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Interim Record of Decision for the Oak Ridge K-25 Site K-1070
Operable Unit SW31 Spring

September 1992

SITE NAME AND LOCATION

SW31 Perennial Spring, also known as K-1070 C/D Leachate Stream
Oak Ridge Reservation (ORR)
K-25 Site [K-1070 Operable Unit (OU)]
Oak Ridge, Tennessee

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial action for the SW31 Perennial Spring, which is part of the K-1070 OU of the U.S. Department of Energy (DOE) K-25 Site in Oak Ridge, Tennessee. This action was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and, to the extent practicable, the National Contingency Plan (NCP). This decision is based on the administrative record file for this site.

The state of Tennessee, after review of relevant documentation, concurs with the federal agencies on the selected remedy.

ASSESSMENT OF THE SITE

If not addressed by implementing the interim response action selected in this Interim Record of Decision (IROD), actual or threatened releases of hazardous substances from this site may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF SELECTED REMEDY

This interim action is the first step towards the remediation of the K-1070 OU, which comprises a burial ground used for the disposal of hazardous and radiological waste. SW31 Perennial Spring collects surface seepage waters and groundwater. Its discharge is primarily contaminated with organic compounds.

The selected remedy is to treat SW31 discharge as follows:

- discharge preconditioning for removal of fouling agents, followed by
- treatment with an air stripper, followed by
- carbon polishing, followed by
- final treatment of the stream through the Central Neutralization Facility (CNF) of the K-25 Site [the CNF is a National Pollutant Discharge Elimination System (NPDES)-permitted facility].

Therefore, this interim action will collect and treat the SW31 spring discharge prior to release of treated effluent to surface water via an NPDES permitted outfall.

STATUTORY DETERMINATION

This interim action protects human health and the environment, complies with federal and state applicable or relevant and appropriate requirements (ARARs) for its limited scope, and is cost-effective. Although this interim action is not intended to satisfy fully the statutory mandate for permanence and treatment to the maximum extent practical, it does utilize treatment in furtherance of that mandate. However, it may not constitute the final remedy for the SW31 Perennial Spring, because K-1070 OU, of which SW31 is part, is currently at an early stage of investigation under CERCLA, and there is no information available now on long-term permanent solutions for K-1070 OU and SW31. This action does not constitute the final remedy for the K-1070 OU; thus, the statutory preference for remedies that employ treatment to reduce toxicity, mobility, or volume as a principal element is but partially addressed in this remedy.

This remedy will result in hazardous substances remaining on site at the K-1070 Burial Grounds above health-based levels. A review of the remedy will be conducted within 5 years once the remedy becomes operational and functional. To this regard, a remedy becomes operational and functional either 1 year after construction is complete or when the remedy is determined by U.S. Environmental Protection Agency (EPA) and the state to be functioning properly, whichever is earlier. The review will be conducted to ensure that the remedy continues to adequately protect human health and the environment while DOE continues to develop final remedial alternatives for the site. Because this is an IROD, review of this site and this remedy will continue as part of the development of the final remedy for SW31 Perennial Spring and in the context of the remediation of K-1070 OU.

Interim Record of Decision
for the
Oak Ridge K-25 Site
K-1070 Operable Unit SW31 Spring

September 1992

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PART 3. RESPONSIVENESS SUMMARY

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ACRONYMS AND INITIALISMS

ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CNF	Central Neutralization Facility
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FR	Federal Register
IROD	Interim Record of Decision
MCL	maximum contaminant level
MTF	Memorandum-To-File
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
ORR	Oak Ridge Reservation
OU	operable unit
PCB	polychlorinated biphenyl
R&D	research and development
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act of 1986
SVOC	semivolatile organic compound
TDEC	Tennessee Department of Environment and Conservation
USC	United States Code
VOC	volatile organic compound

PART 1. DECLARATION

SITE NAME, LOCATION, AND DESCRIPTION

Site Identification

The SW31 Perennial Spring, also known as the K-1070-C/D Leachate Stream, is part of the K-1070 OU located within the K-25 Site, a federal facility on the ORR. Owned by DOE and managed by Martin Marietta Energy Systems, Inc., K-25 is in Roane County, 6 miles southwest of the city of Oak Ridge in East Tennessee (Fig. 2.1).

SW31 is a perennial spring located inside the perimeter fence of K25 (Fig. 2.2). It surfaces approximately 200 ft west of the K-1070-C/D Classified Burial Ground on the east side of K-25. The stream is contaminated primarily with volatile organic compounds (VOCs). Heavy metals have also been found in the water, together with traces of polychlorinated biphenyls (PCBs) and other agents, including minimal alpha and beta activity. The stream flow rate ranges from 3 to 6 gal/min. It is currently discharged to a storm drain and eventually flows to Mitchell Branch.

Description

Groundwater is believed to contribute at least part of the stream flow to SW31. The proximity of K-1070 C/D Classified Burial Ground (a groundwater mound recharged by meteoric waters) and its position upstream of SW31 lend credibility to this assumption. Groundwater flow at K-25 is dominated by relatively shallow, downgradient movement of meteoric recharge to discharge areas along Poplar Creek and the Clinch River.

