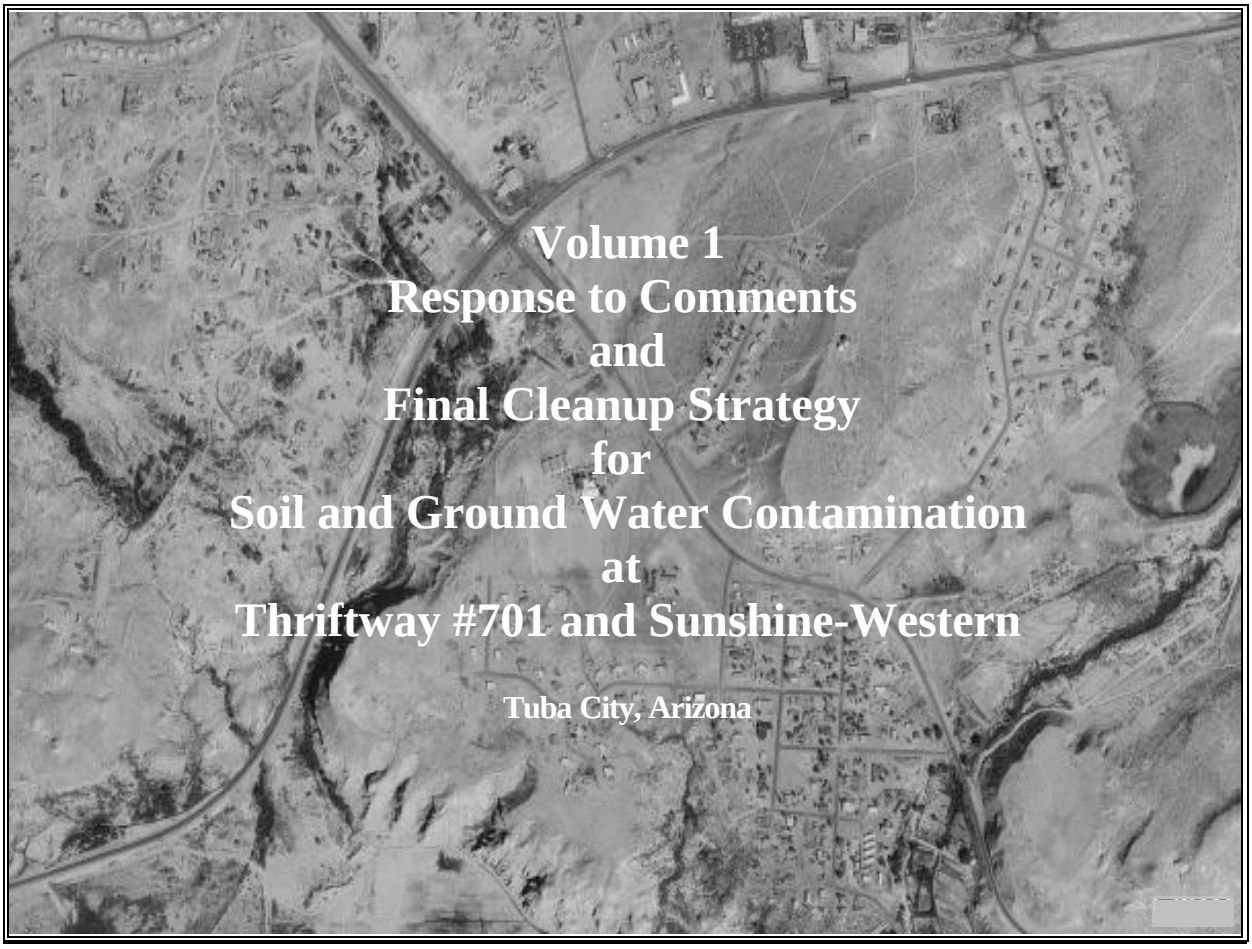

Volume 1
Response to Comments
and
Final Cleanup Strategy
for
Soil and Ground Water Contamination
at
Thriftway #701 and Sunshine-Western

Tuba City, Arizona

U.S. Environmental Protection Agency, Region 9
Underground Storage Tanks Program Office
working with
Navajo Nation Environmental Protection Agency
Hopi Department of Natural Resources, Water Resources Program

December 2003

Acknowledgement:

This document was prepared by the United States Environmental Protection Agency (per U. S. Federal Executive Order 13175, November 6, 2000) working with the Navajo Nation Environmental Protection Agency and the Hopi Department of Natural Resources, Water Resources Program. The cleanup strategy was identified and developed by technical representatives from U.S. EPA Region 9's Waste Management Division, Navajo Nation EPA's Waste Regulatory Compliance Department, and the Hopi Department of Natural Resources, Water Resources Program and Environmental Protection Office, incorporating input received during the public comment period June 24 through August 6, 2003.

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Abbreviations and Acronyms

BTEX	Benzene, toluene, ethylbenzene, and xylenes
MTBE	Methyl tertiary butyl ether.
CAP	Corrective action plan.
EPA	United States Environmental Protection Agency
IRM	Interim remedial measure.
lbs	Pounds
LUST	Leaking underground storage tank.
MCL	Maximum contaminant level.
MSL	Mean sea level.
ppb	Parts per billion.
ppm	Parts per million.
PRG	EPA Region 9 Preliminary Remediation Goal.
RCRA	Resource Conservation and Recovery Act.
RP	Responsible party.
SVE	Soil vapor extraction.
SVVS	Subsurface volatilization and ventilation system.
TPH	Total petroleum hydrocarbons.
UST	Underground storage tank.

1. Introduction

Volume 1 of this document provides responses to public comments received during the public comment period from June 24, 2003 to August 6, 2003. Based upon comments received, this document also presents the final cleanup strategy for soil and ground water contaminated by petroleum released from the Thriftway #701 and Tuba City Express facilities.

- Chapter 1 - An introduction and overview of the public comment process and the petroleum contamination at Thriftway #701 and Tuba City Express gas stations.

- Chapter 2 - Responses to comments received during the public comment period from June 24, 2003 to August 6, 2003.

- Chapter 3 - Ground water cleanup progress in reducing concentrations in the source areas and throughout the plume.

- Chapter 4 - Cleanup goals, time lines, and requirements for the facility operators to clean up the petroleum contamination.

- Chapter 5 - The final cleanup strategy selected by the U.S. Environmental Protection Agency, working with the Navajo Nation Environmental Protection Agency and the Hopi Department of Natural Resources, Water Resources Program. Also, the final contingency plan for cleanup, in case the preferred cleanup method does not achieve the cleanup goals.

Volume 2 provides a full listing of comments received during public the comment period June 24, 2003 to August 6, 2003, and is available upon request.

Leaking Underground Storage Tanks in Tuba City

Underground storage tanks (USTs) at the two gas stations at the intersection of Highways 160 and 264 (the Site) leaked gasoline (Figures 1 and 2). One of the stations, Thriftway, leaked approximately 13,000 gallons (Figure 3). It is not known how much was leaked from Sunshine Western (also known as Superfuels or Tuba City Express (Figure 4). The leaking underground storage tanks were removed and replaced with new tanks. The U.S. Environmental Protection Agency (U.S. EPA), in consultation with the Navajo Nation and Hopi Tribe, have been directing the gas station operators to assess and clean up their petroleum contamination.

Soil and Ground Water Contamination

The gasoline that leaked from the old tanks soaked into the soil at the gas stations and some of the gasoline chemicals have entered the ground water. These chemicals have formed a plume of contamination in the ground water southwest of the Site approximately 1,200 feet in length (Figure 5).

The main chemicals of concern are benzene, toluene, ethylbenzene, and xylenes (BTEX); methyl tertiary butyl ether (MTBE); and total petroleum hydrocarbons (TPH).

Cleanup is Continuing and Will be Expanded

Thriftway Corporation has already started cleaning up parts of the Site. A soil ventilation and volatilization cleanup system (SVVS) at Thriftway #701 has been in operation since September 2000 (Chapter 3, Figures 6 - 8). A second SVVS cleanup system began operating at the Tuba City Express gas station in October 2002. Based on data supplied by Thriftway Corporation, these systems have successfully extracted over 4,800 lbs (approximately 740 gallons) of volatile gasoline contamination from the soil and ground water in the source areas. In addition, these SVVS cleanup systems supply oxygen underground. This added oxygen has enhanced the natural breakdown of gasoline contaminants in soil and ground water resulting in reduced concentrations throughout the plume (Chapter 3, Figures 9 - 12). Installation of a third system, at the Tuba City Truck Stop, is expected in 2004.

U.S. EPA, Navajo Nation, and Hopi Tribe are Working Together to Solve This Problem

U.S. EPA, the Navajo Nation Environmental Protection Agency and the Hopi Water Resources Program continue to monitor the contamination to make sure it does not spread and to confirm the cleanup systems are working. U.S. EPA and the Tribes have worked together to adopt the final remedial strategy for cleanup of the Site as contained in Chapter 5.

Local Water Supplies are Currently Safe

To date, ground water monitoring shows that there is a decrease in the concentrations of contamination in ground water. Also, based on results from sampling by U.S. EPA and Thriftway since 1998, the local Hopi and Navajo springs have not been determined to be contaminated by petroleum from these gas stations. U.S. EPA and the Tribes are working together to ensure that the Site is cleaned up and local water supplies remain safe.

Public Comment Process

The U.S. EPA sought comments from any persons, including members of the communities in and around Tuba City and Moenkopi, members of the general public, other regulatory agencies, Thriftway Corporation, National Petroleum Marketing, Inc., and Sunshine Western, Inc. on the options for cleanup of soil and ground water contaminated by petroleum released from the Thriftway #701 and Tuba City Express facilities.

Public comments were submitted to U.S. EPA orally and in writing during the public comment period starting June 24, 2003 and ending on August 6, 2003, and in person at the public meetings/hearings. Public information meetings were held to discuss cleanup methods for Tuba City Petroleum Contamination on June 24 and 25, 2003 at the Upper Moenkopi Community Building, Upper Moenkopi Village, AZ and the Tuba City Chapter House, Tóh nan‘‘s dizi, Highway 264, Tuba City, AZ, respectively. Official public hearings were held to discuss the cleanup methods and receive

comments on the proposed strategy for the Tuba City petroleum contamination cleanup on August 5 and 6, 2003 at the same locations.

All comments received were reviewed and responses to significant comments were considered before a final soil and ground water cleanup strategy was selected by U.S. EPA working with the Navajo Nation and the Hopi Tribe (Chapter 5). Responses to significant comments are presented in Chapter 2 of this report.

Who to Contact for Questions

The following U.S. EPA, Navajo, and Hopi managers and staff can be contacted with questions concerning the response to comments and the final strategy for cleanup of soil and ground water.

Matt Small, Hydrogeologist, U.S. EPA	(415) 972-3366
Mimi Newton, Attorney, U.S. EPA	(415) 972-3941
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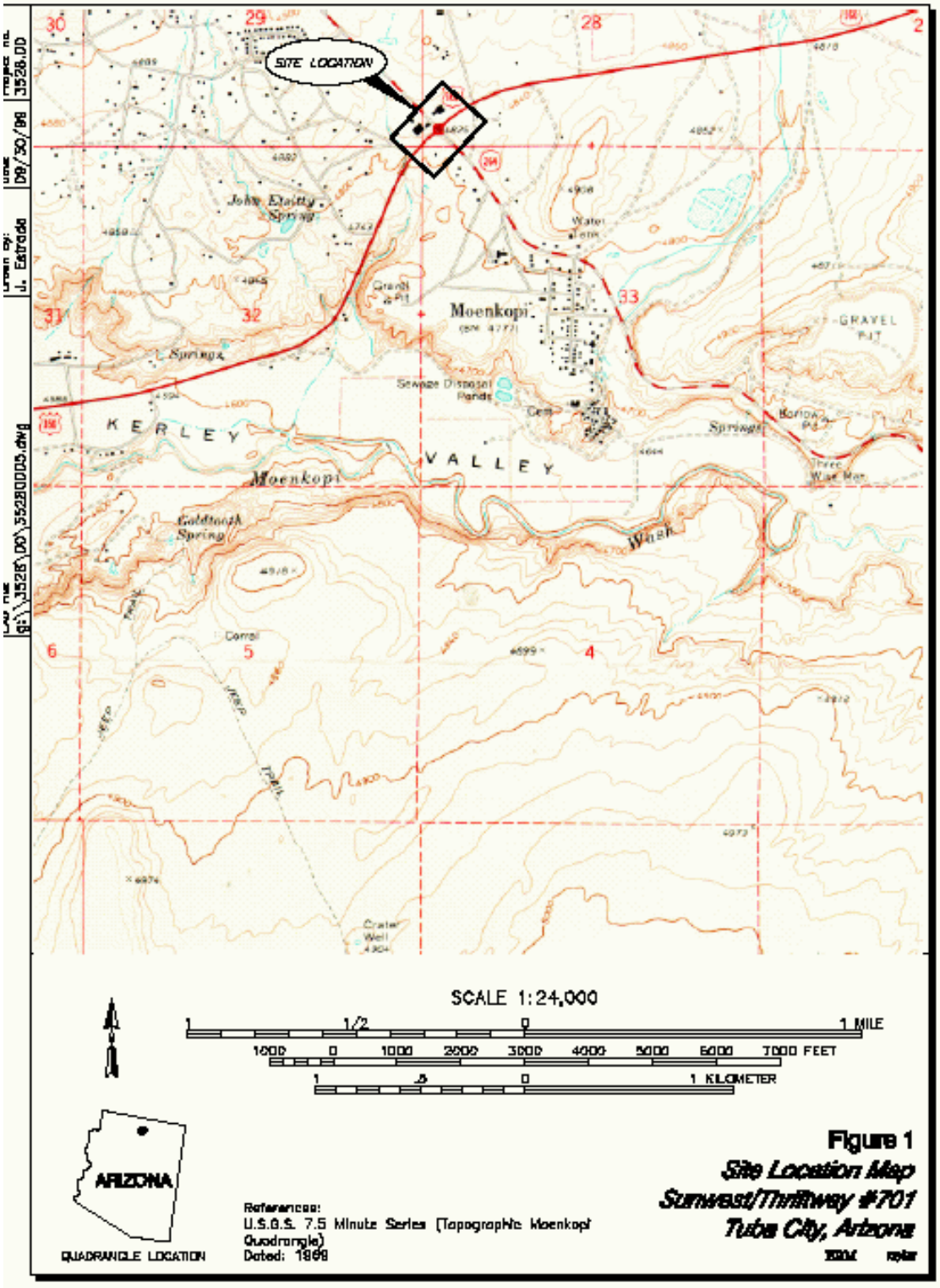

Figure 1. Location of Thriftway #701 and Sunshine Western (also known as Superfuels or Tuba City Express) gas stations at the intersection of Highways 160 and 264, Tuba City, Arizona.

