FINAL

FOCUSED RISK ASSESSMENT FOR THE PERSON GENERATING STATION PUBLIC SERVICE COMPANY OF NEW MEXICO

Prepared For

PUBLIC SERVICE COMPANY OF NEW MEXICO

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EXECUTIVE SUMMARY

The objective of this report is to quantitatively characterize under both current and unlikely, but potential future exposure scenarios the probable carcinogenic and noncarcinogenic risks posed to human health from volatile organic compound (VOC) contamination in soil and shallow ground water at the Public Service Company of New Mexico's Person Generating Station site, Albuquerque, New Mexico. This report evaluates and documents potential threats that would be posed by existing site contamination if no remediation were completed at the site. This report also investigates whether the planned remedial action project is expected to restore the site to a state that is adequately protective of human health. Additionally, this report provides information that can be used to determine concentrations of chemicals that can remain onsite and still be protective of human health.

Previous environmental characterizations at the Person Generating Station site have detected several VOC contaminants, including 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethene (1,1-DCE), and tetrachloroethene (PCE), in both soil and shallow ground water. The source of this contamination was a below-grade waste oil tank, which was removed from service in October 1983. The tank was used to store a variety of liquid waste streams, including steam cleaning residues containing chlorinated solvents.

The Public Service Company of New Mexico prepared a shallow ground water remedial action plan for the site as directed in Phase II, Item 1.B, of the Corrective Action Directive (CAD). The remedial action proposed for the site consists of a two-phased approach to soil and shallow ground water treatment (i.e., initial phase of pilot testing and a second phase of full-scale remediation). Based on the physical site conditions and the nature and extent of contamination, soil vapor extraction and ground water pumping and treatment were identified as the appropriate remedial technologies to implement at this site. Past experience and site-specific, preliminary quantitative analysis of the expected performance of these technologies demonstrate that these technologies should be effective at both removing source contamination and minimizing the potential migration of contaminants. The New Mexico Environment Department has approved this remedial action plan, and initial technology tests are scheduled to begin in late August of 1994.

Quantitative risk information was developed in support of the remedial action plan for the site. Four general types of receptors were considered to evaluate both current and hypothetical future risks posed by exposure to current levels of contamination and by exposure to residual contamination left onsite following completion of the planned remedial project. All risk calculations incorporate potential cumulative risks due to

exposure to 1,1,1-TCA, 1,1-DCE, and PCE in all affected environmental media. Existing site characterization data and fate and transport calculations were used to conservatively estimate the risk assessment concentration levels by media for each of the three VOCs. Toxicity information for the three VOCs was obtained from technical literature.

Exposure equations using U.S. Environmental Protection Agency (EPA) risk assessment methods were developed for several different types of receptors: onsite and offsite current and hypothetical future light industrial/commercial workers, onsite current remediation/construction workers, onsite and offsite hypothetical future residents, and offsite current recreators. Although the physical characteristics and location of the site will likely prohibit unrestricted future residential development, conservative risk estimates based on hypothetical future residential land use were developed for comparison purposes. Risks to hypothetical current residents were also calculated. These risks assume no remediation (i.e., baseline conditions). They were included at the request of New Mexico Environment Department for comparison purposes. Specific risks posed to considered receptors were evaluated by factoring appropriate exposure pathways into the receptor-specific exposure equations. Exposure routes that could be included were dermal contact with contaminated soil, incidental ingestion of contaminated surficial soil, inhalation of VOCs in the outdoor breathing zone due to upward diffusion through soil into the atmosphere, inhalation of VOCs in buildings, dermal contact with contaminated ground water, inhalation of contaminants during domestic use of contaminated ground water, ingestion of contaminated ground water during domestic use, dermal contact with ground water routed into surface water used for recreation, and incidental ingestion of contaminated ground water routed into surface water used for recreation. Total risks posed to each receptor were evaluated by summing the possible risks posed by exposure to each contaminant for all exposure pathways.