Geologic conditions in the vicinity of K-25 are quite complex. Fracturing and jointing of the bedrock provide the chief hydrogeologic mechanism for groundwater flow. There are 25 known groundwater wells within 1 mile of K-25, including wells installed at the Tennessee Valley Authority Blair Road Station, the Blair Road Building at the intersection of Blair Road and Highway 58, and neighboring private residences.

Access to the spring is restricted because of its position inside the perimeter fence of K-25. Admission past the fence is controlled, and all entrances are guarded. Potential risk to the general population is reduced by these institutional controls.

An impact on natural resources from the SW31 spring is the contamination of surface waters from the discharge into Mitchell Branch, which is the main surface water feature in the vicinity of SW31. Mitchell branch flows northwest to its confluence with Poplar Creek, subsequently joining the Clinch River waterway.

General Background

There are industrial, recreational, residential, and light agricultural areas surrounding K-25. Residential properties closest to K-25 are approximately 1.5 miles to the north on the lower slope of Black Oak Ridge in the Poplar Creek/Sugar Grove Valley area. These neighboring areas are lightly to moderately populated.

Climate in the Oak Ridge area is classified as humid subtropical. ORR weather patterns are generally temperate with warm, humid summers and moderately cool winters. The mean yearly temperature is ~ 57 F, and the mean annual precipitation in the region is 54 in. The region enjoys one of the calmest wind regimes in the country; the average wind speed is ~ 4.4 mph.

SITE HISTORY AND ENFORCEMENT ACTIVITIES

The Oak Ridge K-25 Site was constructed during World War II to supply the uranium-enriched material for the Manhattan Project. The fabrication, decontamination, and maintenance processes associated with activities at the K-25 Site produced hazardous and radioactive wastes. To dispose of these wastes, treatment, storage, and disposal facilities were constructed at the K-25 Site. The K-1070-C/D Classified Burial Ground is one such facility comprising several potential contaminant sources, including trenches, pits, diked drum storage areas, and a maintenance storage yard.

A spring with perennial flow (SW31) is located west of and downhill from the K-1070-C/D Burial Grounds and is contaminated by organic chemicals. The source of the contaminants in the spring is thought to be wastes, including solvents and hazardous chemicals placed in the disposal pits. In the mid1970s, the swampy spring discharge area at the base of the K-1070-C/D Burial Grounds was filled, and a pipe was inserted in the hillside to collect natural seepage for routing to a storm drain. The pipe discharge became SW31.

Remediation of SW31 was initially planned under the authority of the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984, within the broader framework of the remediation of the K-1070-C/D Classified Burial Ground.

During December 1989, the ORR was placed on CERCLA's National Priority List. In response to this regulatory initiative, K-25 was divided into OUs to address and isolate environmental problems into more manageable entities. The K-1070 C/D Burial Ground and SW31 became part of the K-1070 OU.

The K-1070 OU is presently undergoing a Remedial Investigation under CERCLA. Data collected during the current characterization and during previous sampling pointed out that SW31 was suited for interim action. Analysis of this data confirmed that the initiative was appropriate, and the lead and support authorities agreed to start interim action for SW31.

An experimental bioremediation project was conducted at the site prior to the decision for interim action. Because of the need for prompt remedial action ensuing from that decision, it was decided to use more reliable and proven techniques to remediate SW31 rather than perfect an experimental technology with uncertain performance. Consequently, the bioremediation project was terminated for reasons not related to this IROD during early 1992.

Compliance with pending regulations had an important part in the decision for action. The NPDES permit for the K-25 Site is presently being renewed; it will require compliance with water quality standards for the various stormwater discharges at the site and will prohibit the introduction of untreated sources into the stormwater system.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

During July 1992, the Proposed Plan for the Oak Ridge K-25 Site K-1070 OU SW31 Spring was released to the public. This document was made available both in the administrative record file and at the information repository maintained by DOE at the Information Resource Center, 106 Broadway, Oak Ridge, Tennessee.

The Notice of Availability for the Proposed Plan was published in the Oak Ridger - the daily newspaper of Oak Ridge - on July 2, 1992. No public meeting was scheduled, but an opportunity for a meeting was offered in the Notice of Availability for the Proposed Plan. The public comment period lasted for 30 days, from July 2 to July 31, 1992.

Although the public expressed no desire to hold a meeting, several comments on the proposed plan were submitted. A response to the comments received during this period is included in the

Responsiveness Summary, which is Part 3 of this IROD.

This decision document presents the selected remedial action for the SW31 Perennial Spring at the DOE's K-25 Site in Roane County, next to the city of Oak Ridge, Tennessee, chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, NCP. The decision for this site is based on the administrative record.

SCOPE AND ROLE OF RESPONSE ACTION

Remediation of the K-25 Site is a complex problem. Division of the site into OUs will facilitate the clean-up process. The K-1070 OU has been identified as a high priority site in the draft ORR Site Management Plan. Although the remedial investigation of the K-1070 OU is ongoing, it was determined that it was appropriate to isolate SW31 for interim action. This initiative is being undertaken to eliminate an identified and easily controllable release of hazardous substances to Mitchell Branch. The goal of this interim action is to quickly reduce the migration of contaminants and degradation of the environment while the investigation of the K-1070 OU continues.

