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Friday December 14, 1990

Part II

Environmental Protection Agency

40 CFR Part 300 Hazard Ranking System; Final Rule

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ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 300

[FRL-3730-8]

RIN 2050 AB73

Hazard Ranking System

AGENCY: Environmental Protection

Agency. ACTION: Final rule.

SUMMARY: The Environmental Protection Agency (EPA) is adopting revisions to the Hazard Ranking System (HRS), the principal mechanism for placing sites on the National Priorities List (NPL). The revisions change the way EPA evaluates potential threats to human health and the environment from hazardous waste sites and make the HRS more accurate in assessing relative potential risk. These revisions comply with other statutory requirements in the Superfund Amendments and Reauthorization Act of 1966 (SARA).

DATES: Effective date March 14, 1991. As discussed in Section III H of this preamble, comments are invited on the addition of specific benchmarks in the air and soil exposure pathways until January 14, 1991.

ADDRESSES: Documents related to this rulemaking are available at and comments on the specific benchmarks in the air and soil exposure pathways may be mailed to the CERCLA Docket Office, **OS-245, U.S. Environmental Protection** Agency, Waterside Mail, 401 M Street, SW. Washington, DC 20460, phone 202-382-3046. Please send four copies of comments. The docket is available for viewing by appointment only from 9:00 am to 4:00 pm, Monday through Friday, excluding Federal holidays. The docket number is 105NCP-HRS.

FOR FURTHER INFORMATION CONTACT: Steve Caldwell or Agnes Ortiz, Hazardous Site Evaluation Division, Office of Emergency and Remedial Response, OS-230, U.S. Environmental Protection Agency, 401 M Street, SW, Washington, DC 20460, or the Superfund Hotline at 800-424-9346 (in the Washington, DC area, 202-382-3000). SUPPLEMENTARY INFORMATION:

Table of Contents

L Background

- II. Overview of the Final Rule
- **III. Discussion of Comments**
- A. Simplification
- **B. HRS Structure Issues**
- **C. Hazardous Waste Quantity**
- D. Toxicity E. Radionuclides
- F. Mobility/Persistence

G. Observed Release H. Benchmarks

- I. Use Factors
- Sensitive Environments
- . Use of Available Data
- L. Ground Water Migration Pathway M. Surface Water Migration Pathway
- N. Soil Exposure Pathway O. Air Migration Pathway
- P. Large Volume Wastes Q. Consideration of Removal Actions
- (Current Versus Initial Conditions) R. Cutoff Score IV. Section-by-Section Analysis of the Rule
- Changes V. Required Analyses

- A. Executive Order No. 12291 B. Regulatory Flexibility Analysis C. Paperwork Reduction Act
- **D.** Federalism Implications

I. Background

In 1980, Congress enacted the **Comprehensive Environmental** Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. 9601 et seq.), commonly called the Superfund, in response to the dangers posed by uncontrolled releases of bazardous substances, contaminants, and pollutants. To implement section 105(8)(A) of CERCLA and Executive Order 12316 (46 FR 42237, August 20, 1981), the U.S. Environmental Protection Agency (EPA) revised the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR part 300, on July 16, 1982 (47 FR 31180), with later revisions on September 16, 1985 (50 FR 37624), November 20, 1985 (50 FR 47912), and March 8, 1990 (55 FR.8668). The NCP sets forth guidelines and procedures for responding to releases or potential release of hazardous

substances, pollutants, or contaminants. Section 105(8)(A) of CERCLA (now section 105(a)(8)(A)) requires EPA to establish:

Criteria for determining priorities among releases or threatened releases (of hazardous substances) throughout the United States for the purpose of taking remedial action and, to the extent practicable taking into account the potential urgency of such action, for the number of taking memory action. Criterio potential urgency or such action, for use purpose of taking removal action. Criteria and priorities * * shall be based upon the relative risk or danger to public health or welfare or the environment * * taking into account to the extent possible the population at risk, the hazard potential of the hazardous substances at such facilities, the potential for contamination of drinking water supplies, the potential for direct human contact, [and] the potential for destruction of sensitive ecosystems * * *.