Quantitative estimates of total risk for current exposure scenarios for onsite and offsite light industrial/commercial workers and onsite remediation/construction workers demonstrate that exposure to existing site contamination at the site is below the EPA target risk range of one individual in one million (10^{-6}) to one individual in ten thousand (10^{-4}) developing cancer over a lifetime and is not expected to cause any noncarcinogenic effects. In other words, existing levels of contamination at the site do not present a significant threat, as defined by EPA risk assessment policy and guidance, to individuals that may be reasonably expected to be exposed under current site conditions (which also included the planned remedial action).

It is important to note, however, that because of more conservative exposure pathways, existing site contamination may pose an unacceptable risk to both onsite and nearby offsite hypothetical residents if the site were to remain unremediated, and to surface water recreators if extracted ground water is not treated before discharge to surface water bodies. Quantitative calculations of total risk for potential future residential exposure scenarios, which are based on conservative estimates of the expected level of residual contamination remaining onsite following completion of the planned remedial action, suggest that the planned remedial action should result in a level of cleanup that will be adequately protective of human health (i.e., resulting in a

cumulative individual carcinogenic risk level within the target risk range of 10^{-4} to 10^{-6} and no noncarcinogenic hazards), even for hypothetical future onsite and offsite residents. Similar calculations of total risk for potential future surface water recreators indicate that treatment of extracted shallow ground water via air stripping and carbon adsorption prior to discharge to receiving surface water, which is currently part of the remedial action plan for the site, will achieve concentration levels that are adequately protective of human health.

The second objective of this report was to develop an estimation of the level of contamination that could remain onsite and still be adequately protective of human health. Risk-based preliminary remediation goals (PRGs) for soil and shallow ground water were developed for each of the VOCs using a cumulative carcinogenic target risk level of 1×10^{-5} and a cumulative noncarcinogenic level of 1.0. The three receptors used to characterize existing and expected residual risk following implementation of the planned remedial project were also used to develop these risk-based PRGs. Existing concentrations of soil contamination are less than the most stringent risk-based PRGs, suggesting that planned soil remediation is necessary only to remove source contamination and prevent potential additional ground water degradation. Using the most conservative land use assumption (unrestricted residential development), target risk-based PRGs for shallow ground water are 3,000 parts per billion (ppb), 0.1 ppb, and 4.8 ppb for 1,1,1-TCA, 1,1-DCE, and PCE, respectively. The risk-based target cleanup level for 1,1,1-TCA is greater than the Maximum Contaminant Levels (MCLs); however, the risk-based PRGs for shallow ground water for PCE and 1,1-DCE are less than their MCLs, due to the chemicals' carcinogenicity. This information should be very useful during future discussions about realistic cleanup goals for the Person Generating Station site.

SECTION 1

INTRODUCTION

Engineering-Science, Inc. (ES) was contracted by the Public Service Company of New Mexico (PNM) to perform several critical tasks involved in selecting, designing, and implementing an appropriate remedial action at the Person Generating Station site near Albuquerque, New Mexico. This report supplements the *Corrective Measures Proposal* (CMP) prepared in accordance with Phase II, Item 1.B, of the Corrective Action Directive (CAD) (Engineering-Science, 1994). The CMP evaluated and recommended the most appropriate remedial technologies for the site, and provided a conceptual design of the recommended remedial approach. Although a preliminary exposure assessment was included in the CMP, the New Mexico Environment Department (NMED) determined that additional quantitative risk information was necessary to assess the continuing need for and effectiveness of the remedial action described in the CMP.

It is appropriate at this point to define some of the key terms used in this focused risk assessment. A *risk assessment* is the scientific estimation of a hazard. A *baseline risk assessment* describes the hazards that might exist if no remediation or institutional controls were applied at a site. The term *focused risk assessment* describes a more specialized risk assessment that incorporates the objectives of different types of risk assessments as described in the U.S. Environmental Protection Agency's (EPA's) Risk Assessment Guidance for Superfund (RAGS) manuals (EPA, 1989, 1991a, 1991b). *Exposure assessment* involves estimating the type and magnitude of exposures to contaminants of concern (COCs) that are present at or migrating from a site. A *risk assessment concentration level* or *exposure point concentration* is the highest concentration a potential receptor would reasonably be expected to contact. A *toxicity assessment* defines the dose at which adverse effects caused by exposure to a COC may occur. And finally, a *risk-based preliminary remediation goal* (PRG) is a long-term target concentration based on toxicity information rather than on promulgated cleanup standards, and which can be used to analyze, select, and design an appropriate remedial action.