It is expected that this interim action will be followed by one or more interim or final source control actions to remediate the K-1070-C/D disposal pits and trenches, which are suspected of causing releases of hazardous substances to groundwater. It is also likely that a final remediation action to address groundwater contamination problems at the K-25 Site as a whole will be required as K-25 Site remediation progresses.

SITE CHARACTERISTICS

SW31 is a perennial spring that surfaces about 200 ft west of the K-1070-C/D Classified Burial Ground on the east side of K-25. The spring discharge is collected by a pipe inserted into the base of a hill and is conveyed to a storm drain. The spring is contaminated by wastes disposed of in trenches or pits excavated into the hill above the spring although the source of contamination is not precisely identified. The principal threat posed by the contaminated spring is degradation of surface water quality.

The SW31 spring waters contain significant concentrations of several VOCs, traces of semivolatile organic compounds (SVOCs), PCBs, and various metals. The total discharge of VOCs from the spring is about 2.4 lb/d based on maximum measured concentrations. Maximum concentrations of VOCs are presented in Table 2.1. The corresponding drinking water maximum contaminant levels (MCLs), where available, are included for comparison. Table 2.2 lists SVOC concentrations. Radiological contamination is minimal: gross or radiation has been measured at 5 pCi/L (MCL is 15 pCi/L), and gross radiation at 8 pCi/L (MCL is 4 mrem/year, screening level threshold of concern is 30 pCi/L).

Iron is the main inorganic contaminant at a maximum concentration of 41 mg/L. Manganese is also found at a concentration of 13 mg/L. Both of these metals exceed the draft NPDES permit water quality limits; they also present an operational concern (fouling) for most discharge treatment operations. Table 2.3 presents the inorganic contaminants of concern at SW31.

The leachate stream data compiled from available sources represent maximum contaminant concentrations. All VOCs, SVOCs, and metals exceeding the MCL or the primary health advisory level are listed as well as all concentrations relevant to process design. Total PCBs have been measured up to approximately 0.005 mg/L. The stream's radioactivity is below the limits established for drinking water.

Routes of exposure to the public presently are limited by institutional controls because SW31 is inside the perimeter fence of K-25. Therefore, only the current plant employees and technical personnel involved in environmental activities like sampling are exposed to the contaminated water. On the other hand, the stream is discharged to a storm drain and eventually to the surface water system. This constitutes a potential hazard to the environment.

SUMMARY OF SITE RISKS

Risk assessment for interim action examines the threat to human health and the environment posed by site contamination both in terms of potential carcinogenic effects and non-carcinogenic toxicity. EPA guidance states that the risk assessment performed in support of interim remediation may be qualitative if insufficient data exist to quantify the risk. Conditions analyzed are those existing in the absence of any remediation. Risk to human health is expressed in terms of excess cancer risk or in terms of reference dose thresholds. In accordance with NCP requirements, ecological risk for nonhuman receptors was also addressed.

The only medium of concern for this interim action is contaminated surface water (spring discharge). In the following screening level risk assessment, only potential receptors based on current conditions were considered. Consequently, risk from exposure to the metals or the low concentration of PCBs in SW31 has not been quantified for human receptors because there are no complete pathways of exposure under baseline conditions; this will be discussed later.

Risk to human health was determined on the basis of the maximum detected concentration for benzene, bis(2-ethylexyl)phthalate, 1,1dichloroethane, ethylbenzene, hexachloroethane, methylene chloride, tetrachloroethene, toluene, 1,1,1-trichloroethane, 1,1,2-trichloromethane, trichloroethylene, vinyl chloride, and xylene. Certain data relevant to risk assessment was unavailable for some of the target contaminants, and health risks could not be derived.

Risk to human health from exposure to contaminated water was evaluated for the only two receptors under worst-case current conditions-a professional sampler who collects water samples for analysis and a general plant worker standing 10 m away from SW31 for 8 h/d, 5 d/week. Risk for this worker would represent a conservative upper-bound risk for the occupants of all buildings near the discharge. The perimeter fence around K-25 and the awareness of professional personnel help deactivate many pathways of exposure; this in turn reduces present risk. The SW31 discharge, although potentially harmful, presently does not expose people to significant risks because of institutional controls.

The pathway of exposure for all potential human receptors is inhalation of volatilized organics from the water stream. Table 2.4 shows the toxicity assessment for the professional sampler, and Table 2.5 shows toxicity assessment for the general plant worker. These tables comprise the quantitative evaluation of both carcinogenic and non-carcinogenic effects. Excess risk quantifies the increase in probability that an individual will develop cancer when exposed to contaminants. This represents the risk to contract cancer solely because of contamination. The estimate involves the evaluation of many assumptions, including duration, manner, and level of exposure. Experimental sampling results are the starting point for estimates and computations. EPA requires estimation procedures that lead to upper-bound results, that is, estimates that are very conservative in the interest of human health and the environment. Excess risk is expressed as a probability and varies between 1 and 0; a value of 1 represents statistical certainty, while a smaller number shows a proportionally lower risk.