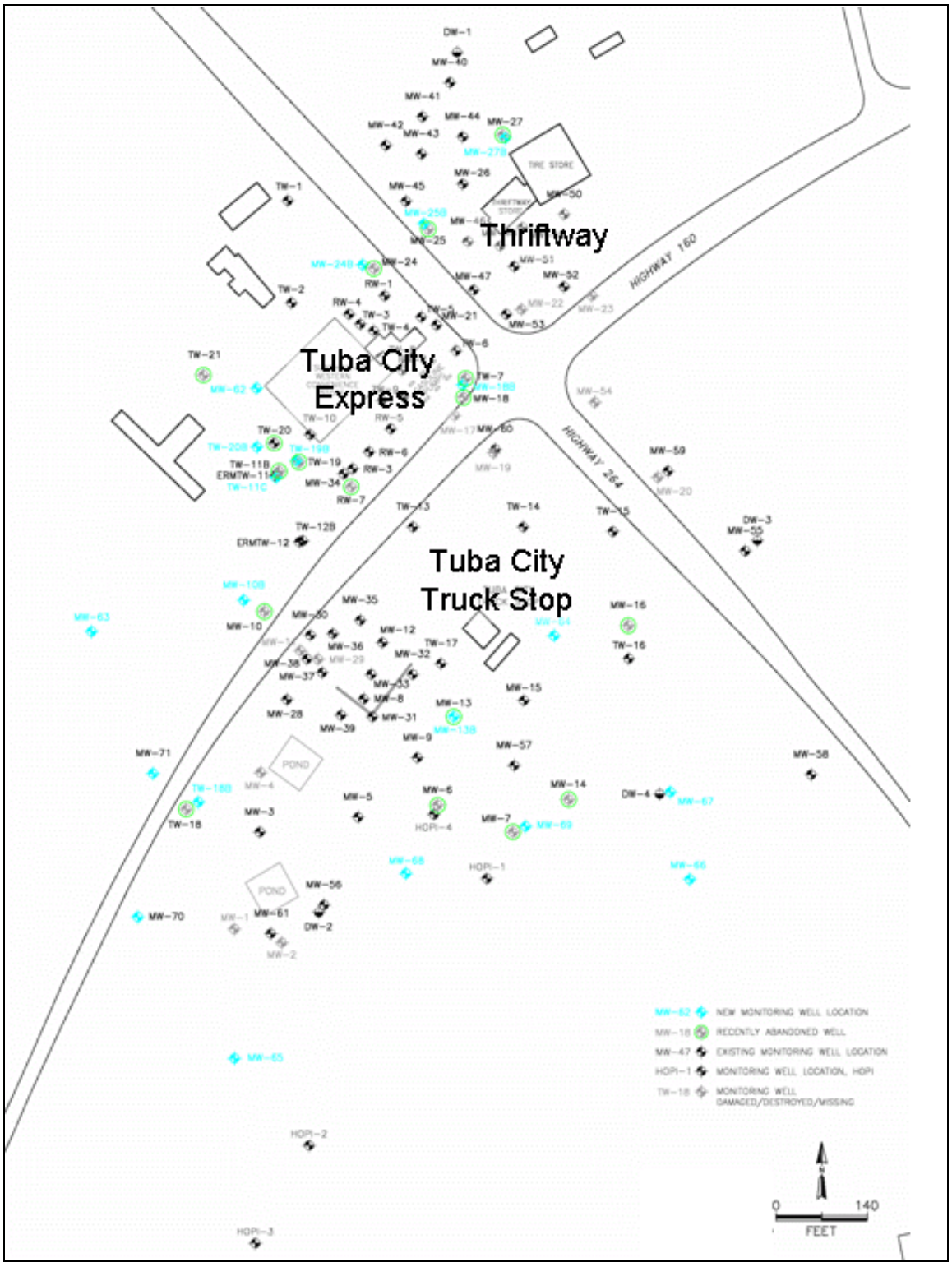

Figure 2. Location of Thriftway #701 and Sunshine Western (also known as Superfuels or Tuba City Express) gas stations at the intersection of Highways 160 and 264, Tuba City, Arizona.

Figure 3. Thriftway #701 gas station.

Figure 4. Sunshine Western gas station, also known as Superfuels or Tuba City Express.

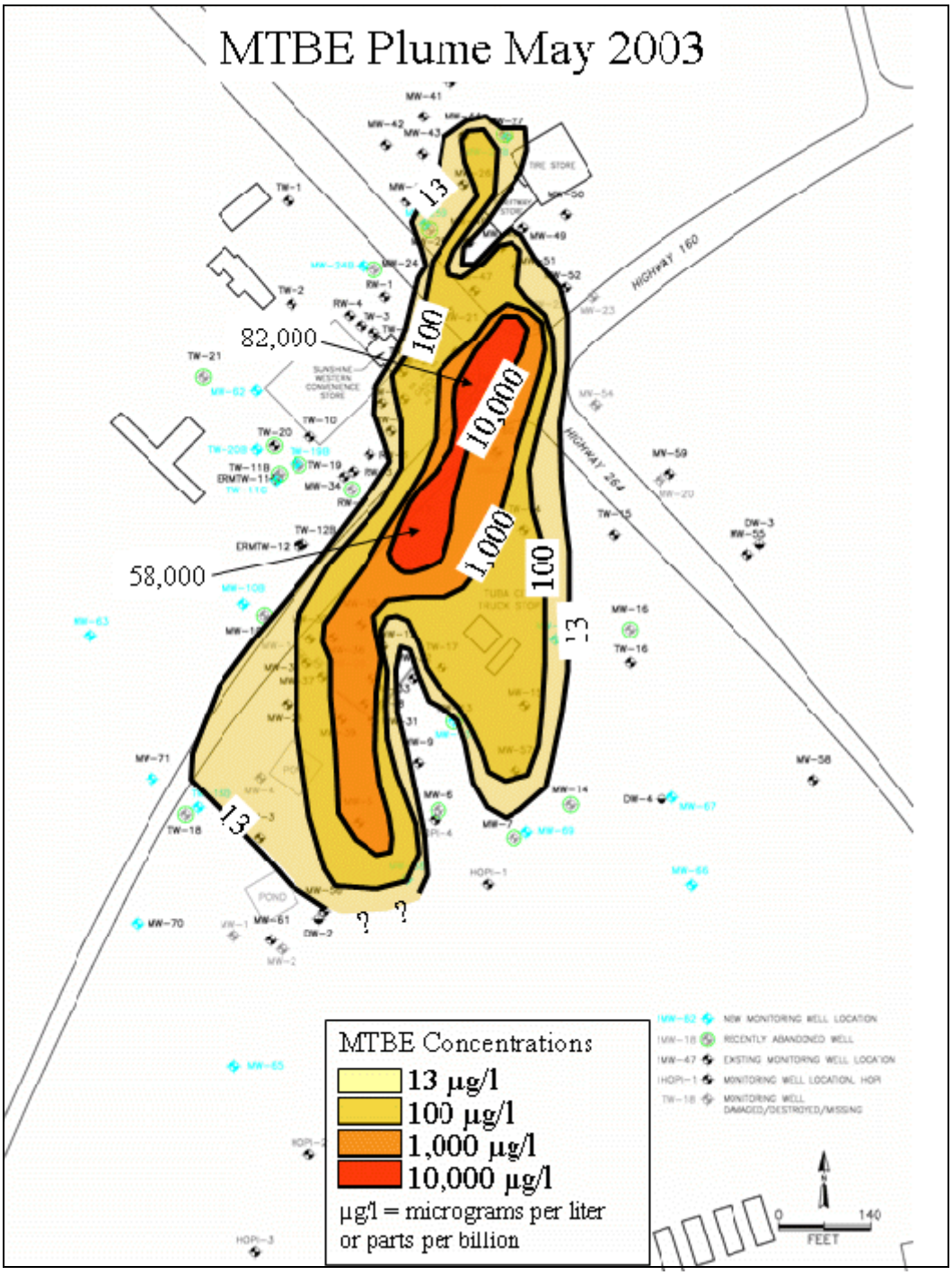

Figure 5. Map showing extent of MTBE ground water contamination May 2003 at Thriftway #701 and Superfuels gas stations in Tuba City (modified from Billings, 2003 by Chris Prokop, U.S. EPA).

2. Response to Comments Received

The comments received were grouped into the following six areas of concern: (1) Cleanup Technologies, (2) Extent and Spread of the Contamination (3) Contingency Plan, (4) Monitoring and Post-Cleanup, (5) Importance of Water, Land, Culture and Public Health, and (6) General. Individual comments were grouped together so that, in most cases, the comments shown below represent a number of individual comments.

Comments were received in writing, by mail, and by e-mail during the official public comment period from June 24, 2003 through August 6, 2003. Oral and written comments were also received during public informational meetings held June 24 and 25, 2003, and during public hearings held August 5 and 6, 2003.

Cleanup Technologies

SVVS

Comment: Community members have concerns as to the ability of the proposed soil ventilation and volatilization system (SVVS) alone (or in conjunction with the BioSparging) in the Truck Stop area to effectively address that hotspot within 3-5 years. These concerns are due to the effectiveness of SVVS in light of the ongoing drought and other hydrological influences in the area, as well as the nature of the soil in the area.

Response: U.S. EPA and the Tribes believe that the proposed SVVS in the Truck Stop area will effectively address the hot spot in that area within the estimated 3-5 year cleanup time. This is based upon performance of the existing SVVS during the two-year period from September 2000 toMay 2003. During this time benzene concentrations in the area of the SVVS cleanup system were reduced to as little as one thousandth of the starting concentrations in some ground water monitoring wells. For example, benzene concentrations in monitoring well MW-48 were reduced from 15,000 ppb to 6 ppb. MTBE concentrations were reduced in the area of the cleanup system to one tenth or less in some ground water monitoring wells during this same period. For example, MTBE concentrations in monitoring well MW-47 were reduced from 11,000 ppb to 460 ppb. Please see Chapter 3 for more detailed discussion of ground water cleanup progress.

U.S.EPA and the Tribes believe that the SVVS is effective, even during drought conditions. In fact, the SVVS has been operating and removing contamination over the last three years during drought conditions. If drought conditions continue and if the water table falls, the transport of contaminants would be reduced, but the SVVS would continue to remove vapors from soil.

U.S. EPA and the Tribes also believe that the SVVS will be effective in both the natural soil and the fill below the Truck Stop. We are also evaluating potential design modifications due to the lack of paving in the Truck Stop area.

Comment: If SVVS is currently working, why are we considering other options?

Response: U.S. EPA required the responsible parties to implement interim cleanup measures by installing and operating the existing SVVS cleanup systems. However, in selecting the overall cleanup strategy, U.S. EPA and the Tribes had to consider whether it made sense to continue using these existing systems as part of the final cleanup plan for the Site. It was also necessary to find out whether the community felt that the continued use of these systems was appropriate. The SVVS systems have proven effective and the use of these systems were generally supported by the community. As a result, U.S. EPA and the Tribes have incorporated the existing SVVS systems into the overall cleanup strategy for the Site.

Comment: I support SVVS being installed south of Highway 160 as soon as possible, prior to April of 2004 if at all possible.

Response: Installation of the SVVS in the Truck Stop area could begin as soon as 60 days following the simultaneous release of this document and the U.S. EPA letter "Approval with Comments of the Amended Interim Remedial Measure Workplan for the Areas Designated as the Tuba City Truck Stop and Downgradient Dissolved Plume, submitted by the responsible parties on August 4, 2003."

Comment: I would like to see a new SVVS system, rather than an old one, put in place to get rid of all this contamination from this Site.