1.1 PURPOSE AND OBJECTIVE

The purpose of this report is to quantitatively characterize under both current and hypothetical future exposure scenarios the potential carcinogenic and noncarcinogenic risks posed to human health from volatile organic compound (VOC) contamination in soil and shallow ground water at the Person Generating Station site. The source of this contamination was a below-grade waste oil tank, which was removed from service in

October 1983. The tank was used to store a variety of liquid waste streams, including steam cleaning residues containing chlorinated solvents. There are three separate objectives of this focused risk assessment. First, this report evaluates and documents potential threats posed by existing site contamination if no action were taken. Second, this report investigates whether the remedial action already planned for the site will pose health risks during implementation and whether such action is expected to restore the site to be adequately protective of human health (commonly termed the risk evaluation of a remedial alternative). This evaluation focuses on the potential risks associated with the remedial action recommended in the CMP, plus potential risks associated with any residual contamination. Third, this report provides information which can be used to determine the levels of contamination that can remain onsite and still be protective of human health, both now and in the future.

1.2 RISK ASSESSMENT APPROACH

A focused risk assessment strategy was implemented to best support the remedial action project planning for the Person Generating Station site. A baseline risk assessment was determined to be inappropriate at this time since PNM and the NMED have already agreed to begin remediation at the site. The focused risk assessment strategy couples elements of the traditional baseline risk assessment and elements of an evaluation of the short- and long-term risks associated with implementing a remedial action at a site. Risks were quantitatively evaluated using a site-specific approach based on the risk assessment principles and procedures outlined in the EPA RAGS (EPA 1989, 1991a, 1991b) manuals.

This focused risk assessment quantitatively evaluated risks posed to human receptors due to exposure to VOC contamination in soil and shallow ground water at the Person Generating Station site. Risks to ecological receptors were not addressed as part of this effort because the site is currently developed for industrial use only, it does not support rare or economically valuable ecological resources, and significant concentrations of VOCs are not likely to be accessible to potential ecological receptors, either now or following remediation.

Existing site characterization data and fate and transport calculations were used to conservatively estimate the concentration levels by media for each of the three VOCs of concern at the site [1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethene (1,1-DCE), and tetrachloroethene (PCE)]. Representative, media-specific concentration levels were developed using the methods specified for calculating exposure point concentrations appropriate for use in risk assessments per EPA (EPA, 1992a) guidance. Existing soil gas data were used in soil diffusion and outdoor/indoor air dispersion models recommended by the EPA to determine conservative exposure concentrations of VOCs under both outdoor and indoor conditions. This approach is conservative when evaluating potential residual site risks because the positive effects of vapor extraction (source removal) are not factored into the residual risk analysis. Existing surficial and vadose zone soil measurements taken from within the former waste tank area in 1984 were used to characterize soil contamination at the site. This approach is extremely conservative because the source area is currently covered by a 25 feet x 35 feet closure cap which minimizes downward infiltration and effectively eliminates the upward soil

exposure pathway. However, in the absence of soil data more representative of onsite and offsite conditions, risk estimates assumed that these most contaminated soils are readily accessible and characteristic of all onsite and offsite soil. In effect, these concentrations represent a "worst case" concentration estimate.

Existing shallow ground water data were used to evaluate current site risks. Existing and modeled shallow ground water data were used to evaluate current and future and expected residual risks, respectively, due to exposure to contaminated ground water. Existing shallow ground water data were also used to evaluate the risks posed to hypothetical receptors under the most conservative exposure scenarios if no action were taken at the site.

Existing ground water data was also used to simulate possible surface water concentrations due to pumping and discharge activities in the absence of treatment. No dilution was considered. This data was used to evaluate potential risks to receptors if treatment of extracted ground water was not implemented during remediation activities. To determine whether the planned treatment of extracted ground water would be sufficient to protect potential receptors, concentrations expected in treated ground water to be discharged to surface water were based both on expected performance estimates and conservatively on surface water standards. The proposed treatment system is expected to reduce VOCs in the extracted shallow ground water to concentrations that meet existing surface water standards prior to discharge.