While the risk of cancer is given as an incremental probability, the danger of non-carcinogenic harmful effects is obtained by comparison with threshold reference doses. A reference dose is an estimate of the daily exposure level likely to be harmless during a lifetime. If the actual dose exceeds this threshold (the ratio of actual dose to reference dose-hazard quotient-is larger than 1), there may be potential harm in exposure.

Excess cancer risk from exposure to contaminated water is estimated to be 4 X 10[-8] for the sampler and no more than 5 X 10[-5] for the general plant worker. In other words, a professional sampler is 40 chances in a billion more likely to contract cancer in a lifetime than if no contamination existed at SW31; a general plant worker is no more than 50 chances in a million more likely. According to the EPA, an excess cancer risk greater than 10[-6] (1 in a million) is the lower threshold for concern, while an excess cancer risk greater than 10[-4] (1 in 10,000) needs very close attention. Therefore, excess risk for the sampler is insignificant, while excess risk is below the upper threshold of concern for the general plant worker. Risk of non-carcinogenic toxicity for the sampler and the worker is absent; the hazard quotient is well below the value of 1.

The modest risk to human population under present circumstances is an insufficient reason to dismiss the need of interim action for SW31. Ecological risk is a reason for concern. The ecological receptors most at risk from SW31 are aquatic organisms in Mitchell Branch. Insufficient data exist for a quantitative evaluation of this risk, but some evidence is available regarding acute toxicity on test organisms.

Two tests were performed with samples from the SW31 discharge to verify the harm to aquatic life from acute toxicity. In both cases, half the test organisms placed in a mixture of clean water and as little as 4 to 6% of SW31 discharge died within 48 hours. This gives rise to the qualitative assertion that risk exists. However, streams from SW31 are combined with other sources of water and contaminants before discharge into Mitchell Branch. Available information is insufficient to determine the present effect that the SW31 discharge alone would have on Mitchell Branch.

DESCRIPTION OF ALTERNATIVES

As previously discussed, the primary mechanism for release of contaminants to the environment from the SW31 spring is direct discharge of contaminated spring water to the K-25 storm drain system. The storm drain conveys flow from the SW31 spring to Mitchell Branch.

The objective of this interim remedial action for SW31 is simply to terminate the direct discharge of contaminants to surface waters by intercepting and routing contaminated waters for treatment prior to discharge to surface waters via a NPDES-permitted outfall. The contaminants found in the SW31 spring are amenable to removal by proven physical/chemical treatment technologies.

Three treatment alternatives were identified. Each of these, as well as a no-action alternative, was subjected to a detailed analysis that applied the nine evaluation criteria established by the SARA and NCP.

The no-action alternative, which is required to be evaluated for all CERCLA remedial actions, serves as a baseline for comparison against the other alternatives and must be carried through the detailed analysis of alternatives. The no-action alternative does not include any active response measures, but rather consists solely of monitoring and activities in support of monitoring.

Alternative 1, No Action

CERCLA requires that the no-action alternative be evaluated at every site to establish a baseline for comparison. Under this alternative, no further action would be taken at the site to reduce risk to human health and the environment from water contamination. Therefore, no cleanup would be performed, and current site risks would not be mitigated.

The no-action alternative includes monitoring of ongoing contamination. Under this alternative, SW31 would be monitored quarterly until a final remedial action for K-1070 OU is undertaken.

This alternative may not meet the requirements of the Fish and Wildlife Coordination Act [16 United States Code (USC) 661 et seq.] as the discharge to a storm drain and then to Mitchell Branch creates a potential risk to fish and wildlife. Also, the Tennessee Department of Environment and Conservation (TDEC) Water Quality Control Act [Chapter 1200-4-3.03(g) of the Rules of TDEC] prohibits the discharge of toxic substances that would impact the growth of aquatic life. In addition, renewal of the K-25 NPDES permit will impact the current practice of routing the untreated stream to a storm drain.

Radiation protection standards are not expected to be violated. These standards are presented in DOE Orders 5400.5 and 5480.11; although not ARARs for remediation, these documents are to-be-considered regulations and are legally binding for DOE's contractors.

This alternative does not reduce the current risk to health and the environment.

Alternative 2, Carbon Adsorption

Carbon adsorption has been used extensively to remove many organic compounds from contaminated waters. The removal process relies on the affinity between contaminants and activated carbon particles. Besides organics, activated carbon can also adsorb some inorganic constituents, even in low concentrations.

A commercially available carbon adsorption treatment system is the primary means for the remediation of SW31 under this alternative. Column-type systems allow efficient use of adsorption capacity. For this alternative, an off-the-shelf, skid-mounted unit would be used. With minimal infrastructure (a pump station and a concrete slab), this equipment would become an operative treatment unit. Once the carbon is exhausted and cannot adsorb any more contaminants, the skid-mounted unit may-if certain conditions are met-be shipped back to the vendor for regeneration while a stand-by replacement is put in service.

