TA-50

Controlled Air Incinerator Permit

Reg. State

PUBLISH

FILED
United States Court of Appeals
Tenth Circuit

AUG 1 8 1994

UNITED STATES COURT OF APPEALS

TENTH CIRCUIT

UNITED STATES OF AMERICA,

Plaintiff-Appellant,

and

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA,

Plaintiffs,

v.

STATE OF NEW MEXICO, and HEALTH AND ENVIRONMENT DEPARTMENT,

Defendants-Appellees.

No. 92-2275

APPEAL FROM THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEW MEXICO
(D.C. No. 90-276-SC)

Elizabeth Ann Peterson (Myles E. Flint, Acting Assistant Attorney General; Karen L. Egbert and J. Carol Williams, Attorneys, Department of Justice, Washington, D.C.; and Robin Henderson, Office of the General Counsel, United States Department of Energy, Washington, D.C., of counsel, were with her on the briefs), Attorney, Department of Justice, Washington, D.C., for the Plaintiff-Appellant.

Susan M. McMichael (Tom Udall, Attorney General of New Mexico, and Randall D. Van Vleck, Assistant Attorney General, Santa Fe, New Mexico, were with her on the brief), Special Assistant Attorney General, Assistant General Counsel, New Mexico Environment Department, Santa Fe, New Mexico, for the Defendants-Appellees.

Before ANDERSON, MCKAY, and TACHA, Circuit Judges

TACHA, Circuit Judge.

8701

The issue presented in this appeal is whether section 6001 of the Resource Conservation and Recovery Act of 1976 ("RCRA"), 42 U.S.C. § 6961, waives federal sovereign immunity from certain state imposed permit conditions that address the presence of radionuclides in the disposal of hazardous waste at the Los Alamos National Laboratory ("LANL"). The district court found that RCRA does waive sovereign immunity for the permit conditions in question and granted summary judgment for the state of New Mexico. We exercise jurisdiction under 28 U.S.C. § 1291 and affirm.

I. BACKGROUND

The Department of Energy ("DOE") is the owner of LANL, a federal facility operated by the Regents of the University of California. LANL is involved in research and development that produces and requires disposal of hazardous wastes[1], mixed wastes[2] and radioactive wastes. The Environmental Improvement Board ("the Board") of the New Mexico Health and Environment Department issued LANL a hazardous waste facility permit to incinerate hazardous waste at an on-site controlled air incinerator. LANL uses its incinerator to burn both hazardous and radioactive waste. This dual role presents the possibility of radioactive waste being

---

1 Hazardous waste is defined by RCRA as "solid waste, or combination of solid wastes" that pose specified risks, by virtue of quantity, concentration or inherent characteristics. 42 U.S.C. § 6903(5). Solid waste is defined as "any garbage, refuse, . . . and other discarded material, . . . resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include . . . source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954, as amended." 42 U.S.C. § 6903(27).

2 "Mixed" waste is waste which has both hazardous and radioactive components. See State of New Mexico v. Watkins, 969 F.2d 1122, 1132 (D.C. Cir. 1992).

accidentally incinerated during a hazardous waste burn or of radioactive emissions from leftover radioactive material being emitted during a hazardous waste burn.

The United States sought a declaratory judgment challenging three conditions imposed in the permit, arguing that the conditions were outside the scope of the waiver of sovereign immunity contained in RCRA § 6001. The United States and the State of New Mexico filed cross-motions for summary judgment, and the district court granted summary judgment in favor of New Mexico. The district court determined that the three challenged permit conditions implemented state regulations adopted by the Board and were "requirements" as contemplated in RCRA § 6001.[3]

The United States argues that New Mexico has not established any standards for radionuclide emissions. Therefore, the permit conditions are not "requirements" because they are not established state standards nor do they implement any "legal or regulatory standard established by the State of New Mexico." The challenged permit requirements are:

1. V.C.3: Determination of Radionuclides Content. Each batch of waste treated under this permit shall be surveyed to determine its radionuclide content.

2. V.E. MONITORING
For each hazardous waste burn, the continuous monitoring and/or recording devices below shall be observed hourly by an operator during waste feed operation . . . .

   10. Radioactivity from the exhaust stack.

---

3 The district court also upheld the permit conditions under the Clean Air Act. 42 U.S.C. § 7416. Because we find the challenged permit conditions acceptable under RCRA, we need not decide this issue.

3. V.F.: During hazardous waste feed operations the following operational limits shall be observed:

9. Radioactivity.

a. The exhaust gas radioactivity measured during operation under this permit shall not exceed the background by ten percent (10%) for more than one minute.

b. The exhaust gas radioactivity measured during operation under this permit shall not exceed the background by fifty percent (50%).

c. Background is defined as that level of radiation read when the incinerator is operating at the parameters required for hazardous waste treatment but no waste feed occurring measured prior to hazardous waste treatment.