Response: In a letter dated August 4, 2003, Thriftway requested that the Truck Stop SVVS installation be deferred until the Thriftway SVVS ceases operation to allow reuse of certain equipment and to avoid simultaneous operation of three SVVS installations. However, working with the Tribes, U.S. EPA has determined that no delays will be permitted simply to allow reuse of equipment. In addition, U.S. EPA and the Tribes are concerned that removal of the equipment from the Thriftway facility would eliminate options for biosparging at the Thriftway facility or restarting the Thriftway SVVS if concentrations should rebound following system shut down.

Excavation

Comment: What would the excavation costs be to treat the 10,000 µg/L and the 100,000 µg/L hotspots in the source area? In the Truck Stop area?

Response: A rough estimate of excavation and transportation costs, based on $200 per cubic yard and an average thickness of 15 feet, for the area contaminated above 100,000 µg/L shown in Figure 5, is $263,000. An estimate for the area contaminated above 10,000 µg/L is $2.7 million. However, this estimate does not include the costs of repairing the intersection following excavation, repairing the utilities, refilling, regrading, resurfacing, or soil disposal. Excavating the area contaminated above 10,000 µg/L would also require excavation and replacement of a major portion of the intersection of Highways 160 and 264. These additional costs could easily double or triple the total costs for the project pushing the estimated costs as high as $750,000 for the area contaminated above 100,000 µg/L and $8 million for the area contaminated above 10,000 µg/L.

Comment: The Proposed Preferred Method should include targeted excavation in the Truck Stop Area's hotspots either alone or in combination with the SVVS.

Response: Targeted excavation is included in the contingency plan but is not included as part of the preferred cleanup strategy. There are a number of potential risks and issues associated with large scale excavation projects. Excavation requires use of heavy equipment and large trucks for hauling that can increase noise, dust, vapors from excavated soils, traffic, and the physical hazards associated with any large-scale construction project. For these reasons and those discussed in the previous response excavation is included in the contingency plan rather than the preferred cleanup strategy.

Comment: The only way the soil can be cleaned up is to remove it and replace it with clean soil.

Response: There are a number of other options for cleaning up soil and ground water. In fact, based on data supplied by Thriftway Corporation, the SVVS systems installed at the Thriftway and Superfuels facilities have successfully removed over 4,800 lbs of contamination from the soil and ground water (Billings and Associates, 2003). The SVVS has also added sufficient oxygen to biodegrade an additional unquantifiable amount of contamination. Other options for soil cleanup are discussed in more detail in the "Proposed Preferred Cleanup Method for Soil and Ground Water Contamination at Thriftway #701 and Sunshine-Western Joint Site Tuba City, Arizona," published in July 2003.

Comment: The best way to achieve 100% cleanup is to do excavation. I've heard that benzene is the hardest part to get rid of and looking at the maps, the highway is where the benzene is and we could excavate in conjunction with the highway renovation. Could excavation of the hotspots be done in conjunction with the highway renovation and possibly minimize costs and time?

Response: Excavation is not necessarily the best way to achieve cleanup. There are a number of potential risks and issues associated with large scale excavation projects. Excavation requires use of heavy equipment and large trucks for hauling that can increase noise, dust, vapors from excavated soils, traffic, and the physical hazards associated with any large-scale construction project.

With respect to benzene, it is actually one of the more easily remediated components of gasoline. Benzene concentrations at this site have been reduced much more quickly than MTBE by SVVS cleanup methods.

The potential for removal of petroleum contamination during highway renovations has been discussed with the Arizona Department of Transportation (ADOT). However, ADOT does not plan to excavate in the areas of soil contamination as part of the planned highway construction. In fact, ADOT has switched from trenching to drilling to minimize contact with petroleum contaminated soil in potentially contaminated areas to minimize the possibility of encountering contamination during their work. Please see detailed ADOT drawings in Volume 2 for more information.

Interceptor Trench and Evaporation Ponds

Comment: Prior use of the trench revealed inherent problems with the system resulting in disproportionate expenditures of time and resources in disposing of water when the volume exceeded the capacity of the ponds and proposing alternative approaches for groundwater disposal by pursuing National Pollution Discharge Elimination System permitting was to no avail.

Response: It is true that flow exceeding the capacity of the ponds, and a lack of approval for groundwater disposal were the key issues blocking use of the interceptor trench system. These issues remain unresolved.

Comment: Whatever methods that are there we need to pursue and utilize them again to see that the overall cleanup of contamination is accomplished.

Response: Re-activation of the extraction trench was not included in the final preferred cleanup strategy for two reasons. First, ground water extraction and treatment has been shown to be a less effective method than SVVS for cleaning up the petroleum hydrocarbon contamination at this Site. This is due to the fact that ground water must flow through the contaminated zone over a long period of time slowly dissolving the petroleum contamination. In comparison, the SVVS method injects air directly into the source areas volatilizing the contamination and supplying oxygen to encourage natural

breakdown. Second, the flow from the trench exceeds the capacity of the evaporation ponds and there is currently no permitted method for disposing of the excess water. Construction of additional ponds is estimated to cost as much or more than installation of the additional SVVS system.

Pump and Treat or Re-injection

Comment: I recommend pump and treat as part of the cleanup.

Response: Pump and treat is not included in the preferred remedy for two main reasons. First, pump and treat has been shown to be a less effective method than SVVS for cleaning up petroleum hydrocarbons found at the Site. This is due to the fact that ground water must flow through the contaminated zone over a long period of time slowly dissolving the petroleum contamination. In comparison, the SVVS injects air directly into the source areas volatilizing the contamination and supplying oxygen to encourage natural breakdown. Second, there is currently no permitted method for disposing of treated water. However, pump and treat can be effective for chemicals that tend to dissolve more easily such as MTBE. As a result, pump and treat remains an option in the contingency plan.

Extent and Spread of the Contamination

Comment: Section 2 of the Proposal states that some contamination has been detected below the alluvium at one ground water monitoring well at the southern tip of the plume. This reference fails to note that this detection was an isolated event following the breakdown of a drilling rig that required completion of MW-68 the following day. Subsequent sampling at MW-68 has confirmed that there are no detectable concentrations of plume-related constituents below the alluvium. To the extent the statement in Section 2 of the Preferred Cleanup Proposal suggests otherwise, this needs to be corrected.

Response: It is true that MTBE was detected in MW-68-Lower, below the alluvium, following installation. It is also true that MTBE concentrations have declined in MW-68-Lower since installation and are now currently non-detect. It should also be noted that MTBE concentrations in monitoring well MW-68-Upper, above the alluvium, have increased since installation. Both the upper and lower wells will continue to be monitored.

Comment: Section 6 of the Preferred Cleanup Proposal also suggests that active remediation may be required in the area of the higher concentrations south-southeast of the Truck Stop. The source of the elevated hydrocarbons south-southeast of the Truck Stop has been the subject of considerable debate. This area of higher concentrations is not the result of the plume

emanating from the Thriftway or Sunshine Western/Tuba City Express source areas. Active remediation for this area should not be required, given the upgradient IRMs and natural attenuation.

Response: U.S. EPA and the Tribes disagree with the commenter's assertion that the area of higher concentration south-southeast of the Truck Stop did not emanate from the Thriftway or Sunshine Western/Tuba City Express gasoline stations. Neither the U.S. EPA, The Tribes, The Responsible Parties, nor any other person(s) have identified any other potential sources for this contamination. To the extent the selected Site-wide cleanup strategy, including contingency plan, includes active remediation in this area, the responsible parties will be required to implement such active remediation.

Comment: What is being done to ensure that contamination does not reach deeper zones? The MTBE contamination appears to be traveling south. What will be done to head this contamination off at the pass? Where will the end or toe of the plume go, will it continue to flow downhill?

R*esponse:* There are two steps being taken to ensure that contamination does not reach deeper zones or continue to migrate away from the site. First and foremost, cleaning up the Site is the best way to ensure that contamination does not reach deeper zones. The initial phases of Site work have been focused on cleaning up the source areas at the Thriftway and Superfuels facilities. Cleaning up the source areas cuts off the supply of contamination to the rest of the plume. In addition, the SVVS method adds oxygen to the ground water which helps increase the rate of natural breakdown of the petroleum products. Natural attenuation monitoring is ongoing in source/treatment areas and the rest of the plume. Thriftway is monitoring chemical concentrations in ground water and geochemical parameters (pH and dissolved oxygen) as primary and secondary indicators of natural attenuation at the site.

As a result of source cleanup efforts, benzene concentrations in the area of the SVVS cleanup systems were reduced to as little as one thousandth of the starting concentrations in some ground water monitoring wells over a two-year period. MTBE concentrations were reduced in the area of the cleanup system to one tenth or less of the starting concentrations in some ground water monitoring wells during this same period. In addition, Figures 6 through 9 in Chapter 3 show that benzene and MTBE concentrations have been reduced throughout the entire plume.

Even though concentrations have been reduced throughout the plume, the length of the plume and possible continued migration are still of concern. The MTBE is migrating in a southwesterly direction, the general direction of ground water flow.

The second step that is being taken is to clean up MTBE contamination at the toe, or southwestern end, of the plume. The final cleanup strategy calls for injecting compounds to increase oxygen in this area to directly stimulate bacteria in the downgradient portions of the plume. The bacteria will then break down and naturally attenuate the MTBE, preventing it from flowing any further to the southwest. This treatment at the downgradient toe of the plume combined with SVVS and natural attenuation will eventually halt plume migration and ultimately clean up the contamination in the treatment area.

Contingency Plan

Comment: What will trigger the Contingency Plan's implementation in order to deal with the hotspots?

Response: If cleanup goals are not achieved within the cleanup area for a cleanup system or method after five total years of operation and monitoring, the Contingency Plan measures or other options will be triggered at the discretion of U.S. EPA, in consultation with the Tribes. The steps leading up to possible implementation of the contingency plan are as follows.

Tribal technical personnel will evaluate analytical results from semi-annual ground water monitoring and communicate cleanup progress to the community. Because ground water moves slowly it may take two or three years of operation and monitoring to determine if cleanup methods are removing contamination from an area of the Site quickly enough to meet the cleanup goals within 5 years. After three years of operation and monitoring, the Responsible Parties must statistically quantify cleanup rates and trends for each cleanup method and cleanup area (a minimum of three years of data are

required for statistical evaluation, see Chapter 5 for more detailed information). This statistical evaluation of cleanup rates and trends will determine the potential for that cleanup method to achieve cleanup goals within the cleanup area within five total years of operation.

If the statistical evaluation indicates that cleanup goals will be achieved by the cleanup method within five total years of operation, the responsible parties may proceed. However, if the statistical evaluation indicates that cleanup goals will not be achieved within five total years of operation, the responsible parties must modify the cleanup system or method to achieve cleanup goals within five total years of operation.

If cleanup goals are achieved within the cleanup area for a cleanup system or method after five total years of operation, confirmatory monitoring will be initiated. If concentrations rebound above cleanup goals, the responsible parties will be allowed to restart the cleanup system or method, or be required to implement the Contingency Plan measures at the discretion of U.S. EPA, in consultation with the Tribes.

Comment: The Proposed Preferred Method should provide a more specific statement of how the use of excavation in the Contingency Plan can or would be triggered so that there is some indication of how long the SVVS and Biosparging will be relied on before another method (possibly excavation) is employed.

Response: The contingency plan will be triggered as discussed in the response to the previous comment. If the contingency plan is triggered, all possible options, including excavation, will be evaluated to achieve cleanup.

Comment: I think the SVVS system is doing its job but still we need to have a backup system if something should fail along the line.

Response: If the SVVS or another component of the preferred remedial strategy fails to prevent further migration of the plume and/or fails to reduce contaminant concentrations at a rate that will achieve cleanup goals within five years, the contingency plan will allow U.S. EPA, working with the Tribes, to direct the responsible parties to implement other cleanup options.

Monitoring and Post-Cleanup

Comment: How often will the current ground water monitoring wells, down slope production wells, and springs be tested and by whom during the cleanup? Are any deep ground water monitoring wells, for configuration of clean-up or other purposes, part of the requirements of the Proposed Preferred Cleanup Method?

Response: The current ground water monitoring wells and springs will continue to be monitored by the responsible parties on an approved schedule, currently semi annually, throughout the cleanup and performance monitoring period. U.S. EPA will also continue to analyze selected duplicate samples. There are currently four deep ground water monitoring wells that are included in the monitoring program. Post-cleanup performance monitoring may include installation of additional monitoring wells.

Comment: Monitor the Site for up to ten years after cleanup goals are achieved, rather than 3 to 5 years.

Response: The period of 3 to 5 years is the anticipated time for completing cleanup. However, ground water contamination monitoring must continue even after cleanup goals have been achieved to verify that the Site no longer poses a threat to human health or the environment. Post-cleanup performance monitoring will be continued after cleanup goals have been achieved to ensure that concentration levels are stable and remain below cleanup levels. Post-cleanup monitoring will be continued for a minimum of one year and possibly longer at the discretion of U.S. EPA in consultation with the Tribes. Post-cleanup monitoring may include installation of additional monitoring wells.

Comment: There should be some type of process for a yearly inspection of the gas stations so there won't be any more contamination.

Response: Based on the personnel and resources currently available, underground storage tank systems on Indian lands in U.S. EPA Region 9 are inspected once every

three years. Our goal is to achieve a frequency of once every two years by October 2004. In addition, sensitive or recalcitrant Sites may be inspected more frequently. The U.S. EPA is currently discussing entering into an agreement that would allow the Navajo Nation EPA to assume responsibility for inspection of gas stations and UST facilities on the Navajo Nation. The Navajo Nation estimates that they would be inspecting these facilities every two years.