To meet this requirement and help set priorities, EPA adopted the Hazard Ranking System (HRS) as appendix A to the NCP (47 FR 31180, July 16, 1982). The HRS is a scoring system used to assess the relative threat associated with actual or potential releases of hazardous substances at sites. The HRS is the primary way of determining whether a site is to be included on the National Priorities List (NPL), the Agency's list of sites that are priorities for long-term evaluation and remedial response, and is a crucial part of the Agency's program to address the identification of actual and potential releases. (Each State can nominate one site to the NPL as a State top priority regardless of its HRS score; sites may also be added in response to a health advisory from the Agency for **Toxic Substances and Disease Registry** (see NCP, 40 CFR 300.425(c)(3)).) Under the original HRS, a score was determined for a site by evaluating three migration pathways-ground water. surface water, and air. Direct contact and fire and explosion threats were also evaluated to determine the need for emergency actions, but did not enter into the decision on whether to place a site on the NPL.

In 1986, Congress enacted the Superfund Amendments and Reauthorization Act of 1988 (SARA) (Pub. L. 90-499), which added section 105(c)(1) to CERCLA, requiring EPA to amend the HRS to assure "to the maximum extent feasible, that the hazard ranking system accurately assesses the relative degree of risk to human health and the environment posed by sites and facilities subject to review." Congress, in its Conference Report on SARA, stated the substantive standard against which HRS revisions could be assessed:

This standard is to be applied within the context of the purpose for the National Priorities List; i.e., identifying for the States and the public those facilities and sites which appear to warrant remedial actions. * * This standard does not, however, require the Hazard Ránking System to be equivalent to detailed risk assessments, quantitative or qualitative, such as might be performed as part of remodial actions. The standard requires the Hazard Ranking System to rank sites as accurately as the Agency believes is feasible using information from preliminary essments and site inspections * * Meeting this standard does not require long-term monitoring or an accurate determination of the full nature and extent of contamination at sites or the projected levels of exposure such as might be done during remedial investigations and feasibility studies. This provision is intended to ensure that the Hazard Ranking System performs with a degree of accuracy appropriate to its role in expeditiously identifying candidates for response actions. [H.R. Rep. No. 962, 99th Cong., 2nd Sess. at 199-200 [1986]]

Section 105(c)(2) further specifies that the HRS appropriately assess the human health risks associated with actual or potential contamination of surface waters used for recreation or drinking

water and that this account should take into account the potential migration of any hazardous substance through surface water to downstream sources of drinking web

SARA added two criteria for SARA addee two contraction evaluating alice ander section Itif(a)(0)(A): Actual or potential Itif(a)(0)(A): Actual or potential entireties of the embient air and on through the human food chain- in . CERCLA section 118, added by SARA, sequires EPA to give a high priority to facilities where the release of hexardons substances has release hexardons substances has resulted in the closing of drinking water wells or has contaminated a minimal drift to the HRS to address facilities that in substantial volumes of was contspecified in section 3001(b)(3)(A)(i) of the Solid Waste Disposal Act, commonly referred to as the Resource mervation and Recovery Act (RCRA). These wastes inch warter, bottom ash wester, sing warter, and flow gas emission control wester generated primetily from the combastion of coal or other feesil hele. Specifically, section 125 sequires EPA to review the HRS to assure the approving consideration of each of the following specific characteristics of such أتعطأ

• The quentity, insistly, and metheology of besterdous ents that are present in such ete and a comperison with other w A

• The extent of, and pote lases of such hexaedous of -Cal fee. s constituents to the corteen unt and

 The degree of risk to human here
 ad the approximation posed by such man health

EPA published as advence notice of represed relemaking (ANPED) on April 1, 1987 (12 FR 11513), announch ie its in to revise th e HRS and ig com ents de a noi ٠ er el L A After a comprehensive review of inal HES, including ration of alternative models and n ariyi "charce Advisory Board seview, EPA published a notice of proposed ublished a notice of proposed doubling (NPRO4) for HBLS revisio a December 22, 1980 for HBLS revisio en December 23, 1998 (35 PR 51962). The NPRM contains a detailed preamble, which should be cassulted for a more extensive discussion of CERCLA, SARA. the HRS, and the proposed changes to the HRS.

Teday, EPA is publishing the revised 1963, which will expressed the 1963 previously in effect as appandix A to the NCP. CERCLA section 105(c)[1] states that the revised 1985 shall be applied to any site newly listed on the NPL after its officitive date; as specified in section

.