The New Mexico Hazardous Waste Act ("HWA"), N.M. Stat. Ann. §§ 74-4-1 to 74-4-14, contains standards concerning hazardous waste permits and disposal. The Environmental Improvement Act, N.M. Stat. Ann. §§ 74-1-1 to 74-1-10 (1978), requires the Board to enforce these standards. N.M. Stat. Ann. § 74-1-8(13). If a hazardous waste disposal facility has met the requirements in the HWA the Board may issue a hazardous waste permit. N.M. Stat. Ann §§ 74-4-4(A)(6) and 74-4-4.2(C). The Board may issue permits subject to any condition necessary to protect health and safety. N.M. Stat. Ann. § 74-4-4.2(C). Sections 501 and 901 of the New Mexico Hazardous Waste Management Regulations ("HWMR"), which adopt Environmental Protection Agency regulations, contain more specific standards for both hazardous waste permits and disposal. 40 C.F.R. §§ 264.344 and 270.32(a), (b). The regulations require that "[t]he operator of a hazardous waste incinerator may burn only wastes specified in his permit." 40 C.F.R. § 264.344(a).

II. ANALYSIS

A. Standard of Review

We review the grant of summary judgment de novo, using the same standard applied by the district court. Applied Genetics Int'l, Inc. v. First Affiliated Sec., Inc., 912 F.2d 1238, 1241 (10th Cir. 1990). Summary judgment is appropriate "if the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to a judgment as a matter of law." Fed. R. Civ. P. 56(c).

B. RCRA Section 6001

Absent an express waiver of sovereign immunity, the "activities of the Federal Government are free from regulation by any state." Mayo v. United States, 319 U.S. 441, 445 (1943). Congress may waive sovereign immunity and authorize the states to regulate federal instrumentalities. Id. at 446. "[A] waiver of the traditional sovereign immunity cannot be implied but must be unequivocally expressed." United States v. Testan, 424 U.S. 392, 399 (1976) (citation and internal quotations omitted).

RCRA section 6001 requires that all federal agencies and instrumentalities

> engaged in any activity resulting, or which may result, in the disposal or management of solid waste or hazardous waste shall be subject to, and comply with, all Federal, State, interstate, and local requirements, both substantive and procedural (including any requirements for permits or reporting or any provisions for injunctive relief and such sanctions as may be imposed by a court to enforce such relief), respecting control and abatement of solid waste or hazardous waste disposal in the same manner, and to the same

42 U.S.C. § 6961. RCRA does not define what constitutes a "requirement." Courts have interpreted "requirements" to mean "objective and administratively preestablished" standards, McClellan Ecological Seepage Situation v. Weinberger, 707 F. Supp. 1182, 1198 (E.D. Cal. 1988) (interpreting similar provision of the Clean Water Act), and "objective, quantifiable standards subject to uniform application." Kelley v. United States, 618 F. Supp. 1103, 1108 (W.D. Mich. 1985) (also interpreting the Clean Water Act); see also Romero-Barcelo v. Brown, 643 F.2d 835, 855 (1st Cir. 1981) (interpreting similar "requirements" language in section 12 of the Noise Control Act, 42 U.S.C. § 4911, as meaning "relatively precise standards capable of uniform application"), rev'd on other grounds, 456 U.S. 305 (1982). However, "the meaning of 'requirement' cannot . . . be limited to substantive environmental standards--effluent and emissions levels, and the like--but must also include the procedural means by which those standards are implemented: including permit requirements, reporting and monitoring duties, and submission to state inspection." Parola v. Weinberger, 848 F.2d 956, 961 (9th Cir. 1988); Mitzelfelt v. Department of the Air Force, 903 F.2d 1293, 1295 (10th Cir. 1990) ("The word [requirement] can reasonably be interpreted as including substantive standards and the means for implementing those standards . . . ."). In PUD No. 1 v. Washington Department of Ecology, the Supreme Court, interpreting the Clean Water Act, recognized that "requirements" are not limited to specific and objective criteria, but can include criteria that are open-ended. 114 S. Ct. 1900, 1910-11 (1994)

(recognizing that criteria "are often expressed in broad, narrative terms, such as 'there shall be no discharge of toxic pollutants in toxic amounts.'"). With these standards as guides we address the government's arguments.

The United States first argues that, because New Mexico has not developed any standards dealing with radionuclides, these permit conditions cannot be construed as implementing any objective, preexisting state standards capable of uniform application. Second, the United States argues that the permit conditions themselves are not RCRA § 6001 requirements because they are not preexisting state statutes or regulations and are not capable of uniform application. We reject these arguments.

Permit condition V.C.3, requiring LANL to survey waste to determine its radioactive content, permit condition V.E.10, requiring that the emissions from a hazardous waste burn be monitored for unauthorized radioactivity, and permit condition V.F.9, requiring that a hazardous waste burn be discontinued if radioactive emissions are detected and reach a determined level, all serve to implement the state standard requiring that only permitted hazardous waste is being disposed of under the hazardous waste permit. See N.M. Stat. Ann. §§ 74-4-4(A)(6) and HWMR § 501 (incorporating 40 C.F.R. § 264.344(a) into the statutory scheme). Ensuring that only permitted waste is being burned also implements other regulatory goals expressed in N.M. Stat. Ann. 74-4-4(a) and 74-4-4.2(c), which provide for hazardous waste permit conditions necessary to protect human health and the environment.