Comment: Are there plans to remove sludges that may remain after the cleanup is finished?

Response: Cleanup must continue until concentrations of all chemicals are below the cleanup levels listed in Table 1 in Chapter 4 of this document. Total petroleum hydrocarbons (TPH) in soil must be cleaned up to less than 100 mg/kg (parts per million). A part per million is a small quantity equivalent to 10 cents in $10,000 or 10 ounces of salt in 31 tons of potato chips. This 100 ppm amount of TPH is too small to cause a sludge. However, some staining and bacterial residue may be present underground after cleanup due to biodegradation of petroleum hydrocarbons. This is a harmless residue resulting from natural biodegradation processes and will dissipate naturally over time.

Comment: I think we still need to continue monitoring the other waters.

Response: The ground water monitoring wells and springs currently being monitored will continue to be monitored on an approved schedule, currently semi annually, throughout the cleanup and for a period of time after cleanup has been completed.

Importance of Water, Land, Culture and Public Health

Comment: I would like to express my concern for our younger generation, for their future with our precious water sources. Springs are our sole source of drinking water and the water is used every day by the whole community including infants and elders. What is the continued risk to water supplies during the cleanup efforts?

Response: Based on results from sampling by U.S. EPA and Thriftway since 1998, the Hopi and Navajo springs in the area have not been determined to be contaminated by petroleum from these gas stations. There are no public drinking water wells pumping the ground water that is contaminated at this site. Also, monitoring of ground water, that is not used for drinking water, shows that there is a decrease in the levels of contamination at the Site.

Comment: Since childhood we are taught to honor and respect water, all Hopi ceremonies

revolve around bringing rainwater to our homeland. The cycle of life for us is that we dance and pray for rain to replenish our underground aquifers. Water nourishes your body and therefore water is considered the most sacred of all natural resources.

Response: The final cleanup strategy adopted for this Site will ensure that contamination from these gas stations does not reach Hopi or Navajo springs and that the ground water is clean so as not to endanger human health or the environment. In recognition of the cultural significance and corresponding traditional uses for the local springs, U.S. EPA's April 2002 modification to its 1996 Order prohibits the Responsible Parties from allowing any contamination from the gas stations to reach the Hopi or Navajo springs in the area. That modification also set stringent water cleanup standards which must be met at the Site before cleanup will be considered complete. Any low concentrations of petroleum contamination that remain below cleanup levels will continue to break down naturally over time.

Comment: We need water for our crops. Many families rely on the foods they grow. Some farmers use spring water to irrigate their gardens. If the spring water is contaminated then it would get into their vegetables.

Response: As mentioned above, the final cleanup strategy adopted for this Site will ensure that contamination from these gas stations does not reach Hopi or Navajo springs and that the ground water is clean so as not to endanger human health or the environment. U.S. EPA and the Tribes are working together to prevent any contamination of the local springs and to clean up ground water at the site to safe levels. The point of compliance for these cleanup levels is at the site. U.S. EPA's April 2002 modification to its 1996 order prohibits the responsible parties from allowing <u>any</u> contamination from the gas stations to reach the Hopi or Navajo springs in the area.

Comment: On the south side of the highway there is a plant there that grows that we use in our ceremonies and most of the time during winter ceremonies we get our plants from there. How can we transplant those herbs or maybe there is another area where the same plant grows.

Response: Please contact Tribal representatives regarding transplanting herbs or other areas where these same plants grow.

Comment: Our pets drink the water and need to be protected as well.

Response: Pets drinking the surface water in the area will not be exposed to petroleum contamination from this site. Surface waters have been tested and no petroleum contamination was found.

Comment: Due to a strong concern about the potential negative health consequences from possible exposure to and effects from soil and water contamination from petroleum, the Hopi Tribal Council directs U.S. EPA to involve the Agency for Toxic Substances Disease Registry to conduct health assessments on the population of Moenkopi.

Response: U.S. EPA has provided site data to the Agency for Toxic Substances Disease Registry (ATSDR). ATSDR is currently reviewing this information.

Comment: Someone at the Day School has complained about smelling gasoline.

Response: Tribal representatives are investigating this complaint. This complaint has also been forwarded to ATSDR (see previous comment).

Comment: How much exposure to benzene can a person take before it can be hazardous or lethal? Same question for MTBE and the other chemicals. What effects do these chemicals have on the body?

Response: Benzene is classified as a known human carcinogen (cancer causing chemical). U.S. EPA has set a maximum contaminant level (MCL) for benzene in drinking water of 5 micrograms per liter (μg/L, or parts per billion). This is the cleanup level for benzene in ground water at the Tuba City Site.

There are no data on the health effects on humans of drinking MTBE-contaminated water. In laboratory tests on animals, cancer and noncancer effects occur at high levels of exposure. These effects include prostration, swollen periocular tissue, increased relative and absolute liver and kidney weights, and increased severity of certain renal lesions. These tests were conducted by introducing the chemical in oil directly into the stomach. The tests support a concern for potential human hazard. Because the animals were not exposed through drinking water, there are significant uncertainties about the degree of risk associated with human exposure to low concentrations typically found in drinking water.

U.S. EPA Region 9 has calculated a preliminary remediation goal (PRG) for MTBE of 13 μg/L which is being used as the cleanup level at the Tuba City petroleum cleanup (U.S. EPA, 2002). See Chapter 4, Table 1 for a listing of cleanup goals for petroleum chemicals at the Tuba City Site.

Comment: Our land, the land itself is very precious to us, and that's the reason why we refer to this land as our Mother Earth.

Response: U.S. EPA acknowledges that Tribes do have strong traditional and cultural

ties to the land. U.S. EPA respects these beliefs and is working with the Tribes to clean up this contamination and restore Mother Earth.

Comment: How does U.S. EPA intend to address the cultural concerns related to the Site? Because even though we came up with cleanup levels and even though we're going to hopefully obtain those cleanup levels through the use of the various technologies, I think that the impacts to the cultural Sites have already happened. I don't believe that any type of consultation has been done with the traditionalists or the elders from both communities and I think that should be done also.

Response: U.S. EPA and the Tribes are continuing to work to address cultural and traditional concerns. To the extent that cultural considerations impact how people might come in contact with contaminants, U.S. EPA and the Tribes have taken those considerations into account in determining appropriate cleanup levels for the Site and appropriate operating parameters for the cleanup systems. Although there was no specific or direct consultation with traditionalists or elders, the Navajo Nation EPA, and Hopi Water Resources Program have communicated input from the community to U.S. EPA. In addition, public meetings have provided a forum for direct community input during the cleanup process.

General

Comment: All options have a cost associated with them but when you are talking about our livelihood and the health of the people, then no amount of money can justify the death of one person if the contamination enters our source springs.

Response: U.S. EPA and the Tribes acknowledge that no amount of money can justify contamination of the local springs or impacts to the surrounding community. U.S. EPA and the Tribes are working together to clean up contamination at this Site and ensure that contamination from these gas stations does not reach Hopi or Navajo springs and that the ground water is clean so as not to endanger human health or the environment. U.S. EPA's April 2002 modification to its 1996 order prohibits the responsible parties from allowing any contamination from the gas stations to reach the Hopi or Navajo springs.

Comment: It is strictly the responsibility of the Thriftway and Superfuels gas companies to clean up the contamination. The leakage came from their gas stations. The responsible party has sufficient funds to remedy a problem that is life threatening.

Response: For a number of years, Thriftway Marketing Corporation (Thriftway) has undertaken remediation of the LUST Site on behalf of itself and the other responsible

parties, Sunshine Western, Inc. and National Petroleum Marketing, Inc. U.S. EPA regards these three companies as the responsible parties for the Site and will continue to expect one or all of them to complete the cleanup that is being required.

Comment: The community should be involved and be concerned and pitch in and help out in some way.

Response: The community has been involved in the review and decision-making process for Site cleanup. A number of public meetings have been held with the community during the duration of this project. In addition, the U.S. EPA accepted formal comments from the community on the options for cleanup of soil and ground water during the public comment period from June 24, to August 6, 2003. All comments received were reviewed and responses to comments were considered before this final soil and ground water cleanup strategy was selected by U.S. EPA working with the Navajo Nation and the Hopi Tribe. Responses to significant comments are presented in this report.

Comment: The Hopi Tribe should not have to incur cleanup costs.

Response: U.S. EPA has ordered Thriftway, Sunshine Western, Inc. and National Petroleum Marketing, Inc. to perform the cleanup at the Site. Neither the Navajo Nation nor the Hopi Tribe have been asked to incur any cleanup costs at the Site. However, both Tribes have expended resources in the form of environmental staff who are helping to oversee the cleanup, which is being performed by Thriftway. The U.S. EPA has also provided grant funding to both Tribes for staffing and oversight of this Site. The Hopi Tribe, on its own initiative, has also expended funds in conducting its own sampling efforts and pilot testing of enhanced bioremediation at the Site.

Comment: I know there is a tribal fund and I know one of the responsible parties pays into it every month and I was told that all the money was being reserved and used for Tribal Government Sites that have been contaminated.

Response: Funding for the Navajo Nation leaking underground storage tank (LUST) fund is collected pursuant to the Navajo Nation Underground Storage Tank Act and the fund is managed according to an approved plan. The Navajo Nation EPA Executive Director and Waste Regulatory Compliance Department manage funds based on an approved criteria to address abandoned LUST sites.

Comment: A combination of methods, where appropriate, is best because only one option may not clean up all the contaminants. Where one option will not help, the other option will be effective and so on for the third option.

Response: A combination of methods has been selected for the final cleanup strategy. Please see Chapter 5 of this document for a more detailed description of the final cleanup strategy.

Comment: I agree with the cleanup methods being proposed. You can see the results from the existing SVVS systems. You want to attack the middle of the plume and the lower end of the plume with an SVVS system in combination with bioremediation programs with the oxygen injection.

Response: Yes, the inclusion of SVVS cleanup as part of the final cleanup strategy is partly based on the effectiveness of the existing SVVS system.

Comment: I hope this cleanup process doesn't take any longer. It should be cleaned up ASAP for our safety and health of our community members. If it were Phoenix or Salt Lake City there would be a declaration of emergency and the cleanup would have been addressed in a rapid and timely manner. But if something like this type of contamination happens in Indian Country for some reason no one wants to clean it up.

Response: The cleanup process is currently proceeding as quickly as possible. Interim cleanup measures are in place and successfully removing petroleum contamination from the subsurface in order to protect public health and safety and the environment. A comprehensive cleanup plan is about to be approved and implemented.

Currently, all communities in the U.S. face some level of pollution or contamination concerns such as those that exist in Tuba City. There are Sites in major cities such as Phoenix, Salt Lake City, and others just as complex and large as the Tuba City Site. Many of these Sites have also taken years to clean up.

Comment: If the gas station had been checking on regulations and requirements that apply to operating a gas station, this would have never happened.

Response: The first leaks from the two gas stations at the intersection of Highways 160 and 264 were reported as early as the mid-1980's. The underground storage tanks (UST) law was not enacted by Congress and signed into law by the President until late 1984 and the regulations for implementing the law were not adopted until December of 1988. Therefore, these leaks occurred prior to the existence of a federal UST regulatory program that described standards for the equipment and operation of the UST systems. Owners and operators that closely follow the regulations and requirements that apply now to their UST systems are less likely to experience releases from their USTs and, even if releases occur, they should be discovered and cleaned up

quickly before posing a problem to human health or the environment.

Comment: There is funding out there that is probably available to do 100% cleanup. I hear of Superfunds that are out there for cleanup and I would like to request U.S. EPA to request some of these funds. I've seen some information indicating that there are funds available that are specifically set aside for Indian Country for environmental contamination and I would like to know if we can use those funds.

Response: Money in the federal Superfund, which was established pursuant to the Comprehensive Response, Compensation and Liability Act (CERCLA), is not available to address petroleum contamination, such as that which exists at the Tuba City Site, due to a "petroleum exclusion" in CERCLA. However, the federal Resource Conservation and Recovery Act (RCRA), which regulates underground storage tanks, provides for a trust fund for addressing certain leaking underground storage tank Sites (LUST Sites). A portion of these funds are set aside for use in Indian Country. U.S. EPA may only access funds in the LUST trust fund under certain circumstances, which include circumstances where no person can be found who is an owner or operator of the tank or tanks concerned, who is subject to the corrective action requirements and who is capable of carrying out such corrective action properly. At this Site, U.S. EPA identified three such responsible parties, Thriftway, Sunshine Western, Inc. and National Petroleum Marketing, Inc. All responsible parties are subject to the corrective action requirements and Thriftway has demonstrated that it is capable of carrying out corrective action properly. Therefore, the LUST trust fund moneys are not available for use at this Site.

Comment: Why does the Proposed Strategy divide the Site up along the border between the Hopi and Navajo land instead of treating it as one community? We have to work as allies against the contamination of the springs because groundwater contamination knows no boundaries and knows no religion.

Response: In addition to defining the border between Navajo and Hopi lands, highway 160 is a physical barrier that divides the Site. It is difficult and expensive to run piping, wiring or other equipment under or over the highway. In addition, the northern side of the highway is the source area and the south side is dominated by dissolved contamination issues. Therefore, separate cleanup systems and approaches have been selected for the two sides of the highway.