105(c)(3), sites scored with the original HRS prior to that effective date need not be reevaluated.

The HRS is a scoring system based on factors grouped into three factor categories. The factor categories are multiplied and then normalized to 100 points to obtain a pathway score (e.g., the ground water migration pathway score). The final HRS score is obtained by combining the pathway scores using a sest-meas equire method. The proposed HRS revised every factor to extent. A few factors were 901 replaced, and several new factors were added. The major proposed changes included:

(1) Consideration of potential as well as actual releases to air

(2) Addition of mobility factors: [3] Addition of dilution and distance weightings for the water migration pathways and modification of distance

visiting in the air migration pathway: [4] Revisions to the toxicity factor: [5] Additions to the list of covered

unitive environments; 16) Addition of human food chain and

recreation threats to the surface water migration pathway; (7) Revision of the hazardous waste

manifiv factor to allow a tiered. approach:

IS Addition of health-based benchmarks for evaluating population factors and ecological-based benchmarks for evaluating sensitive

(9) Addition of factors for evaluating e maximally exposed individual: and (10) Inclusion of a new onsite re pethway

EPA conducted a field test of the proposed HRS to assess us a second HRS of implementing the proposed HRS used HRS to assess the feasibility factors, to determine resources required for specific tasks, to assess the availability of information needed for election of sites, and to identify difficulties with the use of the proposed revisions. To must the objectives, site inspections were performed at 29 sites antionwide. The sites were selected either because work was already lanned at the site or because the sites had specific features EPA wanted to test using the proposed revisions to the HRS. The major results of the field test were netized on September 14, 1980 (54 FR 37960), when the field test report was made evailable for public review and

IL Overview of the Plant Rule

The rule being promulgated today incorporates substantial changes to revisions proposed in December 1988. EPA has changed the rule for three reasons: (1) To respond to the peneral consument submitted by many -communities that the factor categories and pathways need to be consistent with each other; (2) to respond to specific recommendations made b lations made by commenters; and (3) to respond to problems identified during the field test and discussed in the field test report. Major changes affecting multiple pathways include:

 Meltiplication of bazardous waste sentity factor, texticity, and other waste characteristics factors:

• Uncepping of population factors (i.e., no limit is placed on maximum value):

· Revised criteria for establishing an observed release;

Crpping of potential to release at a value less than observed release;

 Revision of the toxicity evaluation to select carcinogenic and non-cancer chronic values in preference to acute toxicity values; • Elimination of Level III

concentrations and extension of weighting based on levels of exposure to searest individual (well/intake: formerly maximally exposed individual) factors;

· Modification of the wei assigned to Level I and Level H concentration

· Revisions to the bench ands used and methods for determining

exceedance of benchmarks;

• Use of ranges to assign values for potentially exposed populations; · Inclusion of factors assessing

exposures of the nonzest individual in all pathways;

· Revisions to distance and dilutio weights in all pathways except ground water migration; • Replacement of the use factors with

less heavily weighted resources factors; · Brainstion of wetlands based on

size or surface water frontege; and · Specific instructions for the

evaluation of radiomuclides at radioactive wests sites and sites with radioactive and other hazardous substances westes.

The major changes in the ground water migration pathway include: • Replacement of depth to squifer/

hydraulic conductivity and scriptive capacity factors with travel time and depth to aquifer factors: and • Revision of the mobility factor.

including consideration of distribution coefficients.

in the surface water migration pathways, the major changes include: • Elimination of the separate

.

recreational use threat; Addition of a ground water to surface water component;

• Incorporation of bioaccumulation into the waste characteristics factor category rather than the targets factor category for the human food chain threat;

• Revision to allow use of additional tissue samples in establishing Level I concentrations for the human food chain threat; and

 Addition of ecosystem bioaccumulation potential factor for sensitive environments.

The major changes in the soil exposure pathway (formerly the onsite exposure pathway) include:

· Elimination of separate consideration of the high risk. population;

 Inclusion of hazardous waste quantity in the waste characteristics factor category;

 Consideration of workers in the resident threat's targets factor category; and

· Revisions to scoring of terrestrial sensitive environments.

The major changes in the air migration pathway include: • Separate evaluation of gas and particulate potential to release; and • Consideration of actual

contamination in evaluating sensitive environments.