The United States objects especially to permit conditions V.E.10 and V.F.9 because they do not merely call for surveying what waste is being burned but also call for the monitoring of radioactive emissions. The United States points out that there are no state standards for radioactive emissions which could guide such permitting conditions[4] and contend that, as a result, the permit conditions cannot be "requirements" for which sovereign immunity has been waived under RCRA § 6001. However, due to the dual capacity of the LANL incinerator as a hazardous waste and radioactive waste incinerator, permit condition V.C.3 alone is insufficient to ensure that only permitted waste is being burned. Radioactive material may remain in the incinerator apparatus following a radioactive burn and be caught in a hazardous waste burn. Permit conditions V.E.10 and V.F.9, therefore, merely recognize the particular circumstances at LANL and operate to ensure that only permitted hazardous waste is being burned. <u>See Sierra Club v. United States Dept. of Energy</u>, 770 F. Supp. 578, 580 (D. Colo. 1991) (recognizing that regulations are often generic while permits may be tailored to the specific facility to ensure greater protection of health and environment).

The United States objects strenuously to the specific provision in permit condition V.F.9 requiring that radioactive emissions during a hazardous waste burn "should not exceed the background by ten percent (10%) for more than one minute." It is

---

4 In its Reply Brief, the United States concedes that it does not challenge the district court's determination that these permit conditions do not "regulate" radioactive waste, instead relying on its argument that the conditions are not "requirements."

true that the state has not provided guidance for analyzing the effects of different levels of radioactive emissions. However, as pointed out above, it does not appear that the state is attempting to substantively regulate radioactive waste through this condition. The ten percent standard can be seen as a cut-off point beyond which it may be reasonably assumed that there is more than a de minimis level of radioactive material in the hazardous waste burn. In this way, condition V.F.9 is merely another tool for New Mexico to implement its statutory and regulatory hazardous waste provisions.

Finally, the United States asserts that permit condition V.F.9 contains a meaningless and unworkable standard. It argues that the condition requires LANL to measure "background" prior to any operation of the incinerator--an impossible task because the incinerator was in use prior to this permit. In the alternative, the United States asserts that the condition requires LANL to measure "background" from time-to-time, and that such a requirement lacks sufficient parameters to be workable. We reject the United States' reading of the permit condition. A plain reading of the condition's language suggests that "background" should be measured when the incinerator is operating and prepared to incinerate, but no waste has been introduced. A measurement at that time produces the "background" which the permit condition requires not be surpassed by certain parameters. Further, the language requiring measurement from time-to-time emphasizes New Mexico's position that it is not engaging in substantive regulation of radionuclides, but simply attempting to ensure compliance with New Mexico's statutory requirements.

III. CONCLUSION

We affirm the district court's grant of summary judgment in favor of the State of New Mexico.

STATE-OF-THE-ART TECHNOLOGY UTILIZING MOBILE REAL-TIME-RADIOGRAPHY CAPABILITIES

WITH

IMMEDIATE APPLICATION OF THIS TECHNOLOGY TO 55 GALLON DRUM TRU WASTE CONTAINER EXAMINATION AND AUDITING ISSUES

By:
Jake P. Lucero
DJL Enterprises, Inc.
P.O. Box 1322
Los Alamos, NM 875444

This presentation is directed to current technologies used in inspection, evaluation and documentation of 55 gal. drums TRU waste containers.

Real-Time-Radiography is probably the only method used today that is fast, economic and user-friendly, by that I mean, it can be adapted quickly to inspect 55 gal. TRU waste drums.

Real-time-Radiography is a partnership between standard radiographic principles and new advanced technologies.

We are able to take advantage of hi-tech communication devices, such as CCD, CID, and C-MOS television cameras, and the personal computer.

With computers (hardware and software) having more capacity and the ease of adapting PC's to do signal processing, we can provide the information (analog or digital) necessary to meet the customers criteria.

The procedure used in documentation of 55 gal. drums TRU waste containers is quite simple. A X-ray Image Intensifier, the electronic detector, if you will, will convert the X-ray energies into visible light and in turn will be picked up and viewed by a television camera, and later displayed onto a television monitor for viewing and analysis.

The X-ray Generator can vary or be variable from 25 KVP to 450 KVP. This means the maximum X-ray energy required to penetrate the 55 gal. drum TRU waste container for radiographic viewing and interpretation.

Other requirements would include manipulator or part handling device that would position the waste container between the X-ray source and the X-ray detector.

The complete X-ray Inspection System would be based in a mobile, transportable trailer containing the proper X-ray radiation shielding, elevators to bring the 55 gal. drum TRU waste containers to the proper height, and for safe handling and later disposition of the container after inspection. All required safety devices alarms, lights, buzzers, interlocks switches, personal dosimetry scram or emergency shut-off would be implemented.

This trailer would be self-contained with its own motor generators, providing the necessary power requirement for the equipment in use. This means that this trailer based X-ray System can be used in remote areas, and will not cause or produce environmental hazards or issues, like chemicals and heavy metals.

All the information gathered would be recorded on a Super VHS Recorder and tape. Copies of frame by frame information can be digitized and formatted on a hard copy for viewing or presentation

Documentation of all information gathered, would have headers with identification numbers, dates, lots, source of origin and any other information needed to identify each and every container.

Summary

This process uses environmentally friendly, safe inspection techniques, to identify and locate free liquid and high density materials in 55 gal. drum TRU waste containers. This technique is non-invasive and produces high resolution images. This method for analysis will result in better and faster inspections with decreased fatigue, stress, errors, cost and training requirements. No photographic chemicals will be used to obtain the image and therefore both costs and environmental risks are reduced. The image data can be transferred from computer memory and manipulated and enhanced for optimum viewing. While the image is displayed on the computer monitor, internal features and objects can be identified and located in relationship to their relative position inside the 55 gal. drum TRU waste container.