Comment: We feel that the parties that originally created the contamination should come forth and submit some sort of financial compensation to address this.

Response: In 1996, U.S. EPA issued an order to three companies, Thriftway, Sunshine

Western, Inc. and National Petroleum Marketing, Inc., to investigate and clean up the contamination emanating from two gas stations, the Thriftway gas station on the northern corner of the intersection of Highways 160 and 264, and the SuperFuels gas station on the western corner of the intersection (Figure 2).

Over the past few years, Thriftway alone has performed the investigation and cleanup of all the contamination from these two sources, which contamination has merged into one plume. Thriftway is performing all the work U.S. EPA required of all three companies, and the obligations of U.S. EPA's 1996 order are being met. Sunshine Western or National Petroleum Marketing are not doing any of the work or paying any of the costs.

Prior to 1999, Thriftway spent over $1 million on assessing and attempting to clean up the contamination. Thriftway has now spent a total of over $2.5 million on assessment and cleanup. Thriftway company officials have expressed the company's desire to finish the cleanup as quickly as possible.

Comment: All agencies and Tribes should work together since it's the only way we can produce results in order to come to some resolution and address the cleanup.

Response: The interim cleanup measures and overall strategy were identified and developed cooperatively over several years by technical representatives from U.S. EPA Region 9's Waste Management Division, Navajo Nation EPA's Waste Regulatory Compliance Department, and the Hopi Tribe's Environmental Protection and Water Resources Offices. They have also worked together in incorporating input received during the public comment period from June 24 through August 5, 2003, leading to adoption of the final cleanup strategy.

Comment: I hope that some sort of a more rapid and fast cleanup comes forth based on these comments. It should be done prior to the end of five years. We cannot stand to see another 10 to 14 more years of cleanup.

Response: U.S. EPA and the Tribes have tried to balance cleanup effectiveness, the speed of cleanup, and cleanup costs in evaluating cleanup options and formulating the selected final preferred cleanup strategy. We estimate the remainder of the cleanup could be completed within the next 3 to 5 years. We definitely do not anticipate another 10 to 14 more years of cleanup.

3. Ground Water Cleanup Progress

Gasoline chemicals originating from the old tanks have entered the ground water. Carried by ground water, these chemicals have formed an underground plume of contamination extending approximately 1,200 feet south and southwest of the gas stations. This chapter describes ground water cleanup progress for benzene and methyl tertiary butyl ether (MTBE). These chemicals are used as indicators of cleanup progress because benzene is the most potentially dangerous of these chemicals and MTBE is the chemical which tends to move the fastest and farthest in ground water.

Current Cleanup Work is Removing Contamination in the Source Areas

Thriftway Corporation has already started cleaning up parts of the Site. The SVVS cleanup system at Thriftway #701 has been in operation since September 2000 (Figures 6 - 8). Based on data supplied by Thriftway Corporation, it has successfully removed over 4,800 pounds (approximately 740 gallons) of volatile hydrocarbon contamination from soil and ground water in the Thriftway gas station Site source area.

Benzene concentrations in the area of the SVVS cleanup system were reduced to as little as one thousandth of October 2000 concentrations in some ground water monitoring wells by October 2002 (Figure 7). For example, benzene concentrations in monitoring well MW-48 were reduced from 15,000 ppb to 6 micrograms per liter (µg/l, which is the sam as parts per billion or ppb). Figure 8 also shows that MTBE concentrations were reduced in the area of the SVVS cleanup system to one tenth or less of October 2000 concentrations in some monitoring wells by October 2002. For example, MTBE concentrations in monitoring well MW-47 were reduced from 11,000 ppb to 460 ppb.

A second SVVS cleanup system started operation at the Tuba City Express gas station on October 23, 2002 (Figure 6). Installation of a third SVVS cleanup system, at the Tuba City Truck Stop, is expected in 2004.

Cleanup Work is Also Reducing Chemical Concentrations in Ground Water

In addition to removing volatile hydrocarbon contamination from the source areas, these SVVS cleanup systems supply oxygen underground. This added oxygen has enhanced the natural breakdown of gasoline contaminants in soil and ground water resulting in reduced concentrations throughout the plume. Figures 9 through 12 show concentrations of benzene and MTBE in ground water in February 2000 and May 2003. The areas with higher chemical concentrations are darker, the lower concentrations are lighter. The decrease in darker color on the May 2003 maps indicates that both benzene and MTBE concentrations are decreasing.

Figures 9 and 10 compare the extent of benzene contamination in ground water during February 2000 and May 2003. The benzene plume length has not changed much, remaining about 1,100 feet long. The leading edge of the plume has moved southward. However, the decrease in darker colors in the center of the plume on the May 2003 map indicates that concentrations inside the plume are decreasing.

Maximum benzene concentrations have been reduced throughout the plume when compared with the 2000 concentrations with only one well, TW-13 remaining above 10,000 ppb measured at 34,000 ppb. The cleanup goal for benzene in water is 5 ppb.

Figures 11 and 12 show the extent of MTBE contamination in ground water during February 2000 and May 2003. MTBE plume length is currently approximately 1,200 feet. Plume shape has not changed significantly. However, the smaller areas of darker color on the May 2003 map indicate that concentrations inside the plume are decreasing. In addition, the highest MTBE concentrations have been reduced by over half from a maximum of 220,000 ppb in 2000 to a current maximum of 82,000 ppb in 2003. The cleanup goal for MTBE in water is 13 ppb.

Local Water Supplies are not Contaminated by Petroleum from These Gas Stations

Numerous springs are present in the Tuba City and Moenkopi area. Many of these springs are used for irrigation, drinking water, and religious purposes (Figure 13). There are no public drinking water pumping the contaminated ground water at this site (Figure 14).

Based on results from water sampling performed by U.S. EPA and Thriftway since 1998, the Hopi and Navajo springs in the area have not been determined to be contaminated by petroleum from these gas stations. The U.S. EPA, the Navajo Nation and the Hopi Tribe continue to monitor the contamination to make sure it does not spread and to confirm the cleanup systems are working.

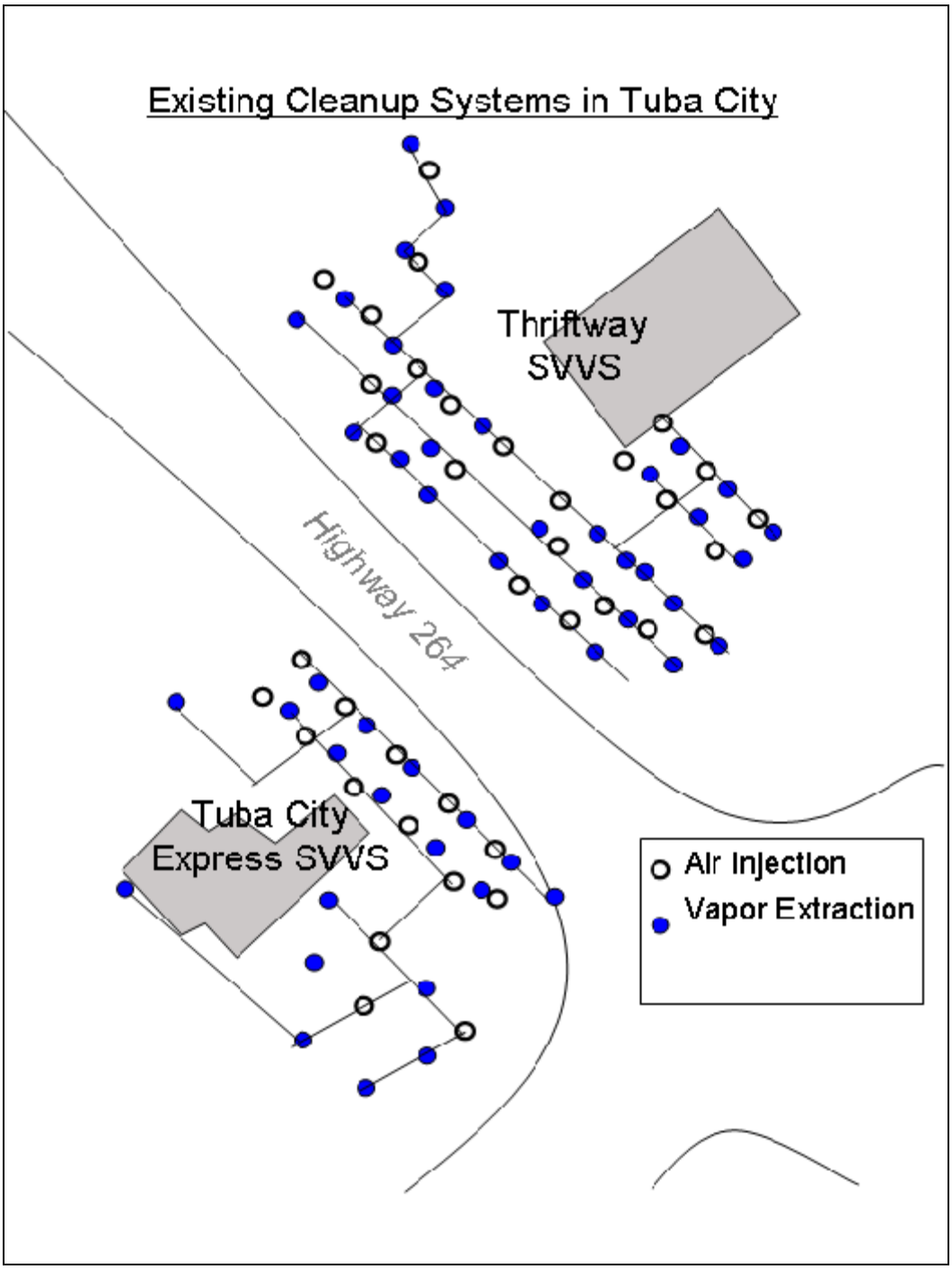

Figure 6. Map showing Subsurface Volatilization and Ventilation System (SVVS) at Thriftway #701 and Superfuels (Tuba City Express) gas stations in Tuba City (map modified from ERM April 2002).

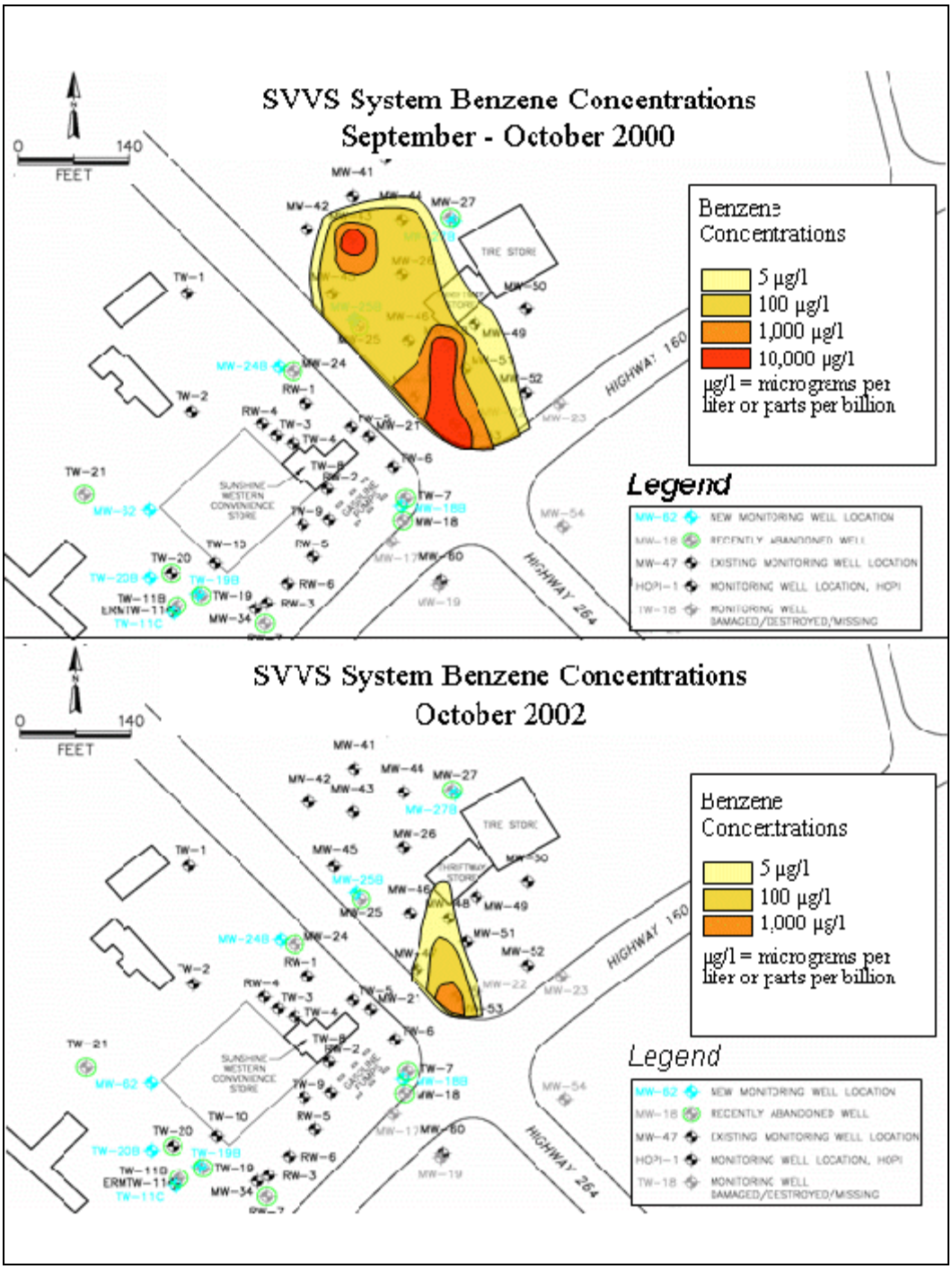

Figure 7. Map showing reductions in benzene concentration due to SVVS operation between October 2000 and October 2002 at Thriftway #701 gas station in Tuba City (map modified from ERM April 2002).