The CMP for the Person Generating Station site included a preliminary investigation of the effectiveness of coupling natural physical and chemical processes with more aggressive pump-and-treat actions to reduce contaminant concentrations in the shallow ground water. Simulated ground water data were used to assess the risks associated with expected residual shallow ground water contamination following implementation of the planned remedial project as described in the CMP. More detailed information on the data used in the focused risk assessment is presented in Section 3 of this report.

Assumptions about land use are at the heart of identifying potential receptors, potential exposure pathways, and reasonable exposure scenarios. The EPA advises that the land use associated with the highest (most conservative) potential level of exposure and risk that can reasonably be expected to occur should be addressed in a risk assessment (EPA, 1991c). Although the exposure scenarios based on hypothetical future residential land use provide the most conservative risk estimates and are important considerations in deciding whether to take an action at a site, EPA risk assessment guidance materials state that this conservative approach may not be justifiable if the site is surrounded by operating industrial facilities and can reasonably be assumed to remain as industrialized areas. In these cases, the EPA recommends using other exposure scenarios, such as agricultural or light commercial/industrial, including a qualitative assessment of the likelihood that the assumed reasonable future land use will occur (55 Federal Register 710). Because the physical characteristics and locale of the Person Generating Station site may prohibit future unrestricted residential development, this most conservative future land use assumption may not be reasonable and representative of the potential future exposure potential for the site. However, NMED requested that conservative risk estimates based on a hypothetical future residential land use be developed for the site, for comparison purposes.

The focused risk assessment includes seven different exposure scenarios:

- Scenario 1: Current risks to both onsite and nearby offsite light industrial/ commercial workers;
- Scenario 2: Current risks to onsite construction/remediation workers;
- Scenario 3: Current risks to potential offsite recreators during remediation activites;
- Scenario 4: Future risks to both onsite and nearby offsite light industrial/ commercial workers;
- Scenario 5: Future risks to onsite construction/remediation workers following remediation;
- Scenario 6: Future risks to both onsite and nearby offsite residents following remediation; and
- Scenario 7: Future risks to both onsite and nearby offsite residents if no action were taken at the site (for comparison purposes).

Risks to light industrial/commercial workers and construction/remediation workers incorporated carcinogenic and noncarcinogenic effects due to exposure to soil and soil gas contamination. No ground water component was included in these exposure scenarios because ground water is located approximately 110 feet below ground surface (bgs) and the planned remedial action consists of a fully enclosed extraction, treatment, and discharge system. It is highly unlikely that these receptors could reasonably be exposed to the ground water medium. VOC concentrations in shallow ground water affected by past activities at the Person Generating Station site were used to assess hypothetical potential residential exposures only (including surface water recreators). Routes of exposure to light industrial/commercial workers were assumed to be incidental ingestion and dermal contact with contaminated surficial soils and inhalation of VOCs within the outdoor breathing zone due to upward diffusion through the contaminated soils into the atmosphere. Routes of exposure to construction/ remediation workers were assumed to be incidental ingestion of and dermal contact with contaminated vadose zone soils currently covered by the protective closure cap and inhalation of VOCs within the outdoor breathing zone due to upward diffusion through the contaminated soils into the atmosphere.

Risks to potential offsite recreators incorporated carcinogenic and noncarcinogenic effects due to exposure to extracted ground water discharged to surface water during remediation. Although the primary recreation receptor is likely to be a golfer using the facilities near the surface water body receiving effluent discharge during remediation activities, a surface water recreator in direct contact with the affected medium during recreational events was assumed (i.e., swimmer). Routes of exposure were assumed to be incidental ingestion of and dermal contact with both contaminated and treated ground water during recreation. No inhalation component was considered. Routes of exposure involving secondary receptors (i.e., fish) were not considered reasonable even under the most conservative assumptions. The surface water body that may receive

treated effluent from remedial activities does not and could not support commercial or sport fish populations.