3.0 ENVIRONMENTAL SETTING

The Mesita del Buey, including TAs 54 and 51 within OU 1148, has been designated for military and scientific purposes since 1942. The following sections describe the environmental setting of the operable unit. The historical operational and waste management practices at the operable unit, and the current activities there have been summarized in Chapter 2, and the data needs for environmental restoration at the operable unit are be summarized in Chapter 5. This section identifies the environmental concerns associated with OU 1148. This section presents the three dimensional geologic/hydrogeologic model based upon the present understanding of the environmental setting and the conceptual model for the MDAs and also demonstrates the need to conduct generic framework studies.

3.1 Topography

The geographic setting of the Laboratory is described in the IWP in Section 2.1,"Geographic Setting". TA-51 and TA-54 are located on Mesita del Buey, a relatively narrow, gently sloping mesa that is bordered on the northeast by Canada del Buey and on the southwest by Pajarito Canyon. Mesita del Buey decreases in elevation from about 7020 ft at TA-51 in the west to about 6650 ft at MDA G in TA-54 in the east. Mesita del Buey is about 1400 ft wide at TA-51. It narrows to about 400 ft at MDA L, and widens to about 1000-1300 ft at MDA G. The south side of Mesita del Buey at MDA G is deeply incised by multiple side drainages that drain into Pajarito Canyon. Pajarito Canyon is about 220 ft deep at TA-51 and 130 ft deep at MDA G, and Canada del Buey is about 160 ft deep at TA-51 and 110 ft deep at MDA G.

3.2 Climate

Los Alamos County has a semiarid, temperate mountain climate. The climate of the county, including frequency analyses of extreme events, is discussed in detail in Bowen (Bowen 1990, 0033) and summarized in the IWP in Section 2.5.3, Climate. Climatic aspects of interest include

- atmospheric transport of contaminants: wind speed, frequency, direction, and stability classification;
- atmospheric pressure cycling ("pumping") resulting in the movement of vapors to the surface; and
- surface water run-off and infiltration: precipitation form, frequency, intensity, and evaporation potential.

Wind speed and direction[1] are measured at five locations around the Laboratory, including MDA G, as indicated in Figure 3.2-1. The monitoring station at MDA G has been in operation since 1980, with data collected at a height of about 39 ft above the ground. Winds vary dramatically with time of day, location, and height above ground level. Figure 3.2-2 presents annual wind roses for daytime and nighttime conditions, and for total daily (day and night) conditions at MDA G. All three wind roses show predominant south-southwesterly winds, blowing up the Rio Grande valley, although a more westerly, downslope component from the Jemez Mountains is common at night. Total wind roses for the four seasons (measured in January, April, July, and October) are also shown in Figure 3.2-2. Although the high frequency of south-southwesterly winds is still evident in the four wind roses, seasonal variations in the frequency of wind directions is evident. For example, the January wind rose indicates the same frequency for both a northerly and a southwesterly wind, although the monthly winds tend to be weaker. The July wind rose shows a higher frequency of southerly winds than other seasons (Bowen 1990, 0033).

Figure 3.2-3 presents hourly wind direction frequencies and mean windspeeds at the 35 ft level of MDA G. The January graph shows a definite diurnal pattern in the main wind direction (i.e., northerly drainage winds during nighttime and channeled southwesterly winds during the day). The April and July hourly wind direction frequency curves indicate much less of a diurnal pattern than was evidenced in January. The October hourly wind direction curve shows an increasing diurnal pattern similar to that for January as drainage winds increase with the advent of winter. More than 40% of the surface winds have speeds less than 5.5 mph, and wind speeds greater than 11 mph occur between 10% and 20% of the time. Many of the strongest winds occur in the spring, predominantly from the south-southwest (Bowen 1990, 0033).

Summer afternoon temperatures in Los Alamos County are typically in the 70s and 80s (°F), infrequently reaching 90°F, and nighttime temperatures are typically in the 50s (Figure 3.2-4). Typical winter temperatures are from 30 to 50°F in the daytime and from 15 to 25°F at night, occasionally dropping to 0°F or below (Bowen 1990, 0033).

Annual average precipitation at MDA G is about 14 in., with about 40% occurring as brief, intense thunderstorms during July and August (Figure 3.2-5). Snowfall is greatest from December through March, with heavy snowfall infrequent in other months (Figure 3.2-4). Annual snowfall averages about 51 in. at TA-54. Variations in precipitation from year to year can be quite large, and annual precipitation extremes in Los Alamos range from 6.8 to 30.3 in. Daily rainfall extremes of 1 in. or greater occur in most years, and the estimated 100-year daily rainfall extreme is about 2.5 in. Precipitation generally increases westward towards the Jemez Mountains (Figure 3.2-5) (Bowen 1990, 0033), and is thus slightly greater at TA-51 than at MDA G.