Figures 1 to 4 show the differences between the pathways in the original HRS and in the final rule.

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Federal Register / Vol. 55, No. 241 / Friday, December 14, 1990 / Rules and Regulations 5153

Figure 1

Ground Water Migration Pathway

ORIGINAL HRS

Likelihood of Release	X	Waste Characteristics X Targets	
Observed Release or		Toxicity/Persistence Ground Water Use Hazardous Waste Quantity Distance to Nearest Well/	
Route Characteristics		Population Served	•
Depth to Aquifer o	f		
Concern			
Net Precipitation			•
Permeability of	• •		
Unsaturated Zon	e		
Physical State			
Containment	· · .		•
	•		

FINAL HRS

Likelihood of Release X	Waste Characteristics X	Targets
Observed Release	Toxicity/Mobility	Nearest Well
or	Hazardous Waste Quantity	Population
Potential to Release		Resources
Containment		Wellhead Protection Area
Net Precipitation	• •	
Depth to Aquifer		
Travel Time		

Surface Water Migration Pathway

ORIGINALHRS

Likelihood of Release X Observed Release or Rouse Characteristics Pucifity Slope/Inservening Texain 1-Year, 24-Hour Rainfall Disease to Neurost Surface Water Physical Same Containment	Waste Characteristics Toxicity/Persistence Hazardous Wast: Quantity	x	Targets Surface Water Use Distance to Scashive Environment Population Servel/Distance to Neasost Intels Downsteam

19 Federal Regions / Vol. 54. No. 243 / Priday, December 14, 1990 / Rules and Regulations



Soil Exposure Pathway¹

FINAL HRS

Resident Population Threat

Likelihood of Exposure	X	Waste Characteristics	x	Targets	
Observed Contamination		Toxicity Hazardons Waste Quantity		Resident Individual Resident Population Workers Resources Terrestrial Sensitive Environments	

┢

Nearby Population Threat

Likelihood of Exposure X	Waste Characteristics X	Targets
Attractiveness/Accessibility	Toxicity	Population Within 1 Mile
Area of Contamination	Hazardous Waste Quantity	Nearby Individual

Air Migration Pathway

ORIGINAL HRS

Likelihood of Release	X	Waste Characteristics X	Targets
Observed Release	•	Reactivity and Incompatibility Toxicity	Population Within 4-Mile Radius
	•	Hazardous Waste Quantity	Distance to Sensitive Environment
•			Land Use
· ·	•	· ·	
		· .	

FINAL HRS

Likelihood of Release	K	Waste Characteristics	X	Targets
Observed Release or Potential to Release		Toxicity/Mobility Hazardous Waste Quantity		Nearest Individual Population Resources
		•		Sensitive Environments
Gas .	•			:
Gas Containment				
Gas Source Type				
Gas Migration Potent	tial			
Particulate		· · ·		· · · ·
Partic vlate Containm	cnt			
Particulate Source Ty	/De			
Particulate Migration				-
Potential	-			

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Section III of this preamble summarizes and responds to major issues raised by commenters. These issues are organized so that issues that affect multiple pathways are covered first, followed by discussions of individual pathway issues. Section IV provides a section-by-section discussion of the final rule. All substantive changes not discussed in section III are identified in section IV. Because the rule has been substantially rewritten to clarify the requirements, editorial changes are not generally noted.

III. Discussion of Communits

About 100 groups and individuals is on the ANFRM and itted com NPRM. Ninetson of these also submitted comments on the field test report; two er groupe submitted comments only the field test report. The commenter hided more than 20 State agencies, werel Pederal agencies, companies. iests only ز است trade associations, Indian tribe unental groups, technical tasts, and individuals. This and shares section summerizes and responds to the major issues raised by commenters. A description of the comments and EPA's tion of the court sense to each issue raised in the is are available in Respon ments on Revisions to the Hazard Ranking System (HRS) in the EPA CERCLA docket (see Assessme s antices American above).