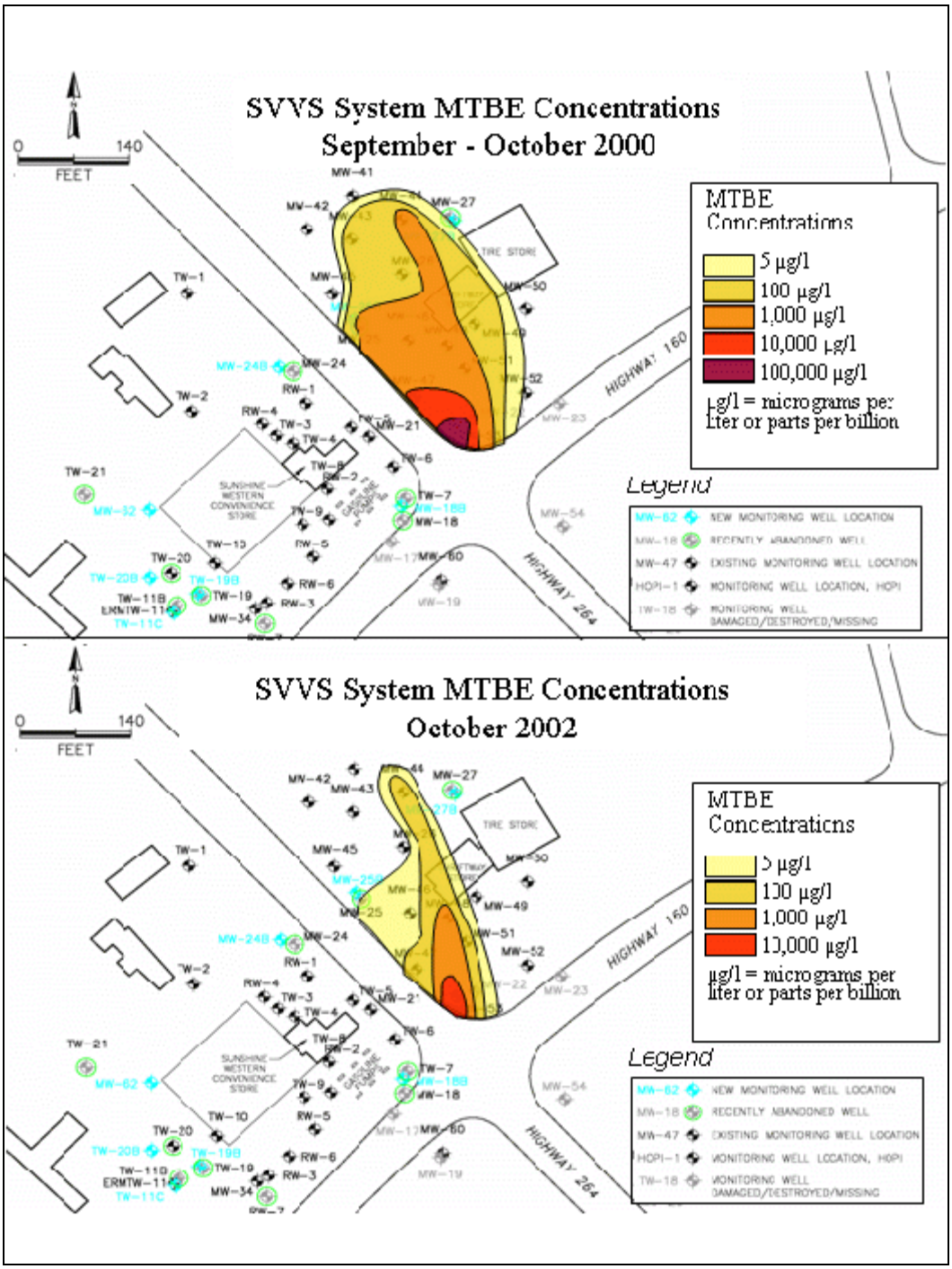

Figure 8. Map showing reductions in MTBE concentration due to SVVS operation between October 2000 and October 2002 at Thriftway #701 gas station in Tuba City (map modified from ERM April 2002).

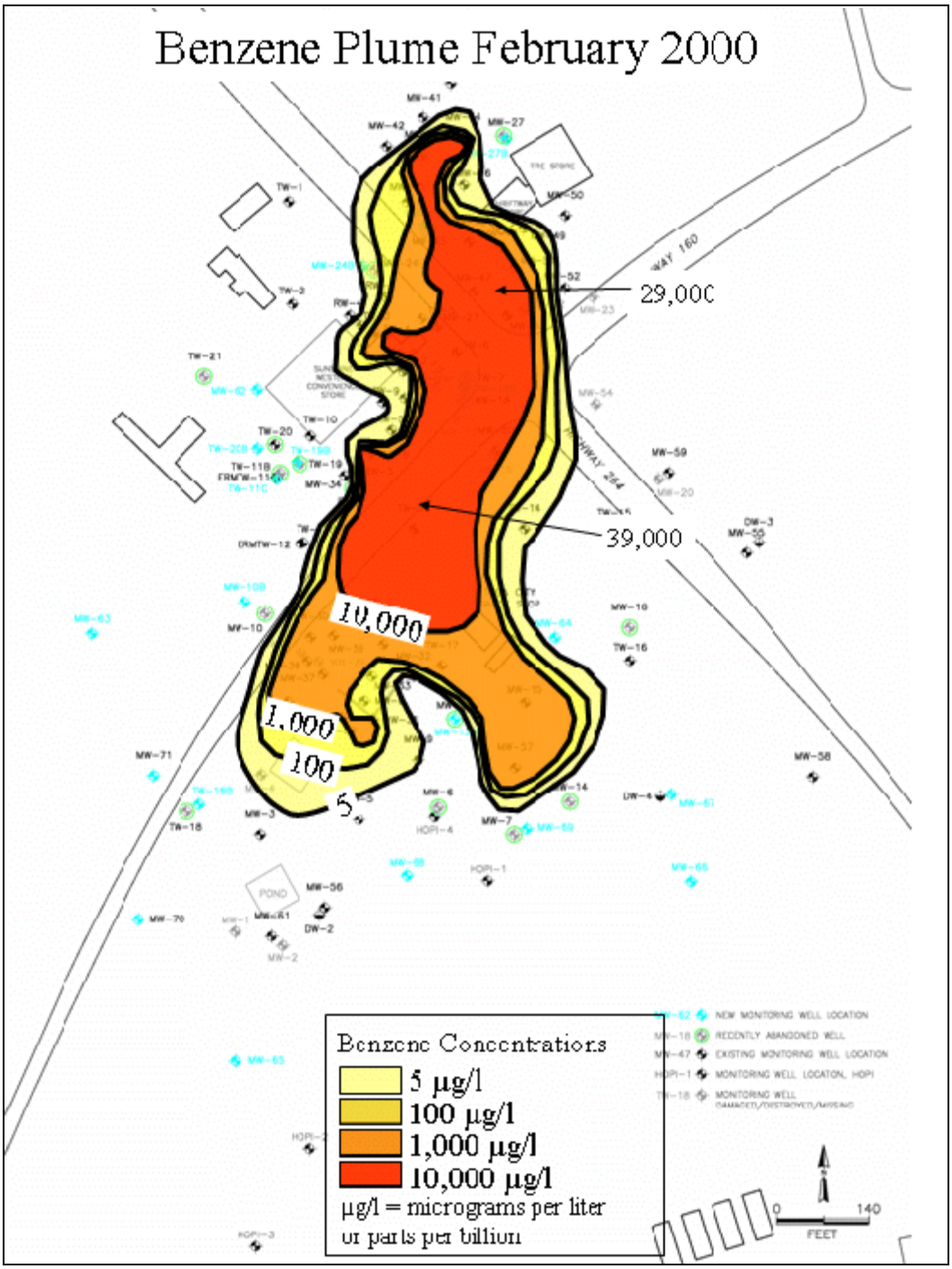

Figure 9. Map showing extent of benzene contamination in ground water, February 2000 at Thriftway #701 and Superfuels gas stations in Tuba City (contoured by Henry Haven, Navajo Nation EPA, map modified from ERM April 2002).

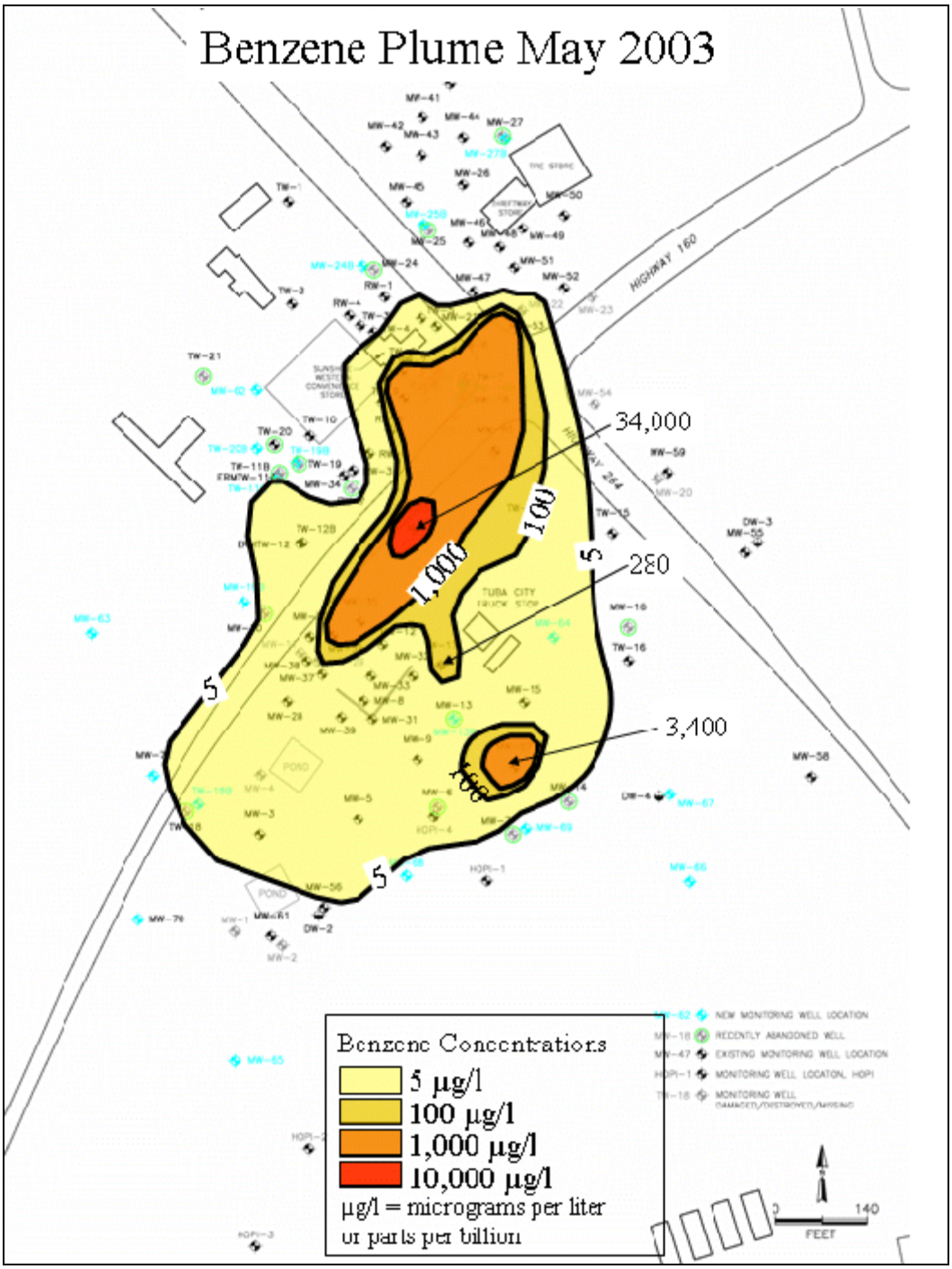

Figure 10. Map showing extent of benzene contamination in ground water May 2003 at Thriftway #701 and Superfuels gas stations in Tuba City (modified from Billings, 2003 by Chris Prokop, U.S. EPA).