Runoff of surface water can occur during either summer thunderstorms or snowmelt periods. The greatest amount of runoff, and therefore the greatest potential for erosion and transport of surficial contaminants, probably occurs during high intensity summer thunderstorms, although little data on runoff and erosion are available. Infiltration of water into the soil and underlying tuff can also occur during either summer thunderstorms or snowmelt periods. There is probably a potential for deeper infiltration in the snowmelt periods because of lower evapotranspiration rates during the shorter winter days when solar radiation and plant activity are at a minimum. In summer, when evapotranspiration rates are highest, there should be less potential for infiltration. The least amount of estimated evapotranspiration at

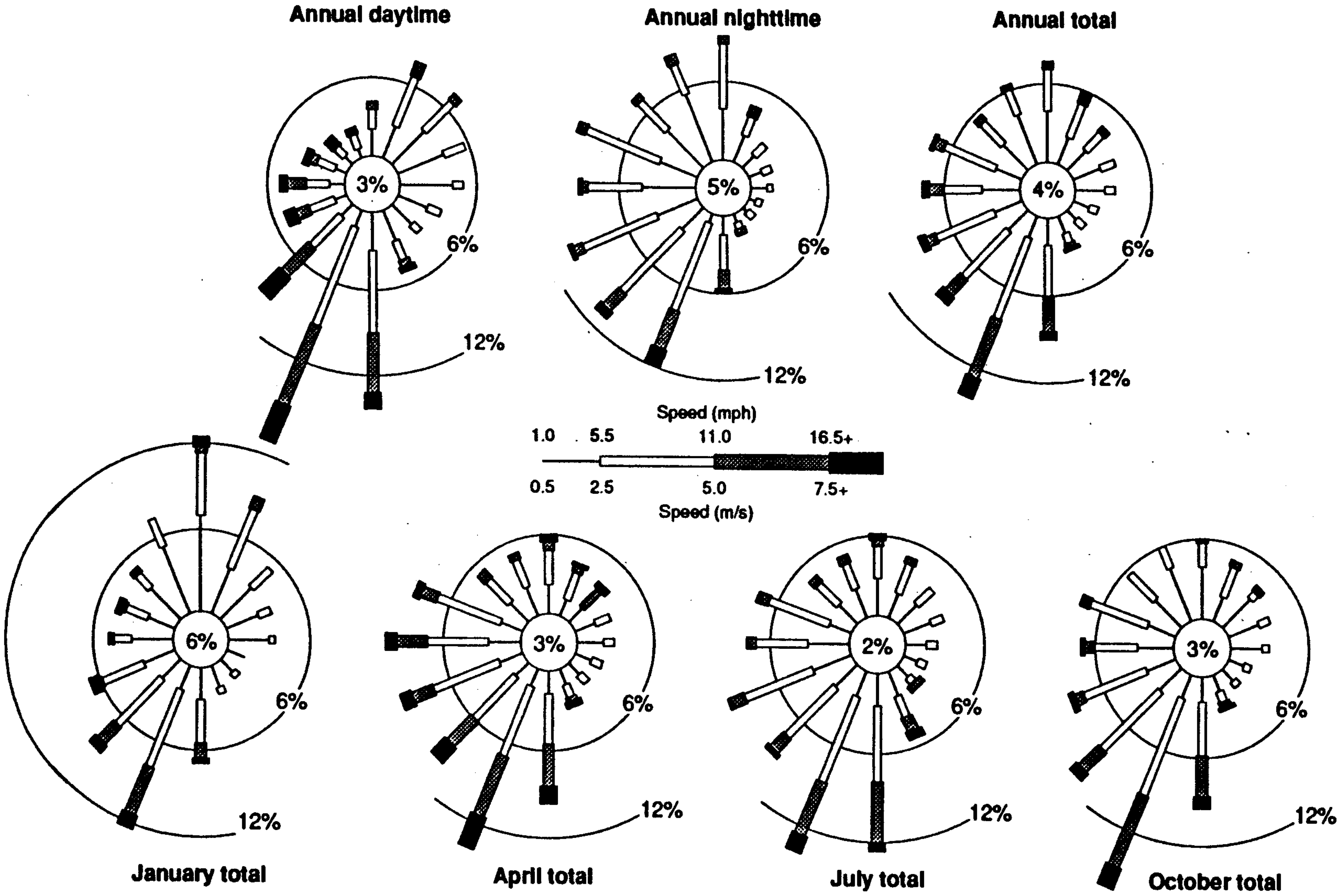

Figure 3.2-2 Annual wind roses for daytime, nighttime, total wind rose and months January, April, July and October.