Contaminated waters from SW31 would require pretreatment to remove suspended solids and other fouling agents that hinder the operation of treatment by carbon adsorption. Pretreatment is required at least for iron and manganese, which are detected in relatively large concentrations in SW31. An off-the-shelf pretreatment system with capability for oxidation, pH adjustment, and flocculation/clarification has been considered because it will be effective even for the high concentrations of iron and manganese that have been found.

Water from the spring would flow through a commercial pretreatment unit and then to the carbon adsorption treatment system. The reactor stream would eventually discharge to a storm drain and on to Mitchell Branch.

Pretreatment unit and main treatment system maintenance and replacement needs must be determined through stream monitoring. However, the analysis of SW31 waters and a theoretical evaluation of this treatment system show that maintenance and regeneration of activated carbon as the primary means of treatment would be very demanding. The type and amount of contaminants present in SW31 would rapidly exhaust large quantities of activated carbon, creating an unrealistic need for maintenance. Besides, residual toxicity not amenable to removal by activated carbon may remain in the stream, and implementing this alternative may present technical complications.

Due to traces of radioactivity in the water, this alternative could also result in the generation of relatively large volumes of mixed waste from carbon adsorption since carbon may concentrate the radioactive contaminants. If mixed waste is generated, the carbon will not be returned to the vendor for regeneration, but will be stored and disposed of as explained in the waste management plan, which will be prepared as part of the remedial design work plan. The pretreatment unit may also generate hazardous or mixed waste as a by-product of cleaning the water.

Because of the potential presence of heavy metals in the stream, there are still some unknown factors involved with this alternative relative to its compliance with the Fish and Wildlife Coordination Act, the TDEC Water Quality Control Act, and the forthcoming K-25 NPDES permit. Compliance with radiation protection standards is expected. Standards for the operation of miscellaneous treatment units are codified in 40 Code of Federal Regulations (CFR) 264.601. These standards require location, design, operation, and closure of the unit in a manner protective of human health and the environment. If the treatment system will include tank(s), regulations on tank storage, operation, and closure in 40 CFR 264.111 and 264.190 et seq. may be applicable or relevant and appropriate for this remedial alternative. This will depend on whether the new units are part of a wastewater treatment system subject to regulation under Section 402 of the Clean Water Act. In the latter case, the tank standards would not be applicable but may be relevant and appropriate.

The expected performance of the carbon treatment system will provide effluent quality in compliance with the cleanup standards (MCLs) listed in Tables 2.1 and 2.2. The heavy metals detected in SW31 probably contribute to the toxicity to aquatic life: the cleanup standards (MCL) of Table 2.3 can be attained, but the pretreatment stage may require modifications to include cleanup of metals.

Treatment residuals will be tested before disposal. If the residuals are RCRA-characteristic waste, the Land Disposal Restrictions of 40 CFR 268 will apply. If mixed waste, they will also be handled according to DOE Order 5820.2A, Radioactive Waste Management.

This alternative neutralizes current risk to human health and may neutralize risk to the environment. Field confirmation of the effectiveness of treatment is needed as this result is possible but not guaranteed.

Capital costs associated with Alternative 2 are estimated at $230,000 with annual operation and maintenance costs at $380,000. This alternative will require 10 months for implementation.

Alternative 3, Air Stripping and CNF Treatment

Air stripping is a process through which volatile compounds are transferred from water to air, thus cleaning up the water. In turn, stripped contaminants become gaseous and volatilize in the atmosphere. A large volume of air is required to strip volatile contaminants from water; gaseous contamination is therefore diluted before it is released to the atmosphere. Compliance with air emissions standards may require cleanup of the gaseous emissions. Air stripping is only effective for removing contaminants that vaporize easily; for example, it cannot extract metals.

An air stripper is a device used to create conditions favorable to the gasification of contaminants dissolved in water. For this alternative, a standard design air stripping tower available off-the-shelf from a commercial supplier in a standard design will be skid-mounted and put in service with minimal infrastructure. If air emissions are excessive, a commercially available gas control system or another acceptable solution in compliance with applicable air quality regulations (Chapter 1200-3-3 of the Rules of the TDEC) will be used to mitigate this problem.

The stream from the air stripper is not sufficiently clean to be discharged although VOCs have been removed. For instance, PCBs may still be in the water since they are not likely to be removed by air stripping. Heavy metals would still be in the water. The CNF can remove metals but cannot treat PCBs; therefore, PCBs would have to be cleaned up before the water was pumped to the CNF. This can be accomplished through a stream polishing stage by means of activated carbon. After air stripping of VOCs, carbon is an effective and efficient technology for polishing the water.

Overall, for this alternative the contaminated water from SW31 would first go through preliminary treatment, as considered for Alternative 2 to remove fouling agents. After pretreatment, the water will flow to the stripping tower for removal of VOCs and then to carbon polishing. The polished stream is eventually routed for treatment to the CNF, an NPDES-permitted facility, for subsequent discharge at Outfall 011. The CNF is about 0.5 mile from the SW31 site.