A. Simplification

In response to SARA. EPA proposed revisions to the HRS so that, to the maximum extent feesible, it accurately assesses the relative risks posed by hexardous weste sites to human health and the environment. Consequently, the proposed rule required more data than did the original HRS. A number of commenters stated that

inters stated th at the data collection requirements of the proposed rule were excessive given its purpose as a screening teel. These commuters expressed concern that the mis were too exten dete seguireen -íve for a screening process: specifically, that the data requirements would lengthen te requirements would lengthen ne needed to scare sites with the يك جيل HRS, increase the cost of listing sites, and, therefore, limit the meney evailable for remodial actions. Most -even those who meidered that the revisions increased a accuracy of the model-stated that e resources required to evaluate sites der the proposed FBIS were 8 1 **CONT**1 tes.

One commenter suggested the proposed HES would be so expensive to implement that EPA would need to develop a new screening tool to determine whether a site should undergo

an HRS evaluation. Another commenter gusted that because of the applexity of the proposed revisions. COR preliminary scoring of a site during the site anno ment process would be impractical because sites would advance too far in the site assessment process before they were determined not to be NPL candidates. Several sters stated that, with the additional requirements, the proposed HRS is more of a quantitative riskessent tool than the screening tool it is a apposed to be. Another suggested that the increased accuracy of the proposed rule over the original HRS is of marginal value relative to the amount of time and money involved, and that the HRS is no longer a quick and inexpensive method of assessing relative risks associated with sites.

Several commenters expressed concern that the increased data requirements of the proposed HRS would affect the schedule of the entire site assessment process. They suggested that these requirements would create a backlog of sites to be evaluated, alow the process of listing sites, and delay cleanup. Some noted that this would be contrary to the goal of identifying and evaluating sites expeditiously.

In response, the Agency believes the requirements of the final rale are within the scope of the site assessment process and that a new screening tool to determine whether a site should undergo an HRS evaluation will not be needed. To assist in screening sites, the site assessment process is divided into two stages:

• A preliminary assessment (PA), which focuses on a visual inspection, collection of available local, State, and Federal permitting data, site-specific information (e.g., topography, population), and historical industrial activity; and

 A site inspection (SI), where PA data are augmented by additional data collection, including sampling of appropriate environmental media and wastes, to determine the likelihood of a site receiving a high enough HRS score to be considered for the NPL.

The field test identified a bestestimate of the average and range of costs incurred to support the data requirements of the proposed HRS. These cost estimates represented the entire site assessment process from PA to SI, and comprehensive evaluations for all pathways at most sites. As such, the Agency believes these cost estimates overstate the costs associated with site assessments occurring on the greater universe of CERCLA sites. The amount of data collected during an SI varies from site to site depending on the complexity of the site and the number of environmental media believed to be contaminated. Some Sis may be limited in scope if data are easy to obtain, while others require more substantial resource commitments. The most important factors in determining costliness of an Si are (1) the presence or absence of ground water monitoring wells in situations where ground water is affected, and (2) the number of affected media, which determines the number of samples taken and analyzed. The Agency believes the greater universe of CERCLA sites will not require the more substantial resource commitments.

Finally. EPA does not agree that the requirements of the final rale will delay the listing of sites. The site assessment process screens sites at each stage, thereby limiting the number of sites that require evaluation for scoring. The Agency believes that it will be possible to score sites expeditionally with the revised HRS.

The Agancy believes the additional data requirements of the final rule will make it more accurately reflect the relative risks posed by sites, but also that the HBS should be as simple as possible to make it easier to implement and to retain its usefulness as a screening device. This approach responds to the majority of commenters who recommended that EPA simplify the proposed HRS to make it easier and less expensive to implement. In response to these co ments, the rule adopted today includes a sumber of inges from the proposed rule that splify the HRS. These simplifying chain es were based largely on EPA's ch field test of the proposed rule, sensitivity studies, and issue analyses undertakin by EPA in response to COR

 In the surface water migration pathway, the proposed recreation throat has been eliminated as a separate threat. Instead of requiring a separate set of detailed calculations and data, the final rule accounts for recreational use exposures through resources factors, where points may be added for recreation use.

• In the ground water migration pathway, the proposed potential to release has been simplified by dropping "sorptive capacity." by revising "depth to aquifer" and making it a separate factor, and by eliminating the vequirement to consider all geological layers between the hazardous substance and the equifer is evaluating travel time to the aquifer. The "travel time" factor (the depth to aquifer/hydraulic conductivity factor in the proposed rule) is now based on the layer(s) with the lowest hydraulic conductivity.