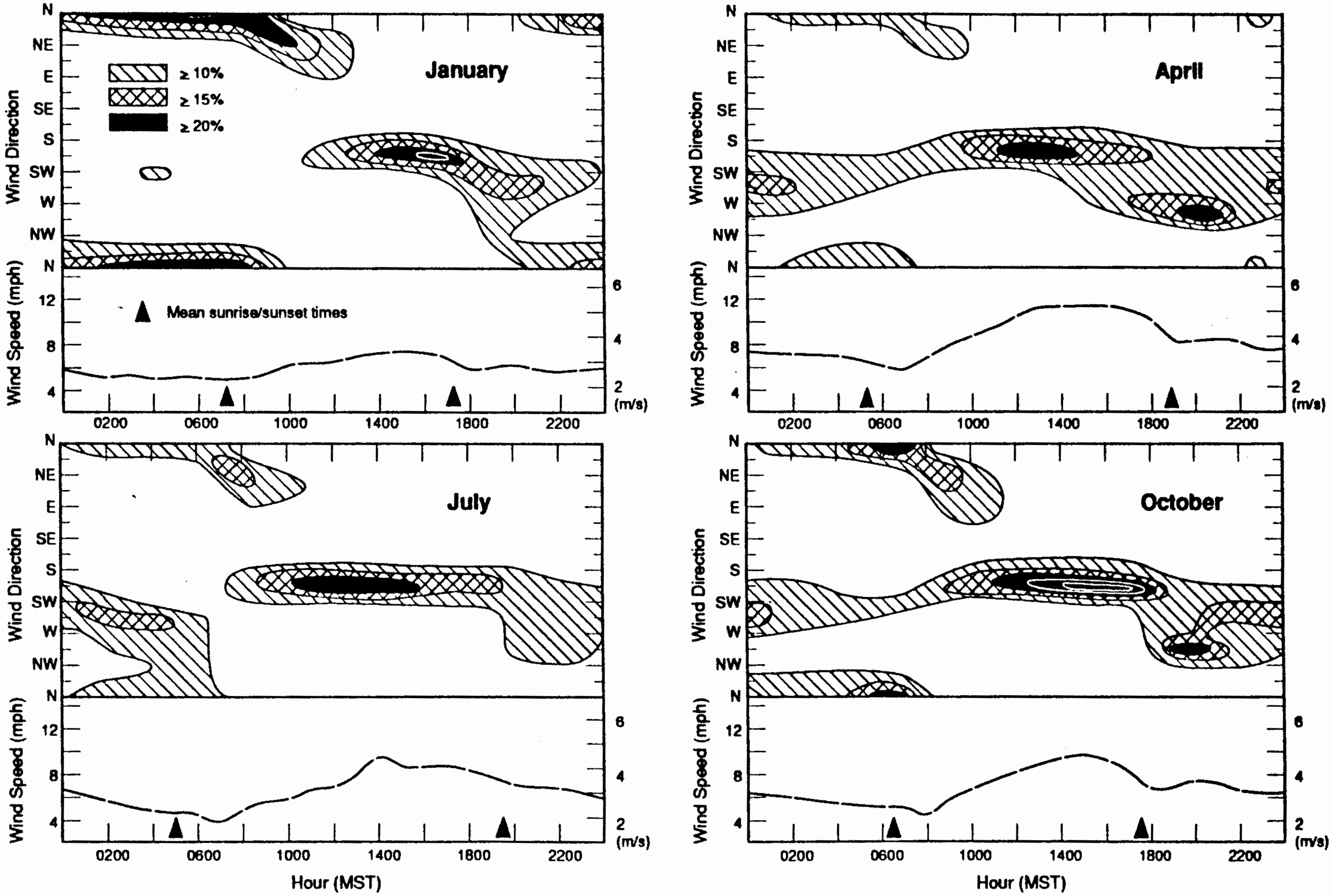

Figure 3.2-3 Hourly wind-direction frequencies and mean wind speeds at meteorological tower in MDA G (35 ft).