The pretreatment unit would require maintenance as determined by stream monitoring, and the air stripping tower may require periodic acid washes to prevent fouling. Air stripping will generate gaseous emissions. Theoretically, off-gas control does not appear necessary, but if it were, the potential advantage of off-gas control vs carbon adsorption as the main water treatment is that since air emissions are free from radionuclides, the carbon used will not be a mixed waste.

The rate of exhaustion of activated carbon in the polishing stage is modest; thus, if applicable, the volume to handle as mixed waste is also small. The potential for generation of hazardous or mixed waste from the pretreatment stage is the same as in Alternative 2.

In addition to the ARARs cited for previous alternatives, the air quality standards in Chapter 1200-3-3 of the Rules of TDEC would apply to this remedial alternative. Besides, the polishing stage stream must meet the waste acceptance criteria of the CNF (listed in The Oak Ridge Gaseous Diffusion Plant K-1407-H and K-1407-A Central Neutralization Facility Waste Acceptance Criteria).

The expected performance of the treatment system will provide effluent quality in compliance with regulations. Cleanup standards as the MCLs listed in Table 2.1, 2.2, and 2.3, or the mandates of the K-25 NPDES permit for outfall 011 are attainable.

This alternative neutralizes current risk to human health and the environment.

Capital costs of Alternative 3 are estimated at $350,000 with annual operation and maintenance costs at $120,000. This alternative requires 10 months for implementation.

Alternative 4, Air Stripping and Direct Discharge

This alternative, like Alternative 3, includes pretreatment, air stripping, and carbon polishing. It differs from Alternative 3 because, after being polished, the stream is directly discharged to a storm drain instead of being transferred to CNF for further treatment.

Toxicity testing of the polished stream before release to the environment would be necessary to verify the viability of this discharge option. Without a pilot test, this alternative's feasibility cannot be quantitatively evaluated or effectively determined.

Carbon polishing would remove residual PCBs. However, the heavy metals detected in SW31 probably contribute to the toxicity to aquatic life and may flow through the treatment system. Conversely, the pretreatment stage could possibly be modified to extend its function to include cleanup of metals. This modification, in turn, could require the addition of treatment chemicals that may be harmful to the environment if not removed, and the modification may only be partially successful.

The implementability of this alternative remains uncertain without field verification. However, it would probably be more involved than Alternative 3 and require some design modifications.

Maintenance and replacement times for the pretreatment unit and the activated carbon system would need to be determined through stream monitoring. The air stripping tower would require periodic acid washes to prevent fouling. Generation of waste would be similar to Alternative 3, with some uncertainty about the need for different chemicals for pretreatment.

There are no additional ARARs besides those examined for Alternatives 1, 2, and 3. As in Alternative 2, there is uncertainty about compliance with the Fish and Wildlife Coordination Act, the TDEC Water Quality Control Act, and the forthcoming K-25 NPDES permit because of the potential presence of heavy metals in the stream.

This alternative neutralizes current risk to human health and may neutralize risk to the environment. Field confirmation of the effectiveness of treatment is needed as this result is likely but not guaranteed.

Capital costs of Alternative 4 are estimated at $260,000 with annual operation and maintenance costs at $120,000. This alternative would require 10 months to be implemented.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Decision Matrix

Table 2.6 shows a schematic summary of the following analysis.

Overall Protection of Human Health and the Environment

Alternative 1 does not offer sufficient protection of human health and the environment; baseline conditions are not acceptable. Alternatives 2, 3, and 4 offer satisfactory protection from exposure to the contaminants discharged by SW31 by removing the contaminants from the water and minimizing harmful effects through treatment.

Alternatives 2, 3, and 4 intend to achieve the same result through solutions that are technically different. Alternative 3 provides for the protection of health and the environment through final stream polishing at an NPDES-permitted facility. The level of protection offered to human health and the environment for Alternatives 2 and 4 depends on resolving the remaining uncertainty about the impact to wildlife from residual contaminants in the discharge.

Compliance with ARARs

Chemical-Specific ARARs: Alternative 3 is expected to meet chemical-specific regulatory limits for discharge. Alternatives 2 and 4 can possibly meet these limits as well. CNF treatment, which results in an NPDES-permitted stream, meets radiation protection standards for Alternative 3. In view of the very minimal radiological contamination of SW31, it is also expected that Alternatives 2 and 4 will comply, but field verification would be necessary to ascertain compliance with DOE Orders 5400.5 (2/8/90), 5820.2A (9/26/88), 5480.11 (7/20/89), and the as low as reasonably achievable principle.

Location-Specific ARARs: In the immediate proximity of SW31, it appears that the direct environmental impact would be limited to siting the temporary treatment system.

