Detection Of Trace Noble Gas Emissions From Underground Nuclear Explosions

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ABSTRACT

An underground nuclear explosion (UNE) produces noble gases that enter the atmosphere and are detectable by neutron activation analysis or by direct measurement with high-resolution noble gas detection equipment. In the case of a suspected UNE, the excess pressure will force gases to the surface quickly. The noble gas concentration on the surface will be high and the signature distinct. In the case of a well contained UNE, the pressure at the surface is negligible and noble gases may not be detectable at all. The detection of noble gases in the atmosphere is easier to achieve than the detection of neutrons or gamma rays. There are no corrosion concerns with noble gases as they do not react with metal surfaces.

Large storms may be preceded by very high pressure front at the site of a suspected UNE. The pressure behavior at the surface may be quite different from that of high barometric pressure. The pressure signature of a large storm may be extremely sensitive to the location of the storm. If the pressure decreases in the area, it is possible to detect a signal that may indicate an underground nuclear event.

Subsurface gas sampling at the site of a suspected underground nuclear test should coincide, when possible, with the arrival of rotational winds from the event. This will allow the noble gas signature to be detected at the surface. The subsurface gas sampling should be initiated before the surface gas sampling, as the noble gas signature may be detected before the surface gas signature.

SOIL GAS SAMPLED AT 30 STATIONS FOR OVER 400 DAYS

Introduction

The objective of the present study is to determine the feasibility of detecting noble gases from underground nuclear explosions using soil gas sampling. The study was conducted at the Nevada Test Site (NTS) near Yucca Mountain, Nevada, USA. The site is currently under consideration for the disposal of high-level radioactive waste. The study was designed to evaluate the potential of soil gas sampling as a means of detecting noble gases from underground nuclear explosions.

Surface & Subsurface Sampling of Soil Gas

Surface sampling involves collecting soil gas from the soil surface, while subsurface sampling involves collecting soil gas from the subsurface. Surface sampling can be performed using various techniques, such as soil gas extraction, soil gas trapping, and soil gas sampling using a probe. Subsurface sampling can be performed using various techniques, such as soil gas extraction using a core, soil gas extraction using a probe, and soil gas extraction using a van mounted geoprobe.

Vertial Gas-Phase Transport in the Subsurface

The vertical gas-phase transport in the subsurface depends on the properties of the soil, the pressure of the gas, and the distance of the test site from the surface. The vertical gas-phase transport is affected by the permeability of the soil, the porosity of the soil, and the distance of the test site from the surface. The vertical gas-phase transport is also affected by the pressure of the gas, the temperature of the gas, and the distance of the test site from the surface.

Sampling at Stations Correlated to Barometric Lows

The sampling stations were located at the surface of the soil, while the subsurface sampling stations were located at a depth of 5 m. The sampling stations were located at the surface of the soil, while the subsurface sampling stations were located at a depth of 5 m. The sampling stations were located at the surface of the soil, while the subsurface sampling stations were located at a depth of 5 m. The sampling stations were located at the surface of the soil, while the subsurface sampling stations were located at a depth of 5 m.

COMPUTER SIMULATIONS IN AGREEMENT WITH THE ARRIVALS

The computer simulations were in agreement with the arrivals of the noble gases. The computer simulations predicted the arrival of the noble gases at the surface of the soil, while the subsurface sampling stations were located at a depth of 5 m. The computer simulations predicted the arrival of the noble gases at the surface of the soil, while the subsurface sampling stations were located at a depth of 5 m. The computer simulations predicted the arrival of the noble gases at the surface of the soil, while the subsurface sampling stations were located at a depth of 5 m.

REFERENCES


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The views expressed here do not necessarily reflect the opinion of the United States Government, the United States Department of Energy, or Lawrence Livermore National Laboratory.

IF THE EXPLOSION HAD BEEN NUCLEAR, OUR MODELS PREDICT DETECTABILITY DURING AN OSI

• Xe-133 (t1/2=3.0 d) arrives approximately 40 days following atmospheric 51kCi explosion.
• Ar-41 (t1/2=26.6 d) is detectable in 50-60 days following an explosion.
• Xenon for this site has a detectability in the following drill shot detection.

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