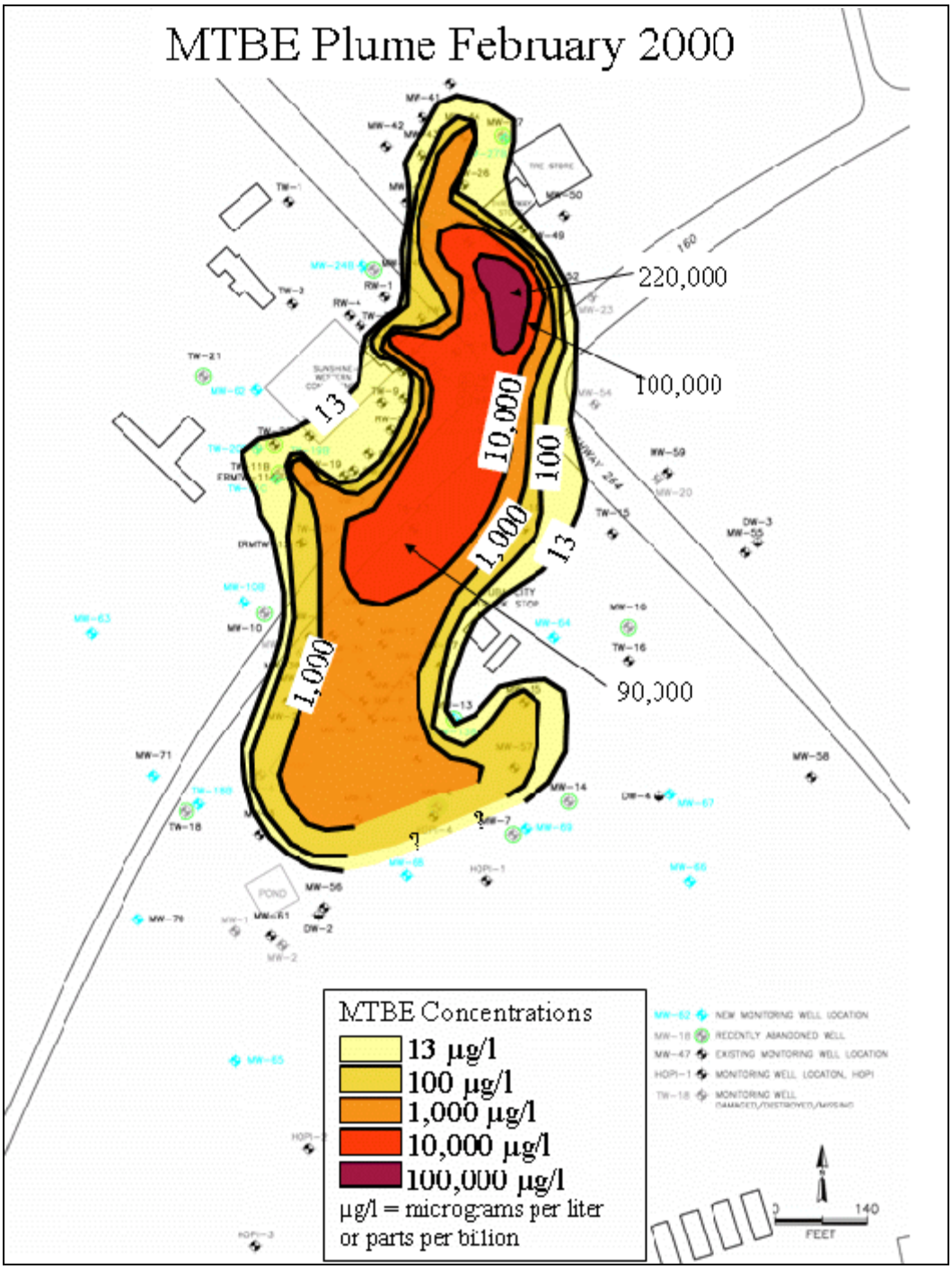

Figure 11. Map showing extent of MTBE contamination in ground water, February, 2000, at Thriftway #701 and Superfuels gas stations in Tuba City (contoured by Henry Haven, Navajo Nation EPA, map modified from ERM April 2002).

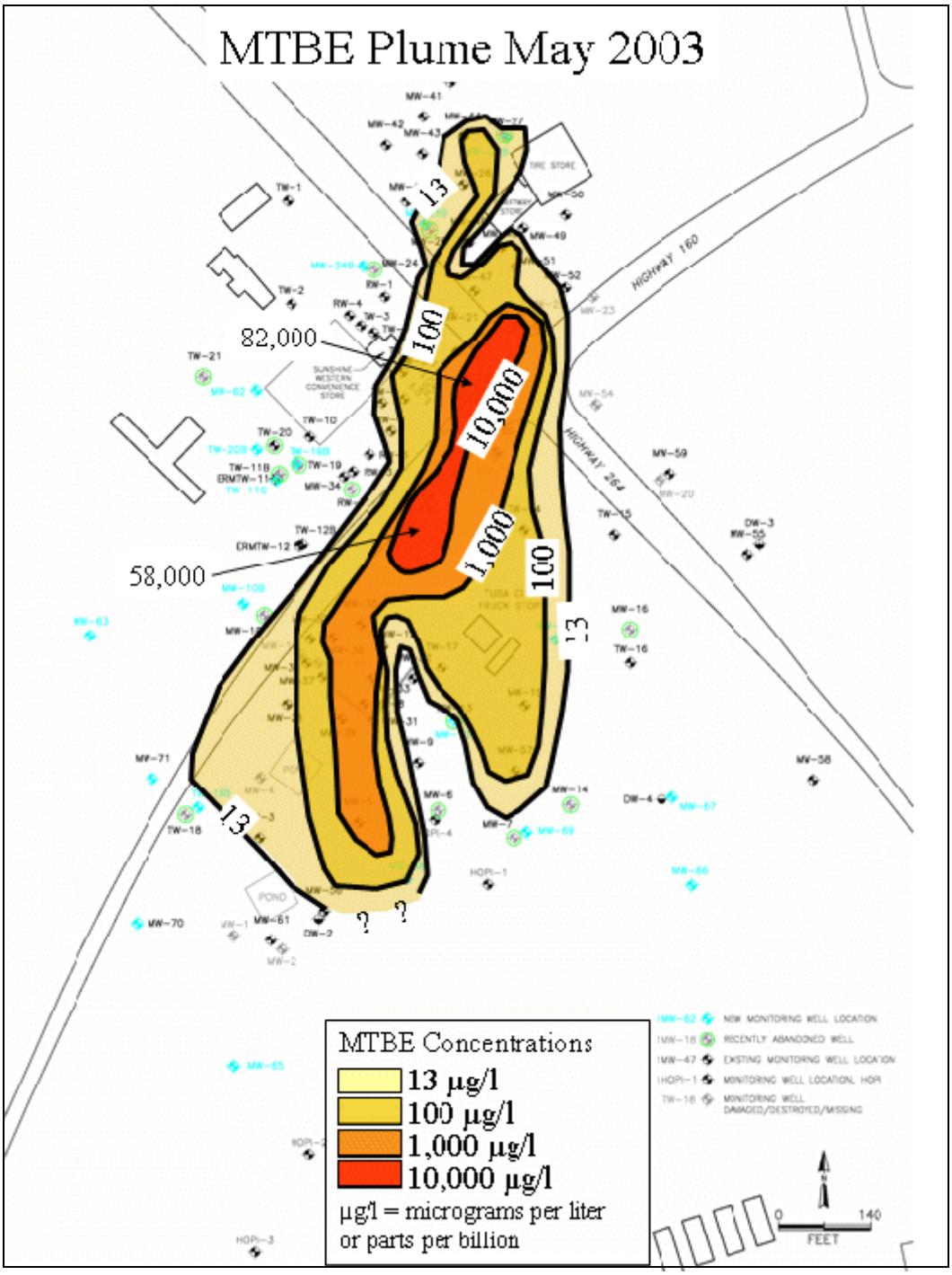

Figure 12. Map showing extent of MTBE ground water contamination May 2003 at Thriftway #701 and Superfuels gas stations in Tuba City (modified from Billings, 2003 by Chris Prokop, U.S. EPA).

Figure 13. Hopi Main (Susungva) Spring, Lower Moencopi Village.

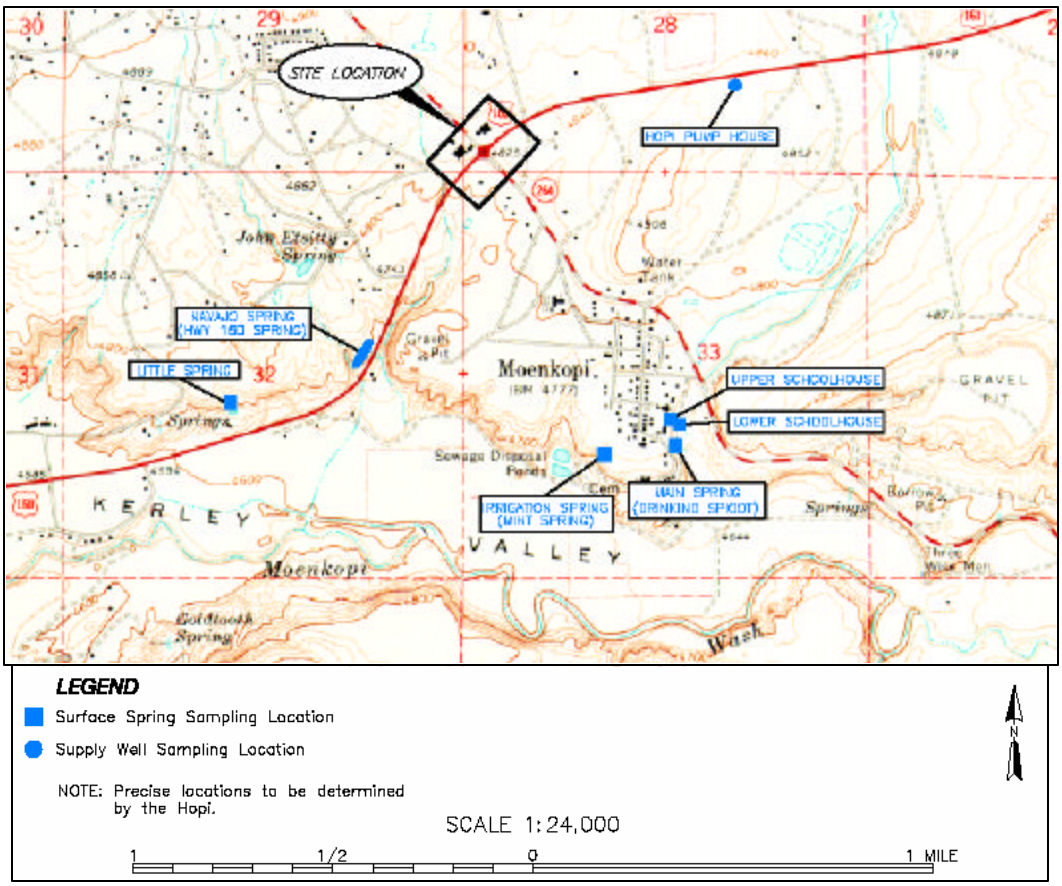

Figure 14. Drinking water wells and springs in the Tuba City Site area.

4. Cleanup Goals, Time Line, and Funding

Soil and ground water cleanup goals for the petroleum chemicals in the Tuba City-Moenkopi area are listed in Table 1. Soil contamination is not allowed to cause the contaminant concentrations in (1) ground water and surface water to exceed the water cleanup standards; (2) ground water to have an observable petroleum sheen or film using either the product interface probe method or visual measurement using a product thickness bailer; and (3) surface water to have an observable petroleum sheen or film. Note that these soil cleanup goals are for subsurface soils only. If surface soils are impacted, then the U.S. EPA Region 9 preliminary remediation goals for direct soil contact under a residential exposure scenario will apply.

Table 1. Cleanup goals for Thriftway #701 and Sunshine Western leaking underground storage tank site, Tuba City, Arizona.

Chemical	**Water Cleanup Goal (parts per billion, µg/l)**	**Soil Cleanup Goal (parts per million, mg/kg)**
Methyl tert-butyl ether (MTBE)	13	0.003
Benzene	5	0.002
Ethylbenzene	700	0.7
Toluene	1,000	0.6
Xylene	10,000	10
Benzo(a)pyrene	0.2	0.4
Total Petroleum Hydrocarbons (TPH)	235	100
Total Residual Petroleum Hydrocarbons (TRPH)	235	100

Time Line for Cleanup

U.S. EPA plans to request the final cleanup plan for Site cleanup from the facility operators in December 2003. U.S. EPA anticipates that the final cleanup plan will be approved and implemented in 2004. Once all of the cleanup measures are in place, it is estimated that Site cleanup work will take from 3 to 5 years to complete. However, environmental conditions can be unpredictable and cleanup speed is difficult to predict. Therefore, the cleanup time of 3 to 5 years is an estimate, not a guarantee.

Who Pays for the Cleanup?

U.S. EPA Administrative Order Requires Thriftway and Sunshine Western to Clean up Contamination

U.S. EPA Administrative Order, Docket No. RCRA 7003-09-96-01, names Thriftway Corporation, National Petroleum Marketing, Inc., and Sunshine Western, Inc. as the responsible parties for cleaning up the petroleum contamination in Tuba City. This order requires the responsible parties to perform Site assessment and cleanup. The order is an enforceable legal document and failure to comply with the requirements of the order can result in assessment of penalties. Subsequent amendments to the order have also required installation of interim cleanup measures and preservation of water quality in local springs.