Action-Specific ARARs: Standards for operation and maintenance of miscellaneous treatment units in 40 CFR 264.601 are applicable to the components of the remedial alternatives studied. Tank storage regulations in 40 CFR 264.111 and 264.190 et seq. may be applicable or relevant and appropriate, as discussed previously. Treatment residuals and by-products must be tested before disposal and managed as hazardous or mixed waste, as applicable. Alternatives 2, 3, and 4 can comply with these regulations. Air emissions from the air stripper must meet state ambient air quality standards. The NPDES permit in force at K-25 establishes the regulatory framework for the treatment of discharge and their release to the environment. Discharges to Mitchell Branch are prohibited if they contain toxic substances that could cause specific toxic effects or hinder growth of aquatic life. For Alternatives 2 and 4, this will need technical attention during implementation.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence of an interim solution should be evaluated with the understanding that this remedial initiative is temporary. Regulatory guidance recommends that temporary remediation beevaluated in the framework of overall site strategy. For instance, an interim remedy should be considered effective until a permanent remedy can be implemented, but its suitability for incorporation into the permanent solution should be examined, if possible. No information is available today on a future permanent remedial solution for SW31. It is therefore impossible to answer this question with any certainty at this time.

Alternative 2 demands constant maintenance. Removal of the type and amount of contaminants found in the SW31 discharge requires large quantities of activated carbon and will impose an impractical maintenance burden. Carbon adsorption will perform poorly in the short term and is not a viable long-term solution. In addition, the presence of residual toxicity in the stream is possible.

The effectiveness and permanence of Alternative 3 is good. This alternative requires transportation of water to the CNF, and collection of environmental remediation discharge at the CNF is endorsed by the NPDES permit at K-25. Successful treatment in this facility is guaranteed once the waste acceptance criteria are met. Discharge occurs at Outfall 011, which is monitored under the authority of the NPDES permit. Incorporation in a long-term solution may be possible, but this advantage is speculative at present.

For Alternative 4, which releases treated waters into Mitchell Branch, stream monitoring from the polishing stage will require constant attention. Also, field verification of effectiveness is necessary to confirm the degree of cleanup that can be obtained.

Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of toxicity, mobility, or volume is a complex objective that is seldom fulfilled in all its aspects. All alternatives will generate waste that may be RCRA-listed or mixed as a by-product of the pretreatment stage. Alternative 2, if implemented, would produce very large amounts of exhausted activated carbon that require either regeneration or handling as mixed waste. Alternatives 3 and 4 will produce air emissions that may potentially require cleaning with commercial off-gas control equipment even if this appears unnecessary. These alternatives also require regeneration of the polishing stage. For all alternatives, pretreatment may generate hazardous or mixed waste. All by-products of water treatment need to be monitored and tested as appropriate. If by-products are classified as hazardous or mixed waste, their management and disposal will comply with applicable regulations.

Short-Term Effectiveness

Alternatives 2, 3, and 4 have very similar short-term impacts as a result of incidental construction requirements. For example, the necessity of rerouting the contaminated discharge creates a potential risk for all personnel involved in construction. Having workers near SW31 while it is untreated is not desirable, but this risk can be managed effectively. Impact of construction on the environment is considered negligible. Human communities outside the perimeter fence of K-25 will not be affected by activities related to the implementation of a remedial alternative.

The effectiveness of all action alternatives is prompt. Protection of the environment from contamination is achieved immediately after the operation begins.

Implementability

All remedial alternatives are based on mature technologies, but implementation may require design modifications for Alternatives 2 and 4 based on results from field tests. The goals projected for each alternative are technically realistic in the scope of the alternative; however, the lack of a field pilot study creates some uncertainty. For timely remediation, a higher degree of uncertainty in the design was preferred over a longer period of engineering development. The administrative feasibility of these alternatives depends on the achievement of a consensus among DOE and regulatory agencies involved in the evaluation and approval process.

Cost

Order-of-magnitude costs for capital expenditure vary from $230,000 (Alternative 2) to $350,000 (Alternative 3). Annual operation and maintenance costs vary from $120,000 (Alternative 3) to $380,000 (Alternative 2). Alternative 4 costs are intermediate. There is significant uncertainty in these estimates. The lack of a pilot test leaves a broad margin of indetermination, for instance, on the characterization of by-product wastes and on other issues, as previously discussed.

State Acceptance

The state of Tennessee has reviewed the alternatives proposed for interim action at SW31. TDEC concurs with the selection of Alternative 3, Air Stripping and CNF Treatment, as the alternative best suited for interim remediation of SW31 Leachate Stream.

Community Acceptance

During the public comment period for the Proposed Plan for the remediation of SW31, several comments and questions were presented about the proposed alternative. There was, however, consensus about the appropriateness of Alternative 3 for interim action at SW31, and the public agreed with the selection of this alternative. The Responsiveness Summary of this IROD addresses the questions and comments from the public in detail.

THE SELECTED REMEDY

Based on consideration of the requirements of CERCLA, the analysis of the alternatives, and public comment, DOE, EPA, and the state of Tennessee have determined that Alternative 3, Air Stripping and CNF Treatment, is the most appropriate remedy for interim action at the SW31 Perennial Spring, K-25 Site 1070 OU, Roane County, Tennessee.

Alternative 3 comprises the installation of a pretreatment unit, an air stripping tower, and a carbon adsorption polishing stage available off-the-shelf from commercial vendors. Discharge from SW31 would be treated through this system and then routed to the CNF-an NPDES-permitted facility-for final treatment to remove all residual contaminants in the water. Up to 9000 gal/d of water would be treated. Figure 2.3 shows a simple flow diagram to illustrate the various treatment stages.

