter months the winds are predominately from the north and northeast.

INEL/NOAA/NPS Wind Monitor: In May, 1989, through a cooperative effort with INEL and NOAA, a wind speed and direction monitor was installed near the wilderness area boundary within the park. Equipment is owned and operated by DOE. Data is transmitted by satellite to INEL for analysis. No data is yet available.

Other Met Data: Craters of the Moon personnel also operate a NOAA temperature/precipitation station at headquarters and a fire weather station in the North End of the park.

RADIONUCLIDE MONITORING:

INEL Sampler: Since 1973, INEL has operated a radionuclide monitor at Craters of the Moon. Data from the INEL Environmental Monitoring Program Annual Reports follows:

Annual Environmental Radiation Exposures (mR)

1982: 125 +/- 4
 1983: 113 +/- 4
 1984: 121 +/- 6
 1985: 113 +/- 5
 1986: 111 +/- 6
 1987: 98 +/- 4 (report notes this value may be 11% low)
 1988: 118 +/- 4

Particulate Beta Activity in Air (10 -15 uCi/mL)

Year	Range	Annual Average (95%CI)
1985	16-120	42 +/- 7
1986	1-1,120	70 +/- 50
1987	12-57	32 +/- 3
1988	8-50	27 +/- 3

Antimony-125 Activity in Air (10 -15 uCi/mL) - annual average

1985: not reported
 1986: not reported
 1987: 2.2
 1988: below minimum detectable concentrations

Idaho State University: In June, 1989, ISU initiated radionuclide monitoring on a DOE contract to verify INEL data. Data is not available at this time.

Deer Thyroids: Deer thyroids are collected as described in the bioeffects section above.

CONCLUSION:

The air at Craters of the Moon is relatively clean, however impacts are increasing with a corresponding decrease in quality. This fact makes air quality a significant issue at Craters of the Moon for the future. The National Park Service has the opportunity to plan ahead at Craters, rather than reacting to a crisis situation. With this opportunity comes the responsibility to prevent a resource crisis. Now is the time to document baseline parameters and to establish an effective monitoring program to ensure adequate protection of this Class I airshed.