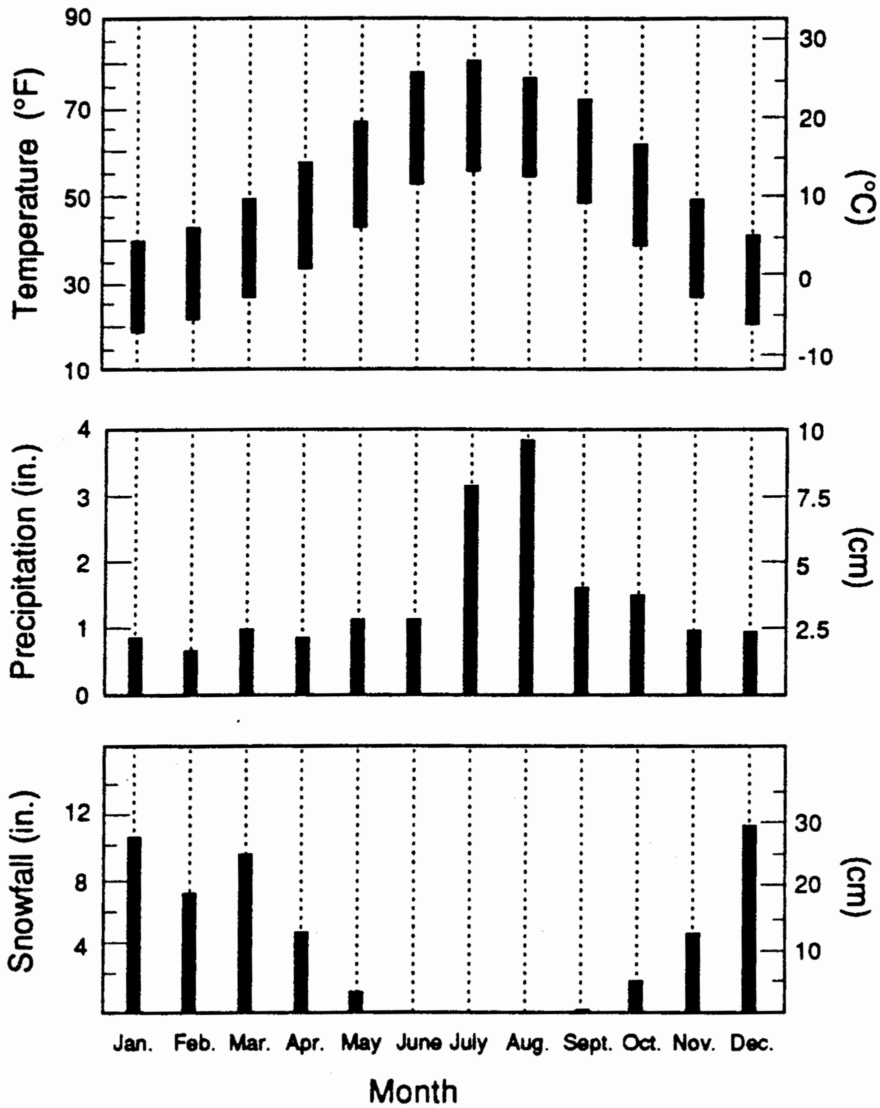

Figure 3.2-4 Yearly distribution of average monthly temperature, precipitation, and snowfall at TA-59 (Bowen 1990).

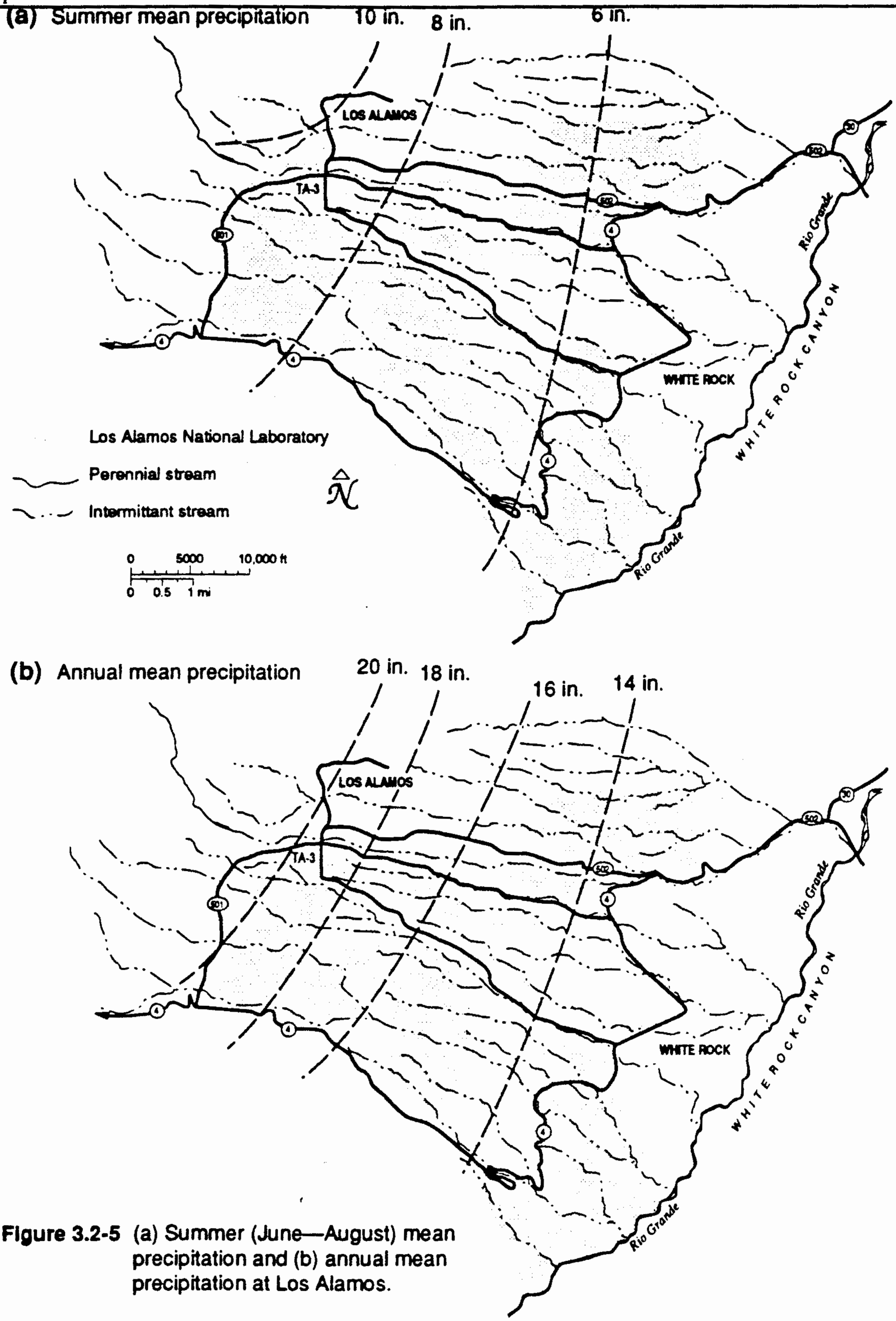

Figure 3.2-5 (a) Summer (June—August) mean precipitation and (b) annual mean precipitation at Los Alamos.

TA-51 sites of trench-cover design experiments occurs in late fall and winter--less than 0.1 cm/day, and the greatest during the summer--greater than 0.2 cm/day (Nyhan et al. 1989, 0171).