The purpose of this response action is to control potential risk to health and risk to the environment posed by the contamination of the SW31 stream. Existing conditions at the site pose an excess lifetime cancer risk of 5 x 10[-5] to the general plant worker. This risk relates to the organic contamination of SW31 discharge, which discharges approximately 2.4 lb/d of VOCs to the environment. This discharge is currently being routed to a storm drain. In addition, there is evidence that SW31 stream discharge is toxic to aquatic life, probably because of its heavy metals concentrations.

This interim action will treat the discharge, which will be able to eventually be discharged as an NPDES-permitted stream. This action will result in neutralization of the risk to health and the environment that SW31 currently poses. Within 10 months from this IROD, "substantial continuous on-site physical remedial action" [SARA 120(e)(2)] will have been implemented.

The expected performance of the treatment system will provide effluent quality in compliance with regulations. Cleanup standards, such as the MCLs listed in Tables 2.1, 2.2, and 2.3 and the mandates of the K-25 NPDES permit for Outfall 011, are attainable. Table 2.7 presents an estimation of the capital costs of each major component of the selected remedy. Table 2.8 states operation and maintenance costs in terms of annual costs. A present value is not computed because of the interim nature of this action.

The operation and maintenance costs may continue consistent with the length of duration of the environmental restoration of the K-25 Site.

STATUTORY DETERMINATIONS

Protection of Human Health and the Environment

The selected remedy protects human health and the environment from the contaminated stream of SW31 Perennial Spring through treatment and discharge of an NPDES-permitted stream. All pathways of exposure for possible human receptors and for wildlife and the environment are deactivated through source control measures by treating SW31 discharge. There are no short-term risks associated with the selected remedy that cannot be effectively managed, and no adverse cross media impacts are expected from the remedy.

Compliance with ARARs

The selected remedy of discharge treatment through pretreatment, air stripping, carbon polishing, and final CNF treatment will comply with all chemical-, action-, and location-specific ARARs for the limited scope of this interim action. ARARs are presented below.

Chemical-Specific ARARs: State Water Quality Criteria (Rules of the TDEC Chapter 1200-4-3), Safe Water Drinking Act MCLs, and the NPDES permit in force at K-25. Although not ARARs, the waste acceptance criteria of CNF must also be met. Radiation protection must comply with standards as set forth in DOE Orders 5400.5 and 5480.11 and radioactive waste management criteria of DOE Order 5820.2A. Land Disposal Restrictions in 40 CFR 268 will be adhered to.

Location-Specific ARARs: The selected remedy must also comply with the Fish and Wildlife Coordination Act (16 USC 661 et seq.) and the TDEC Water Quality Control Act [Chapter 1200-4-3-.03(3g) of the Rules of TDEC].

Action-Specific ARARs: The following action-specific ARARs must be met: Treatment in a Unit, 40 CFR 264.601; Tank Storage, 40 CFR 264.111, 264.190 et seq.; Leaks or Spills, 40 CFR 302.4, 302.6; Disposal of Treatment Residuals, 40 CFR 268, DOE Order 5820.2A; Air stripping, air quality standards (Chapter 1200-3-3 of the rules of TDEC), 40 CFR 265.1032(a)(1). In addition, the Proposed RCRA Subpart CC, 56 Federal Register (FR) 33490, July 22, 1991, is to-be-considered. Cost Effectiveness

The selected remedy is cost-effective. The overall relationship between the benefit offered and the expenditure necessary to obtain it compares favorably to that of the other alternatives studied.

Use of Permanent Solutions and Treatment

Because this is an interim action, the use of permanent solutions needs to be considered only in the framework of long-term integration with final remediation for this OU. Presently, no information is available to this regard. Any conclusion would be speculative and, therefore, irrelevant as a statutory determination.

While the alternatives studied are comparable in implementability and short-term effectiveness, the selected alternative presents a more favorable trade-off between cost and effectiveness of remediation. The discharge of an NPDES stream is a guarantee of performance and reliably pursues the reduction of toxicity to aquatic life.

Reduction of toxicity, mobility, or volume through treatment was the most decisive factor in the selection of this remedial alternative. The state and local community concurred with the rationale behind this choice.

Although not a permanent solution, the selected remedy meets the statutory requirement to use treatment technology to the maximum extent practicable.

Preference for Treatment

This interim action satisfies the statutory preference for treatment as a principal element. However, it does not definitively address the principal threats to health and the environment posed by OU K-1070. Future action for this OU will be addressed under the remedial investigation scheduled to start in late 1992.

DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for interim remediation of SW31 Perennial Spring, K-25 Site, was released for public comment during July 1992. The Proposed Plan identified Alternative 3, Air Stripping and CNF Treatment, as the preferred alternative. DOE reviewed all comments submitted during the public comment period. Upon review of these comments, it was determined that no significant changes to the remedy as it was originally identified in the Proposed Plan were necessary.

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PART 2. DECISION SUMMARY