Risks to hypothetical future residents reflected both the carcinogenic and noncarcinogenic effects due to exposure to soil gas, soil, and shallow ground water. Risks from domestic use of contaminated ground water were factored into the total risk calculation under the residential exposure scenario. Routes of exposure to this receptor included inhalation from showering with, dermal contact with, and ingestion of ground water; dermal contact with contaminated surficial soil; and inhalation of VOCs inside houses. More detailed information on the types of exposure considered for each receptor and how exposure equations were developed for this focused risk assessment is presented in Section 4 of this report.

Toxicity information used to characterize potential site risks under different exposure scenarios was obtained from the technical literature. Information on toxic endpoints (i.e., critical effects on target organs) was factored into the risk calculations. More detailed information on specific toxicity values and sources is presented in Section 5 of this report.

Cumulative total risk estimates were developed for each different exposure scenario considered in this report. Both carcinogenic and noncarcinogenic risks for each receptor were evaluated for all exposure pathways completed under conservative assumptions. These risks were summed for all chemicals and exposure pathways to define the total risk to a specific receptor. Section 6 presents these risk calculations and qualitatively discusses the meaning of these values.

1.3 RELATIONSHIP TO OTHER PLANNING DOCUMENTS

This focused risk assessment was prepared to support the remedial action described, evaluated, and recommended for implementation at the Person Generating Station site (Engineering-Science, 1994). Quantitative risk estimates can be useful in determining the level of remediation required at a site to protect current and potential future human receptors from harmful exposure to site contamination. This focused risk assessment makes use of all available site characterization data to develop medium-specific concentration estimates that are representative of potential exposures at the site. This focused risk assessment also conservatively evaluates the anticipated effectiveness of the planned remedial project in reducing the risk posed by site contamination to acceptable levels. Such data supplements existing technology performance evaluations to ensure that an appropriate response action is planned for the site. Finally, this focused risk assessment contributes to the overall design of the planned remedial action for the Person Generating Station site by specifying whether treatment of extracted ground water is necessary and identifying the level of residual contamination that can remain onsite and still be adequately protective of human health. These risk-based target cleanup goals provide benchmark values that can be used to guide final decisions on the required level of remediation at the site.

SECTION 2

SITE DESCRIPTION

The following sections briefly describe the physical characteristics and operational history of the Person Generating Station site. Summary information on the nature and extent of contamination from site activities is also presented.

2.1 PHYSICAL CHARACTERISTICS

The Person Generating Station site, which was operated and is maintained by the PNM, is located in the Albuquerque Basin, a physiographic drainage basin in the middle portion of the long Rio Grande Valley which runs north to south throughout New Mexico (Kelley, 1977). The Person Generating Station site is surrounded by operational industrial facilities and commercial businesses. The AT 8 SF Railroad runs through the right-of-way on the site's western boundary. Interstate 25 (and its right-of-way property) is located approximately 1,000 feet to the east of the site. The New Mexico Championship Golf Course is located to the northeast and downgradient of the Person Generating Station site, across Interstate 25. No residential developments currently exist within the immediate environs of the Person Generating Station site (see Figure 2.1).

The regional topography of the Rio Grande Basin is defined by the Rio Grande River, which flows perennially north to south, approximately bisecting the alluvial valley and creating an alluvial floodplain to the east and west. Tijeras Arroyo, which has eroded through the land surface southeast of the Person Generating Station site, opens south onto the Rio Grande floodplain and flows to the southwest. The land surface in the vicinity of the Person Generating Station site slopes from 5 to 40 percent to the west. Local landforms include dissected terraces and alluvial fans. The Person Generating Station site itself is characterized by physical topographical features and hardy, weedy vegetation common in semiarid, front range, industrial areas.

The ground water table is approximately 110 feet below ground surface (bgs) at the Person Generating Station site. Ground water generally flows southward within the Rio Grande Basin. However, in the immediate vicinity of the Person Generating Station site, the upper 25 to 35 feet of ground water flows about 82° east of south at a gradient of 0.43 percent, flattening east of Interstate 25 (Metric, 1993). Potentiometric measurements suggest the presence of a lower flow zone in which ground water flows 83° east of south at a gradient of 0.48 percent. Further details on site hydrogeology can be found in the *Corrective Action Directive Assessment Summary Report, Person Generating Station* (Metric, 1993) and the CMP (Engineering-Science, 1994).