An extension of the historic record of annual precipitation at Los Alamos has been presented with a study that correlated historic precipitation and tree-ring widths (Abeele 1980, 0637). Using an index of tree-ring width, the largest estimated precipitation in the last 100 years is about 31 in. occurring in 1919 AD, which agrees well with the estimated 100-year precipitation of 30 in. based on historic climatic records. The estimated maximum annual precipitation during the period of tree-ring record was about 40 in. in 1597 AD (Abeele 1980, 0637).

3.3 Soils

Soils on Mesita del Buey are derived from Bandelier Tuff bedrock and were formed under a semi-arid climate. Soils on the mesa top are mainly thin, well-drained sandy loams of the Hackroy series (Nyhan et al. 1978, 0161). "The surface layer of the Hackroy soils is a brown sandy loam, or loam, about 10 cm [3.9 ins.] thick. The subsoil is a reddish brown clay, gravelly clay, or clay loam, about 8 inches [7.9 in.] thick. The depth to tuff bedrock and the effective rooting depth are about 8 inches to 20 inches [7.9 to 19.7 in.]" (Nyhan et al. 1978, 0161). Clay-rich subsurface horizons, such as those that occur in the Hackroy soils, are believed to have been formed by the translocation of suspended clay from the upper horizons, and the reddish colors record extensive chemical weathering. The development of such soils in a semiarid climate is believed to have taken at least tens of thousands of years The presence of these soils on Mesita del Buey suggests very low erosion rates under undisturbed conditions, although detailed studies of soil genesis necessary to confirm this have not been conducted on the Pajarito Plateau. Intermixed with the Hackroy soils on the mesa tops are small areas of deeper loams of the Nyjack series and patches of bedrock. The Nyjack soils are texturally similar to Hackroy soils, and Nyjack soils are distinguished by thicknesses of 8 to 40 in. and by the common presence of pumice fragments in the lower soil (Nyhan et al. 1978, 0161). Areas of rock exposure are common towards the edges of the mesa.

The slopes between the mesa top and canyon bottoms consist of steep rock outcrops and patches of shallow, undeveloped colluvial soils (Nyhan et al. 1978, 0161). The south-facing canyon walls of Pajarito Canyon are steep and have little or no soil material or vegetation, whereas the north-facing walls of Canada del Buey have areas of thin dark-colored soils. The characteristics and distribution of these soils suggests faster erosion rates of surficial material on the south-facing canyon walls than the north-facing walls under the present vegetation and climate, although detailed studies of spatial variations in erosion are not available to confirm this.

The canyon bottoms north and south of Mesita del Buey are underlain by thick, poorly-developed, well-drained soils of the Totavi series formed in alluvium (Nyhan et al. 1978, 0161). Alluvium penetrated by drill holes is up to 30 ft thick in the center of Pajarito Canyon south of TA-54, and is up to 12 ft thick in Canada del Buey north of TA-54 (John et al. 1966, 0708; Devaurs 1985, 0046).

3.4 Hydrologic Setting

3.4.1 Surface Water

Runoff and infiltration of surface water are significant aspects of surface water hydrology on Mesita del Buey, providing mechanisms by which contaminants can be potentially mobilized and transported through the environment. Runoff may carry contaminants into drainage channels, and then transport and deposit them downstream. Infiltration of surface water is the source of subsurface moisture which can potentially transport contaminants underground.

Surface runoff occurs on Mesita del Buey and in small drainages off the mesa for brief periods during spring snowmelt and intense summer thunderstorms. A gauging station was constructed on a small drainage on Mesita del Buey at MDA G (Figure 3.4-1) to determine rainfall-runoff relations for a representative part of the mesa, and to measure the concentrations of contaminants transported in the runoff. Small amounts of plutonium were detected in both the runoff and in the suspended sediments, documenting transport of contaminants from MDA G, although the quantities measured were below levels of regulatory concern (Abeele et al. 1981, 0009; Purtymun et al. 1983, 08-0014).

Runoff from summer storms on the Pajarito Plateau reaches a maximum discharge in less than two h, and has a duration generally less than 24 h. High discharge rates can transport large masses of suspended and bed sediments for long distances down the canyons. Spring snowmelt runoff occurs over a period of several weeks to several months at a low discharge rate. Although the long duration of snowmelt runoff results in the movement of significant masses of suspended and bed sediments, the mass transported seems to be less than that carried by summer runoff events (Purtymun et al. 1990, 0215).

Stream flow is ephemeral in Canada del Buey and Pajarito Canyon north and south of Mesita del Buey, respectively, and also occurs during snowmelt or thunderstorms (Purtymun and Kennedy 1971, 0200; Devaurs and Purtymun 1985, 0049). Southwest of Mesita del Buey near White Rock, Pajarito Canyon has some intermittent return flow at seasonal springs, where alluvium pinches out onto the underlying basalt (Purtymun and Kennedy 1971, 0200).

3.4.2 Alluvial Aquifers

IWP Section 2.6.4, "Geohydrology of Canyon Surface Waters and Alluvial Aquifers," discusses alluvial aquifers in the canyons of the Pajarito Plateau on a canyon-by-canyon basis. These perched aquifers in alluvial fills of the canyon bottoms are created and maintained by recharge from surface channels. Water moves downward through the alluvium until it is impeded by the less permeable tuff. Depletion by evapotranspiration and movement into the underlying rock limits the size of the alluvial aquifers. These aquifers are of interest because of the following issues: