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| | | | | 216-T-3, 216-T-6, and | | | | |
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7. Abstract

This document describes the actions necessary to provide interim stabilization of radioactive surface contamination associated with waste sites managed under Radiation Area Remediation Action. Interim stabilization is scheduled for FY 1994.

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# INTERIM STABILIZATION PLAN AND ALTERNATIVES EVALUATION FOR 241-WR VAULT AND 216-Z-12, 216-T-3, 216-T-6, AND 241-T-361 WASTE SITES

9413137.0036

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January 1993

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# INTERIM STABILIZATION PLAN AND ALTERNATIVES EVALUATION FOR 241-WR VAULT AND 216-Z-12, 216-T-3, 216-T-6, AND 241-T-361 WASTE SITES

## 1. PURPOSE

This document describes actions designed to provide interim stabilization of radioactive surface contamination associated with the 241-WR vault, 216-Z-12 crib, 216-T-3 reverse well, 216-T-6 cribs, and 241-T-361 waste storage tank. Corrective action was requested in Surveillance Compliance Inspection Report EP-88-10 for the 241-WR vault. Interim stabilization will be accomplished separately for each job site, i.e., the 241-WR vault is separate from the 216-Z-12 crib and the combined areas of the 216-T-3 reverse well, 216-T-6 cribs, and 241-T-361 waste storage tank. There are no inspection reports or Radiation Problem Reports against the 216-T-3, 216-T-6, 241-T-361, or 216-Z-12 waste sites, but corrective action is required to prevent migration of radioactive material.

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## 2. SITE DESCRIPTIONS

### 2.1. 241-WR VAULT

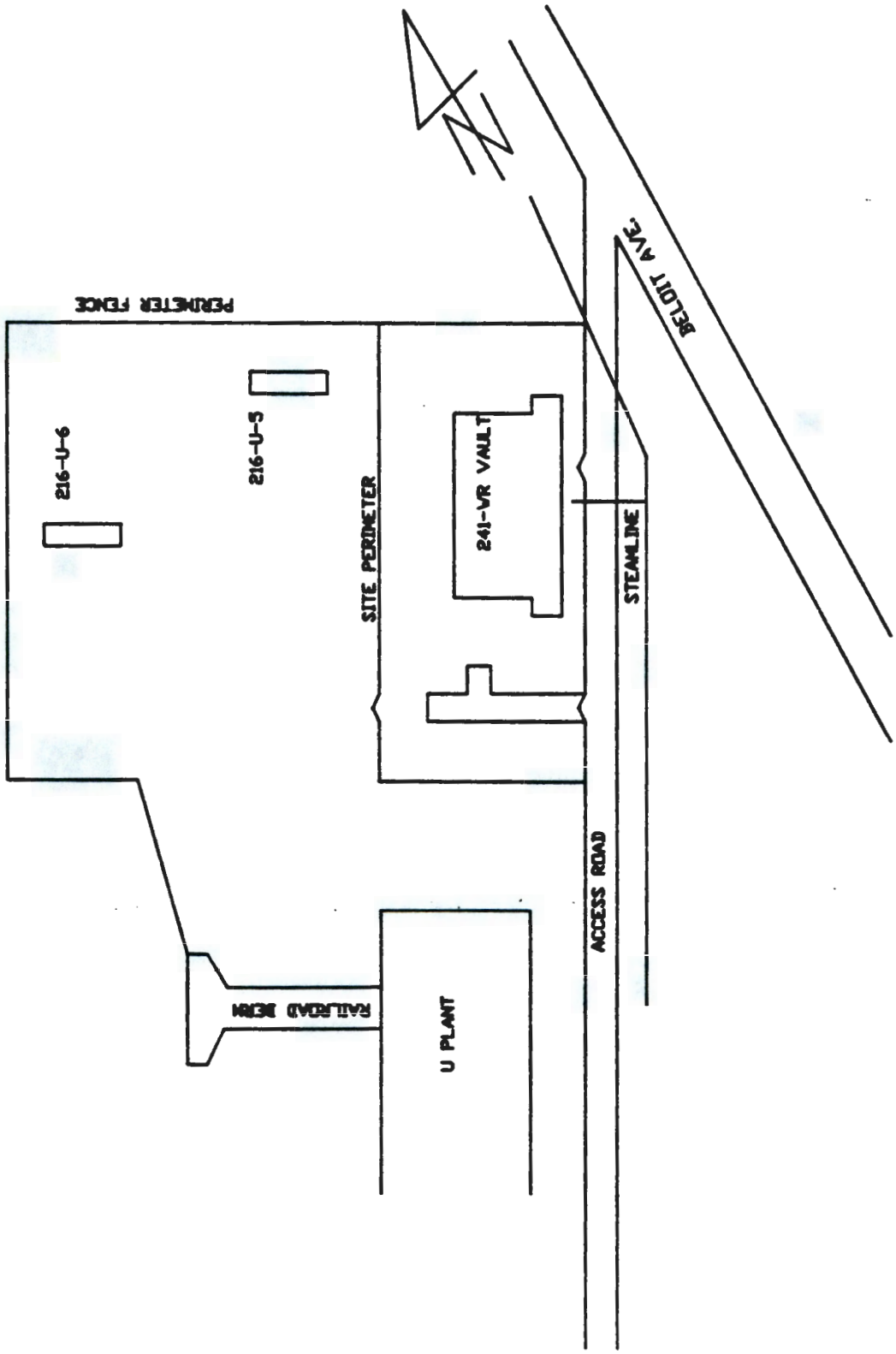
The 241-WR vault is located immediately northeast of U Plant, in the east central portion of the 200 West Area. Refer to Figure 1 for a site map. The vault is a below grade structure with dimensions of 125 ft by 65 ft by 45 ft deep. There are nine individual chambers, each with an accompanying 50,000 gal tank, arranged in one row of five and a row of four. Some decommissioning work has been completed, including removal of the exhaust stack, utilities, and isolation of facility exhaust lines.

The area is surrounded by an 8-ft chain-linked fence. There are numerous power poles located within the bounds of the fence. Each is outfitted with a floodlight and are fed by overhead power lines. The lighting systems are not currently used. An overhead deactivated steam line enters the site. The steam line is 4 inches in diameter and wrapped in asbestos. The vault roof has been interim stabilized with urethane foam.

The entire site and portions of the surrounding area is surface contaminated with radioactive material. The source of the contamination appears to be tumbleweed fragments. The contaminated area is 1.3 acres.

Due to the proximity to the 241-WR vault, the surface contaminated 216-U-5 and 216-U-6 cribs, located west of the vault will also be interim stabilized as part of the activities at the 241-WR vault.

Figure 1. Site Map for 241-WR Vault.



## 2.2. 216-Z-12 CRIB

The 216-Z-12 crib is located south of the Plutonium Finishing Plant in the 200 West area. Refer to Figure 2 for a site map. The 216-Z-12 crib received effluent from 1959 through 1973. There was 24,000 grams of plutonium discharged to the crib during this time. Crib construction consists of a gravel-filled excavation, with an effluent line running the entire length. The top of the crib is located 15 ft below grade. Structures associated with the crib include gage wells, diversion boxes, and monitoring wells. The site is surface contaminated with radioactive material. The source of the contamination appears to be tumbleweed fragments. Approximately 1 acre is contaminated. The site is covered with vegetation typical of the surrounding desert.

A portion of the crib has undergone in situ vitrification.

## 2.3. 216-T-3 REVERSE WELL, 216-T-6 CRIBS, AND 241-T-361 WASTE STORAGE TANK

The 216-T-3, 216-T-6, and 241-T-361 waste sites are located west of T Plant in the 200 West Area. The south perimeter of the site is 23rd Street. Refer to Figure 3 for a site map. Both the 216-T-3 and 216-T-6 facilities received effluent after it had been passed through the 241-T-361 settling tank.

The 216-T-3 reverse well received effluent from 1945 to 1946. Although records indicate that no effluent was discharged to the facility after 1946, it was not officially deactivated until 1975. At this time, all aboveground piping was removed, and the ground surface decontaminated. The well consists of an 8-inch diameter casing embedded 207 ft in the ground, which is still evident in the field.

The 216-T-6 cribs (number 1 and 2) received effluent from 1946 to 1947. Deactivation of the cribs consisted of blanking a pipeline upstream of the cribs, after it exited the 241-T-361 settling tank. The cribs consist of two 12-ft by 12-ft by 4-ft wooden structures 25 ft below grade. The number 1 crib flowed into the number 2 crib. The cribs are posted as cave-in potential.

Thirteen wells were drilled in 1947 in an effort to understand the distribution of radionuclides under the cribs. These wells are visible in the field. In 1975, the ground surface was leveled, and sink holes filled. It is unknown if the sink holes are related to the wooden below grade structures.

The 241-T-361 settling tank was operational from 1945 to 1947. It received effluent from T plant and discharged to the 216-T-3 and 216-T-6 waste disposal facilities. It was deactivated by blanking the inlet and outlet lines. The tank is constructed of reinforced concrete, has a capacity of 36,000 gallons, and is located 9 ft below grade. There are eight abovegrade risers visible in the field.

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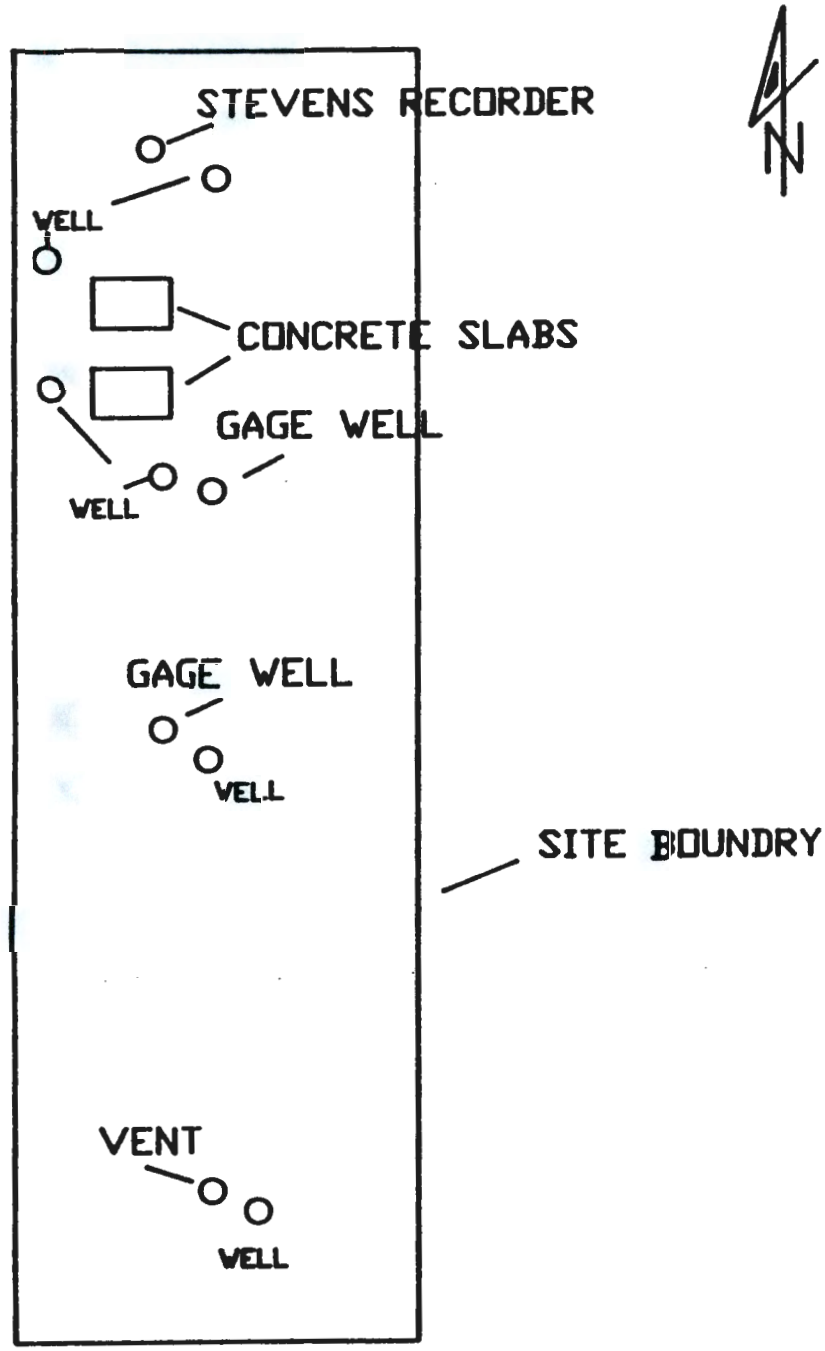
Figure 2. Site Map for the 216-Z-12 Crib.



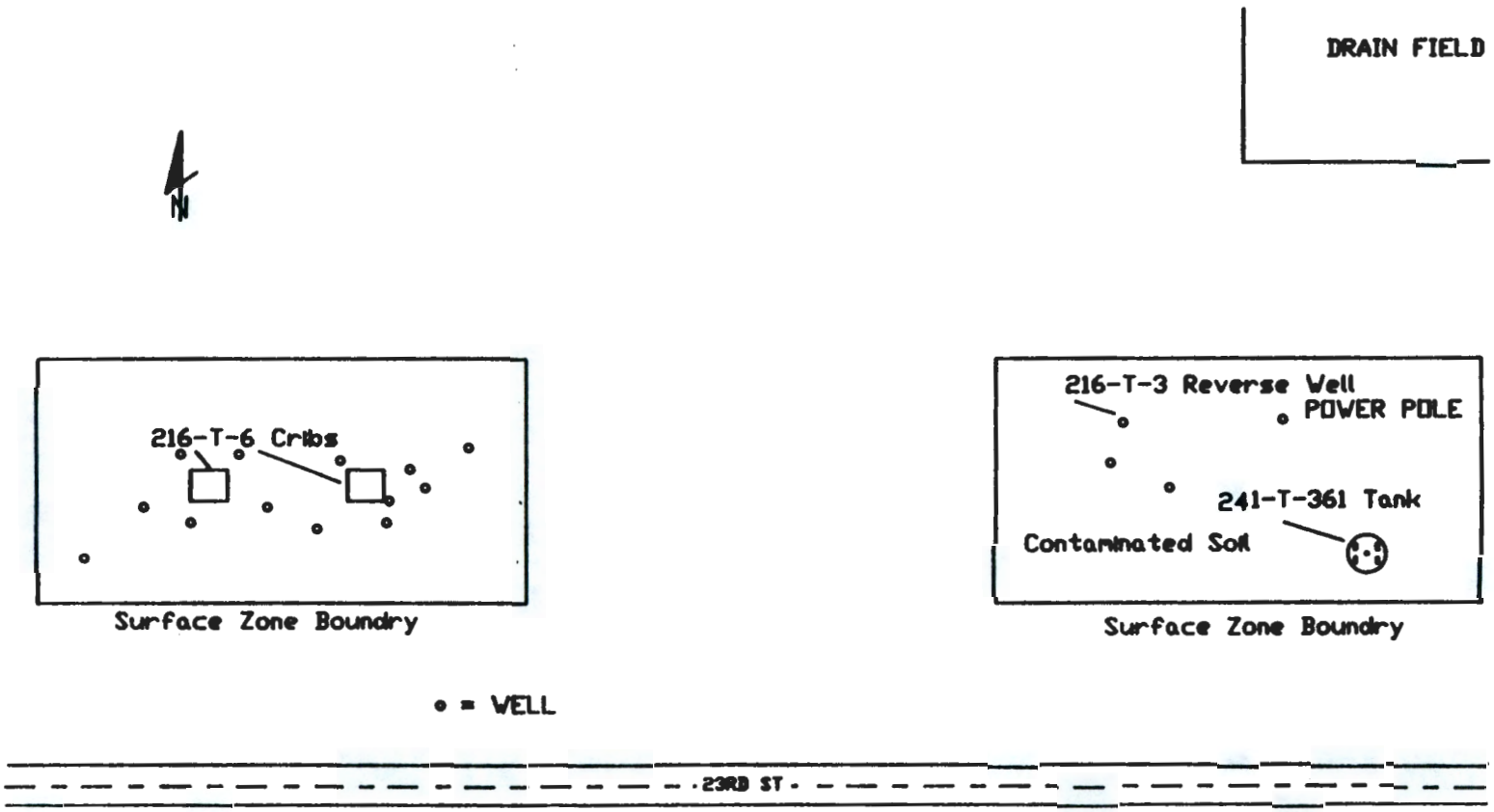



Figure 3. Site Map for 216-T-3 Reverse Well, 216-T-6 Cribs, and 241-T-361 Waste Storage Tank.

There are two separate surface contaminated areas. One contains the 241-T-361 settling tank and 216-T-3 reverse well. The other contains the 216-T-6 cribs. There is one power pole associated with the 214-T-361 settling tank. The source of radioactive contamination appears to be tumbleweed fragments.

## 3. OBJECTIVE AND CONSTRAINT

The primary objective of interim stabilization is to bring inactive waste disposal facilities into compliance with the requirements of WHC-CM-7-5, Environmental Compliance, and subsequently maintain it in that condition until the final remediation strategy is implemented. Based on the requirements of WHC-CM-7-5, Part L, "Inactive Radioactive Waste Sites," the 241-WR vault, 216-Z-12 crib, 216-T-3 reverse well, 216-T-6 cribs, and 241-T-361 waste storage tank do not have an adequate barrier over the contamination to prevent migration, and the contamination of the soil surface is higher than allowed.

The main constraint is that the interim stabilization should not, to the extent possible, eliminate any reasonable alternatives for the final remediation of the site.

## 4. INTERIM STABILIZATION ACTIVITIES

The selected interim stabilization activities for inactive waste sites are described below. They consist of two phases which are the site preparation and consolidation and stabilization.

### 4.1. SITE PREPARATION

#### 4.1.1. 241-WR Vault

There are numerous preparation activities that will need to be performed at the 241-WR vault. This includes removal of fence, power poles and associated light fixtures, and a portion of an overhead steamline.

Fence removal is required to allow access for heavy equipment. The entire site is surrounded by chain-linked fence. Depending on work site specifics, it may be possible to remove only portions of the fence.

Power pole removal will be required to allow decontamination and or interim stabilization to proceed smoothly. As a consequence, associated light fixtures and power lines will also have to be removed.

The overhead steam line will have to be partially removed to facilitate heavy equipment operations in this area. This will entail asbestos abatement.

Other significant site preparation required at the 241-WR vault are civil surveys and radiological surveys. Interim stabilization strategies will be based partially on the results of these surveys.

#### 4.1.2. 216-T-3 Reverse Well, 216-T-6 Cribs, and 241-T-361 Waste Storage Tank

Site preparation required at the 216-T-3 reverse well, 216-T-6 cribs, and 241-T-361 settling tank will include the extension of approximately 13 wells. Because the 216-T-6 surface contaminated area is isolated from the 216-T-3 and 241-T-361 surface contaminated zone, a haul road between the two will have to be established. Civil and radiological surveys will be completed.

#### 4.1.3. 216-Z-12 Crib

Site preparation required at the 216-Z-12 crib will include the extension of monitoring wells, isolation of crib risers, and civil and topographic surveys. There are eight monitoring wells that will require extension to account for grade change. There are also several crib risers of interest. Two of the risers are gage wells made of carbon steel. One riser is a filter assembly also of carbon steel. Another riser is also made of carbon steel pipe, but with a metal cap assembly. This assembly houses instrumentation used during crib operation.

Other site preparation activities include a criticality engineering evaluation and coordination with nearby carbon tetrachloride extraction operation.

The only site preparation required at either 216-U-5 or 216-U-6 cribs will be to verify the locations of the cribs through civil surveys.

### 4.2. CONSOLIDATION AND STABILIZATION

Stabilization activities associated with each area will be discussed separately.

#### 4.2.1. 241-WR Vault

Interim stabilization of the 241-WR vault will be accomplished with a with a combination cover of shotcrete, biobarrier, and soil. The goal of interim stabilization will be to minimize the chance that the vault will become a collection point for run-off.

An attempt to remove radioactive surface contamination located outside the perimeter fence will be necessary. If contamination is removed, it will allow for consistent radiological posting when the job is completed. Some consolidation may occur inside the perimeter fence as well. Areas where soil has been removed will be downposted or interim stabilized based on radiological conditions. Due to the number of below grade encasements, much of the area may remain as underground radioactive material. If soil volumes



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are large, some or all of the soil may be consolidated on the 216-U-5 and 216-U-6 cribs. Any vegetation that is not easily crushed or matted will have to be removed. Low spots near the vault will be leveled. Some grading of the area surrounding the vault may be necessary to help consolidate contaminated soil and to minimize the possibility for run-off accumulation near the vault.

Shotcrete may be used to interim stabilize the vault surface as required by the radiological conditions. Soil and rock cover may be used for areas around the vault. Due to uncertain topographical and radiological parameters, it is unknown what amounts of fill will be required. If soil and rock cover is used near the vault, some existing soil will have to be removed from the area to allow placement of 18 to 24 inches of uncontaminated soil without bringing grade above the top edge of the vault.

The 216-U-5 and 216-U-6 cribs and any associated area will be interim stabilized with 18 to 24 inches of uncontaminated soil. If soil from the vault area is consolidated on one or both of these cribs, then it will also be interim stabilized with 18 to 24 inches of uncontaminated soil.

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#### 4.2.2. 216-T-3 Reverse Well, 216-T-6 Cribs, and 241-T-361 Waste Storage Tank

There are two separate surface contamination areas located approximately 50 ft apart. Radioactive surface contamination from the 216-T-3 reverse well and 241-T-361 settling tank will be scraped and consolidated on the 216-T-6 cribs. Approximately 6 to 8 inches of soil will be removed. Because of the presence of risers associated with the 241-T-361 settling tank, this area will not be scraped. A shotcrete and biobarrier cover may be installed over this area to interim stabilize radioactive surface contamination, depending on radiological conditions.

If shotcrete application over the 241-T-361 settling tank is required, it will be accomplished in several steps. There is very little vegetation associated with the 241-T-361 settling tank, but some of it may have to be removed. The risers will be covered in plastic or other suitable material. This will be necessary to ensure that the shotcrete does not adhere to the risers. A biobarrier will then be placed over the area that will receive shotcrete. This is necessary to minimize the growth of undesirable plants. Shotcrete reinforcement material will then be added to aid in the long-term integrity of the shotcrete cover. A layer of shotcrete 3 to 4 inches deep will then be applied over the area.

Consolidation activities over the 216-T-6 cribs will take soils from the 216-T-3 and 241-T-361 waste areas, and any surrounding soil from the 216-T-6 cribs and place it over the cribs and adjacent areas. The consolidated soils will then be interim stabilized with 18 to 24 inches of uncontaminated soil. Consolidation activities may be hampered by the numerous well casings located in this area. Areas disturbed by earth moving will be revegetated at the appropriate time of the year.

#### 4.2.3. 216-Z-12 Crib

Interim stabilization activities in this area will be relatively straight forward. There may be some consolidation activities, but most of the area will be interim stabilized with 18 to 24 inches of uncontaminated soil. Total acreage to be backfilled will be approximately 1 acre. Areas disturbed by earth moving will be revegetated at the appropriate time of the year.

## 5. INTERIM STABILIZATION ALTERNATIVES

This section provides a comparison of several alternative methods for interim stabilization of the 241-WR vault, 216-T-3 reverse well, 216-T-6 cribs, 241-T-361 waste storage tank, and 216-Z-12 crib.

### 5.1. CRITERIA FOR COMPARISON

To be considered a viable candidate method for interim stabilization, the primary test to be met is availability. Many technologies could be considered for application to various remediation problems at Hanford. The majority have not yet been tested or fully evaluated for applicability as interim stabilization methods. Since the time needed to accomplish this would preclude timely interim stabilization, they have not been considered as viable.

Based on availability, four methods were selected for comparison. They are:

- Consolidation of surface contamination and stabilizing with soil or rock cover.
- Removal of contaminated surface soil and burial as low-level radioactive waste.
- Application of a soil fixative.
- Application of shotcrete over a biobarrier.

The first two methods are currently available and have been used successfully onsite. Soil fixatives have been used previously onsite with mixed results; however, their low cost makes them attractive. Shotcrete and biobarrier was just recently used onsite, so that it is also a viable candidate.

Section 3 identified the objectives and constraint for interim stabilization. These are the prime criteria. Secondary criteria that need to be considered are described below.

Manual Compliance - Does the method provide an adequate barrier between the contamination and the environment to prevent migration by wind, water, or vegetation uptake? Does the method render the radioactivity in the surface soil less than detectable with a field instrument and less than specified in WHC-CM-7-5, Part K, "Standards of radioactive Soil Contamination."

Cost - What is the total estimated cost? Is the method affordable? Some methods may be affordable for small sites but not for large sites.

Durability - Will the method hold up to weather and require surveillance and maintenance activities until the final remediation is implemented?

Level of Maintenance - What type of maintenance does the treatment require to keep it functional?

Remedial Investigation/Feasibility Study (RI/FS) Impact - Will the method have an adverse impact on future RI/FS activities at the site?

Potential Side Effects - Are there any potential side effects which may cause problems in the future?

Impact on Final Remediation Alternative - What impacts will the interim stabilization method have on the potential final remediation methods in terms of cost and processes or increasing waste volumes?

## 5.2. EXPECTED PERFORMANCE TO CRITERIA

### 5.2.1. Consolidation and Soil (or Rock) Cover

This method has already demonstrated its ability to meet the barrier and surface contamination requirements. It is estimated that the cost for this alternative is 0.64/ft$^2$. The durability is very good. It is not damaged by vehicles which perform routine surveillance nor the trucks or spray rigs which may be needed for maintenance. Normally, the only maintenance required is the periodic application of herbicide. No impact is expected to future RI/FS activities. Sites that are surface contaminated are interim stabilized with soil prior to beginning RI/FS activities. No side effects are expected. Consolidation and stabilization would have a minimal effect on final remediation alternatives of multimedia caps, in situ grouting or stabilization, or in situ vitrification of soil. It will have a impact if excavation and soil treatment is chosen. While processes such as soil washing and ex situ stabilization would not be impacted, a volume increase does occur during interim stabilization activities. Volume increases are directly related to the size of the consolidation pile and the depth below the consolidation pile that is contaminated. If the macroengineering concept is implemented for this area, the impacts of interim stabilization with clean soil will be minimal.

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#### 5.2.1.1. 241-WR Vault

Soil and rock cover would be used to interim stabilize contaminated land associated with the vault and not the vault itself. Total area that would be interim stabilized is 35,740 $ft^2$. This equates to a cost of $22,874. An additional 4,000 $ft^2$ may have to be interim stabilized at the 216-U-5 and 216-U-6 cribs.

#### 5.2.1.2. 216-T-3 Reverse Well, 216-T-6 Cribs, and 241-T-361 Waste Storage Tank

Soil and rock cover would be used to interim stabilize the 216-T-6 cribs. Soil from the vicinity of the 241-T-361 settling tank and 216-T-3 reverse well will be consolidated over the 216-T-6 cribs. Total area to be interim stabilized is 21,780 $ft^2$. This equates to a cost of $13,939.

#### 5.2.1.3. 216-Z-12 Crib

Nearly the entire crib would be interim stabilized with 18 to 24 inches of uncontaminated soil. The crib area is nearly an acre. This would equate to a cost of $27,878.

### 5.2.2. Removal and Burial

This method is routinely used and has been effective in achieving manual compliance. Since the surface contamination is removed from the site, no barrier is needed and the soil remaining meets the standards. This is the most expensive alternative due to the high cost of waste disposal ($67/$ft^3$ for low-level radioactive waste). This alternative is not viable for large sites due to the cost of burial. As with interim stabilization, this alternative is very durable and only routine herbicide application should be needed. No impact is expected to future RI/FS activities. No side effects are expected since the surface is in the same physical state that occurs naturally. This alternative is the least disruptive of all four on future remediation. No impacts are foreseen.

#### 5.2.2.1. 241-WR Vault

This is not a viable alternative for the majority of the site, as there is a long history of spills in this area. This would require a large amount of excavation to remove the contaminated soil. In addition, the area is underlain by numerous radioactive encasements. However, if the top 6 inches of soil was removed a cost of $1,197,290 would be incurred.

#### 5.2.2.2. 216-T-3 Reverse Well, 216-T-6 Cribs, and 241-T-361 Waste Storage Tank

The total job site covers approximately 2 acres. If 6 inches of soil were removed from this area, a volume of 43,560 $ft^3$ would be generated. This equates to a cost of $2,918,520.



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#### 5.2.2.3. 216-Z-12 Crib

Removal of 6 inches of contaminated surface soil from this crib would cost $1,459,260.

### 5.2.3. Fixative

Fixative application has not been demonstrated to provide an adequate barrier to migration. It would also not change the contamination levels in the soil surface, and therefore not meet the surface contamination standards. The cost for use of the fixative is very low at $0.10/ft$^2$. Past experience with fixatives has shown that they are very susceptible to damage by vehicles. It is expected that periodic herbicide application may be necessary. In fact, it appears that vegetation grows best where fixatives have been applied. The use of fixatives would have no impact on future RI/FS activities. Fixatives will result in some loss of permeability of the soil. This could result in run-off accumulations in undesirable locations. In the long term, fixatives would probably have little or no effect on final remediation alternatives of multimedia caps, in situ grouting or stabilization, or in situ vitrification of soil. It may have a impact if excavation and soil treatment is chosen, especially with regards to soil washing. Additional process steps may be required to remove the fixative from the contaminated soil. If the macroengineering concept is implemented for this area, the impacts of fixative use to interim stabilize soil will be minimal.

#### 5.2.3.1. 241-WR Vault

Fixative application would incur a cost of $3,574 for the contaminated area surrounding the vault.

#### 5.2.3.2. 216-T-3 Reverse Well, 216-T-6 Cribs, and 241-T-361 Waste Storage Tank

If the contaminated 2 acres were treated with a fixative, a cost of $87,120 would be incurred.

#### 5.2.3.3. 216-Z-12 Crib

Fixative application would incur a cost of $4,356.

### 5.2.4. Shotcrete Over a Biobarrier Cloth

This method would meet both the barrier and surface contamination criteria. It is moderately expensive at about $2.40/ft$^2$. Shotcrete is expected to be durable and the level of maintenance low. The thick, hard cover over the site may impact on RI/FS sampling, but some form of interim stabilization would be required prior to initiating RI/FS activities. Because it is impermeable, shotcrete could have the side effect of run-off accumulations in undesirable locations. Shotcrete application may have minimal effects on the final remediation alternatives of multimedia caps, in situ grouting or stabilization, or in situ vitrification of soil. It may have an impact if excavation and soil treatment is chosen. Additional process

steps may be required to process the thick, hard shotcrete layer. If the macroengineering concept is implemented for this area, the impacts of shotcrete use as a interim stabilization method will be minimal.

#### 5.2.4.1. 241-WR Vault

Shotcrete application for the area surrounding the vault will incur a cost $85,776.

#### 5.2.4.2. 216-T-3 Reverse Well, 216-T-6 Cribs, and 241-T-361 Waste Storage Tank

If the contaminated 2 acres were treated with shotcrete, a cost of $209,088 would be incurred.

#### 5.2.4.3. 216-Z-12 Crib

Shotcrete cover would cost $104,544.

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## 6. CONCLUSIONS

Based on the above discussions and engineering judgement, the following conclusions were obtained.

### 6.1. 241-WR VAULT

The best alternative here is small-scale consolidation of soil from areas around the vault and a combination of soil and shotcrete cover. Interim stabilization with soil and rock is not appropriate as covering the surrounding area with 18 to 24 inches of soil would make the vault the low spot, and therefore susceptible to run-off. If the vault roof itself is contaminated, it may be necessary to interim stabilize it. Interim stabilization with shotcrete would meet the criteria regarding future remediation of the site better than would 18 to 24 inches of clean soil. Removal and burial is not applicable here because of the history of spills, and the fact that there a several encasements located under the area. Soil fixatives would not allow the area to be radiologically downposted.

### 6.2. 216-T-3 Reverse Well, 216-T-6 Cribs, and 241-T-361 Waste Storage Tank

Consolidation and interim stabilization is the best alternative for this area. This alternative will allow downposting of the area at the most reasonable cost. Shotcrete would also allow downposting but would be more expensive. A fixative would not allow downposting. Removal and burial, while allowing downposting, would be prohibitively expensive.

### 6.3. 216-Z-12 Crib

Interim stabilization of this crib with 18 to 24 inches of uncontaminated soil is the best alternative. This will allow the area to be downposted to underground radioactive material at the most reasonable cost. A shotcrete cover would meet this criteria, but at a higher cost. Removal and burial would also meet this criteria, but since this is a crib even if the surface was decontaminated the area would still be posted as underground radioactive material. Fixatives would not allow the posting to be changed.

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