Thriftway Committed to Cleaning Up Petroleum Contamination

One of the responsible parties, Thriftway Corporation, has expressed a strong commitment to cleaning up the petroleum contamination in Tuba City. Thriftway has taken over responsibility for the entire cleanup including contamination emanating from the Superfuels facility. Prior to 1999, Thriftway spent over $1 million on assessing and attempting to clean up the contamination. Thriftway has now spent over $2.5 million on assessment and cleanup. Thriftway company officials have expressed the company's desire to finish the cleanup as quickly as possible.

Funding is Limited, Cost is a Consideration When Selecting Cleanup Methods

As with any company, Thriftway must pay for environmental cleanup out of company revenues. With over $2.5 million dollars already spent on Site assessment and cleanup, additional costs are a concern. In addition, the timing of the cleanup costs can be important. Initial investment costs versus long-term operation and maintenance costs may be important when compared with current and long-term company revenues.

5. Final Cleanup Strategy for Soil and Ground Water Contamination

The final strategy for cleanup of soil and ground water contaminated by petroleum released from the Thriftway #701 and Tuba City Express facilities has been selected by U.S. EPA working with the Navajo Nation and the Hopi Tribe after considering comments received during the public comment period. Please refer to Figure 15 for location of remediation sub areas. Comments received have helped determine preferred cleanup methods and more clearly define the conditions under which the Contingency Plan measures must be implemented.

Source Areas - Proposed Cleanup Method

The contamination in these areas consists of high concentrations of benzene, toluene, ethylbenzene, MTBE, and TPH. The gas station operators have already started cleaning up the areas of higher concentration at the Thriftway facility, Superfuels facility, and at the intersection of Highways 160 and 264 where the original releases occurred. An SVVS at Thriftway has been in operation since September 2000. To date, it has successfully removed over 4,800 lbs of contamination from the Thriftway gas station Site. addition, these SVVS cleanup systems supply oxygen underground. This added oxygen has enhanced the natural breakdown of gasoline contaminants in soil and ground water resulting in reduced concentrations throughout the plume. A second SVVS started operation at the Superfuels gas station on October 23, 2002. These existing SVVS installations are the preferred cleanup method to address the source areas.

Tuba City Truck Stop Proposed Cleanup Method

The contamination in these areas consists of high concentrations of BTEX, MTBE, and TPH. Installation of a third SVVS, at the Tuba City Truck Stop, is expected in the year 2004 to clean up areas of higher concentration on the south side of Highway 160 as well as to the south of the Tuba City Truck stop. This SVVS installation is the preferred cleanup method to address the Truck Stop area.

For this cleanup option it will be important for U.S. EPA in consultation with the Tribes to evaluate the need for extra SVE around the Truck Stop to prevent vapor exposures. There may also be a need to close the Truck Stop Café during system start up. There may also be an option to install sparge and vent wells in the area of the higher concentrations south southeast of the Truck Stop. Due to the relatively thin unsaturated zone, there may also be a need to evaluate the potential for horizontal sparge and vent wells in some areas. Additional information regarding this cleanup method is included in the U.S. EPA letter, "Approval with Comments of the Amended Interim Remedial Measure Workplan for the Areas Designated as the Tuba City Truck Stop and Downgradient Dissolved Plume, submitted by the responsible parties on August 4, 2003" issued simultaneously with this report.

Downgradient Dissolved Plume - Proposed Cleanup Method

The leading edge is the southwestern portion of the dissolved plume composed mainly of benzene and MTBE. Enhanced bioremediation is the preferred cleanup method in the lower concentration areas of the plume downgradient of the source areas. Enhanced bioremediation consists of subsurface injection

of compounds that will provide additional oxygen to enhance the natural breakdown, or biodegradation, of benzene and MTBE. Additional information regarding this cleanup method is included in the U.S. EPA letter, "Approval with Comments of the Amended Interim Remedial Measure Workplan for the Areas Designated as the Tuba City Truck Stop and Downgradient Dissolved Plume, submitted by the responsible parties on August 4, 2003" issued simultaneously with this report.

Performance Monitoring

The current ground water monitoring wells and springs will continue to be monitored by the responsible parties on an approved schedule, currently semi-annually, throughout the cleanup and performance monitoring periods. U.S. EPA will also continue to analyze selected duplicate samples.

Performance monitoring must include analysis for concentrations of chemicals listed in Table 1 as well as geochemical indicators including but not limited to pH, temperature, dissolved oxygen, and electrical conductivity. Ground water elevations must be measured in monitoring wells. Progress reports must include interpretation of performance monitoring data including but not limited to:

- Graphs of chemical concentration versus time with ground water elevation versus time plotted on a second y axis for each well,
- Concentration contour maps for each of the chemicals listed in Table 1 with the minimum contour interval equal to the cleanup goal for that chemical and logarithmic contours above the cleanup goal (e.g., MTBE contours 13 ppb, 100 ppb, 1,000 ppb, 10,000 ppb, 100,000 ppb),
- Concentration contour maps for each geochemical indicator, and
- Cumulative removal concentration versus time plots for SVVS emissions.

Performance monitoring must continue even after cleanup goals have been achieved to verify that the Site no longer poses a threat to human health or the environment. Performance monitoring will be continued for a period of time after cleanup goals have been achieved, at the discretion of U.S. EPA in consultation with the Tribes, to ensure that concentration levels are stable and remain below cleanup levels. Post-cleanup performance monitoring may include installation of additional monitoring points.

Cleanup Progress and Contingency Plan Trigger

The contingency, or back-up, cleanup plan will be triggered if the selected cleanup methods fail to prevent further migration of the plume and/or fail to reduce contaminant concentrations at a rate that will achieve cleanup goals within a reasonable period of time. The estimated cleanup time of 3 to 5 years is considered reasonable. Any additional time required for cleanup will be considered by U.S. EPA in consultation the Tribes.

If cleanup goals are not achieved within the cleanup area for a cleanup system or method after five total years of operation and monitoring, the Contingency Plan measures or other options will be triggered at the discretion of U.S. EPA, in consultation with the Tribes. The steps leading up to possible implementation of the contingency plan are as follows.

First Three Years of Operation and Monitoring for a Cleanup Method and Cleanup Area
U.S. EPA and Tribal technical personnel will evaluate analytical results from semi-annual ground water monitoring and communicate cleanup progress to the community. Because ground water moves slowly it may take two or three years of operation and monitoring to determine if cleanup methods are removing contamination from an area of the Site quickly enough to meet the cleanup goals within 5 years.

After Three Years of Operation and Monitoring of a Cleanup Method and Cleanup Area
After three years of operation and monitoring, the Responsible Parties must statistically quantify cleanup rates and trends for each cleanup method and cleanup area (a minimum of three years of data are required for statistical evaluation). This statistical evaluation of cleanup rates and trends will determine the potential for that cleanup method to achieve cleanup goals within the cleanup area within five total years of operation. The evaluation must include calculation of point attenuation rates during the three year remediation period for all monitoring wells currently above cleanup goals within the cleanup area for that cleanup method. Point attenuation rates must be calulated with a 90% single-tailed confidence interval as described in Appendix I of Newell, *et al.* (U.S. EPA, 2002). The evaluation must be performed using no fewer than 6 sampling dates and 3 years of data.

If the evaluation indicates that cleanup goals will be achieved by the cleanup system or method within five total years of operation, the responsible parties may proceed. However, if the evaluation indicates that cleanup goals will <u>not</u> be achieved within five total years of operation, the responsible parties must modify the cleanup system or method to achieve cleanup goals within five total years of operation, subject to review and approval by U.S. EPA in consultation with the Tribes.

After Five Years of Operation and Monitoring
If cleanup goals are achieved within the cleanup area for a cleanup system or method after five total years of operation, confirmatory monitoring will be initiated. If concentrations subsequently rebound above cleanup goals, the responsible parties will either be allowed to restart the cleanup system or cleanup method, or be required to implement the Contingency Plan measures at the discretion of U.S. EPA, in consultation with the Tribes.

If cleanup goals are <u>not</u> achieved within the cleanup area for a cleanup system or method after five total years of operation, the Contingency Plan measures or other options will be triggered at the discretion of U.S. EPA, in consultation with the Tribes. The contingency cleanup plans for each cleanup area are described below. Contingency plans can be implemented on portions of the Site as needed (please refer to Figure 15 for location of remediation sub-areas).

Source Areas - Contingency Plan
Hot Spots (residual areas of high concentration) –The potential for residual hot spots appears to be highest in the area of the intersection. Lingering hot spots may not be treated by MNA. Any such hot

spots may need to be addressed through expansion of the SVVS, excavation, and/or intensive enhanced bioremediation.

Tuba City Truck Stop Areas - Contingency Plan
Hot Spots (residual areas of high concentration) –The potential for residual hotspots appears to be highest in the area of the intersection and along Highway 160. Hot spots may not be treated by MNA. Any such hot spots may need to be addressed through expansion of the SVVS, excavation, and/or intensive enhanced bioremediation.

Downgradient Dissolved Plume - Contingency Plan
Plume Migration – If cleanup efforts fail to stop plume migration, ground water will either have to be 1) pumped and treated and/or re-injected; or 2) treated directly using in-place cleanup methods such as air sparging or treatment trenches constructed at the downgradient edge.

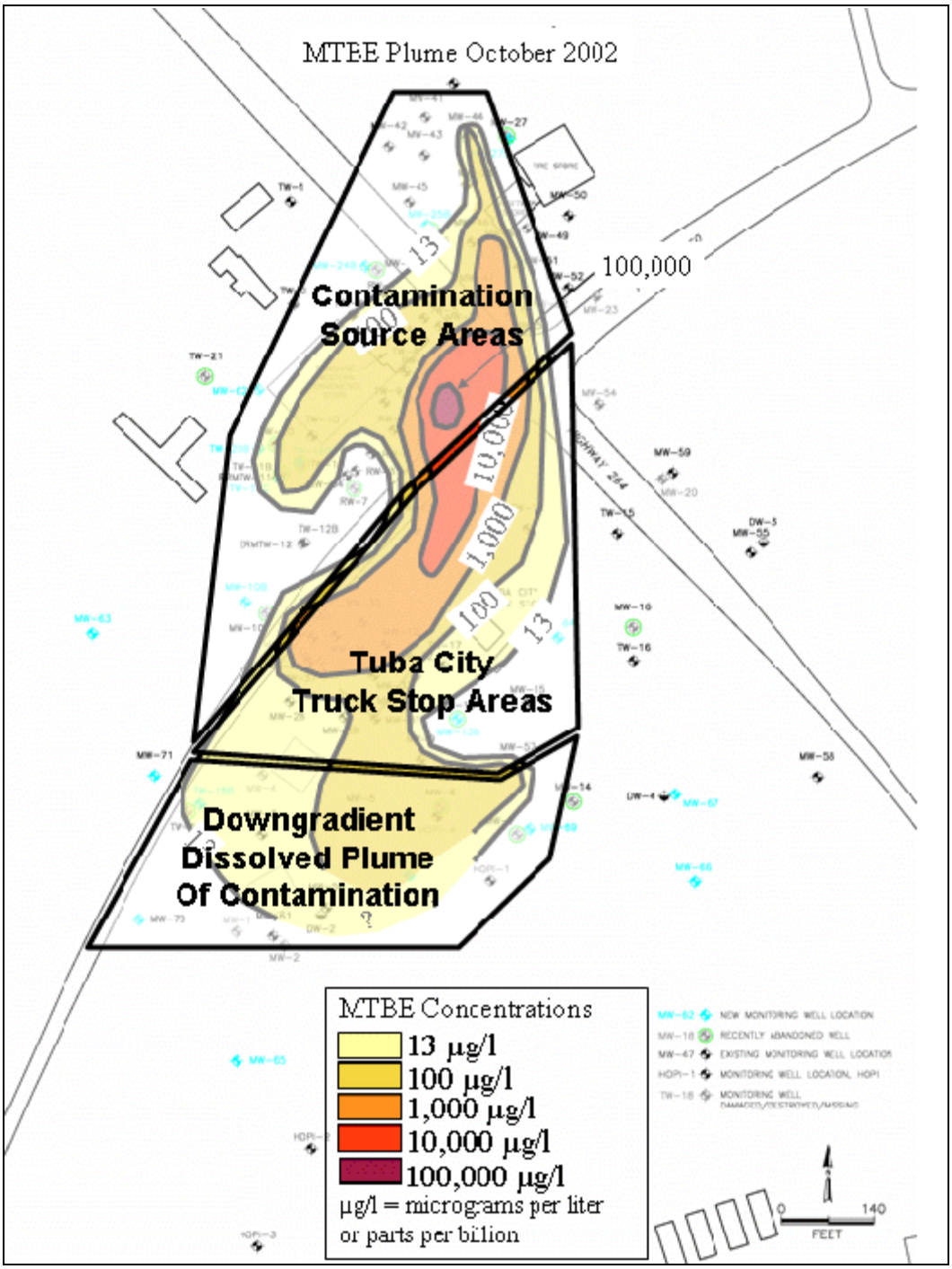

Figure 15. Site map showing sub areas for cleanup overlaid on top of Tuba City MTBE Plume October 2002 (Contoured by Henry Haven, Navajo Nation EPA, map modified from ERM April, 2002).

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