In the three migration pathways (i.e., ground water, surface water, and air), the use factors in the proposed rule—"land use" in the sir migration pathway, "drinking water use" and "other water use" in the ground water migration pathway, and "drinking water use" and "other water use" in the surface water migration pathway—have been replaced by "resources" factors. The "fishery use" factor has been dropped from the surface water migration pathway. A resources factor has been added to the soil exposure pathway.

• In the soil exposure pathway, the requirement that children under seven be counted as a separate population has been dropped. The "accessibility/ frequency of use" factor has been replaced by a simpler "attractiveness/ accessibility" factor.

• In the surface water migration pathway, the "runoff curve number." which required determining the predominant land use within the drainage area, has been replaced by a simpler factor, "soil group," which only requires classifying the predominant soil group in the drainage area into one of four categories.

 In the air migration pathway, the maps used to assign values of particulate migration potential (formerly particulate mobility under potential to release) have been simplified.

 In all pathways, potentially exposed populations are assigned values based on ranges rather than exact counts, reducing documentation requirements.

 In the surface water and ground water migration pathways, Level III benchmarks have been dropped.

• In all pathways, hazardous waste quantity values are based on ranges, which will reduce documentation requirements. The methodology and explanation for evaluating the hazardous waste quantity factor have been simplified.

• Containment tables have been simplified in the air, ground water, and surface water migration pathways.

A number of the simplifications, such as the changes to the travel time and hazardous waste quantity factors, better reflect the uncertainty of the underlying site data and, therefore, do not generally affect the accuracy of the HRS. In addition, EPA notes that some revisions that may appear to make the HRS more complex actually make it more flexible. For example, the hierarchy for determining hazardous waste quantity allows using data on the quantity of hazardous constituents if they are available or can be determined; additionally, data on the quantity of hazardous wastestreams, source volume, and source area can be used, depending on the completeness of data within the hisrarchy. The hierarchy allows a site to be scored at the most precise level for which data are reasonably available, but does not require extensive data collection where available data are less precise.

In response to comments on the complexity of the rule language, the presentation of the HRS has been reorganized and clarified. Factors that are evaluated in more than one pathway are explained in a separate section of the final rule (§ 2) to eliminate the repetition of instructions. The proposed HRS included descriptive background material that, while useful, made the HRS difficult to read. Much of this descriptive material has been removed from the rule.

B. HRS Structure Issues

Although the proposed rule retained the basic structure of the original HRS, a number of commenters felt that the HRS should provide results consistent with the results of a quantitative risk assessment. Several commenters identified this issue explicitly, while others identified specific aspects of the proposed rule that they believed to be inconsistent with basic risk assessment principles. The commenters maintained that if the HRS is to reflect relative risks to the extent feasible, as required by the statute, its structure should be modified to better reflect the methods employed in quantitative risk assessments. Commenters stressed the need for EPA. to follow the advice of the EPA Science Advisory Board (SAB) as expressed in the SAB review of the HRS:

Revisions to the HRS should begin with the development of a chain of logic, without regard for the sase or difficulty of collecting data, that would lead to a risk assessment for each site. This framework, but not the underlying logic, would be simplified to account for the very real difficulties of dats collection.

This chain of logic * * * should lead to a situation in which an increased score reflects an increased risk presented by a site.

In response to the structural issues raised by commenters and to the statutory mandate to reflect relative risk to the extent feasible. EPA made a number of changes to the final rule. These structural changes affect how various factors are scored and how scores are combined, but do not involve changes in the types or amount of data required to score a site with the HRS. The Agency stresses that the limited data generated at the SI stage are designed to support site screening, and are not intended to provide support for a quantitative risk assessment.

General structural changes. While the final rule retains the basic structure of the proposed rule in that three factor categories (likelihood of release, waste characteristics, and targets) continue to be multiplied together to obtain pathway scores, the structure has been changed in certain respects to make the underlying logic of the HRS more consistent with risk assessment principles.

The key structural changes to the waste characteristics factor category were to-make use of consistent scales and to multiply the hazardous waste quantity and toxicity (or, depending on the pathway and threat, toxicity/ mobility, toxicity/persistence, or toxicity/persistence/bioaccumulation) factors. Within the waste characteristics factor category, factors have been modified so they are on linear scales. These modifications make the functional relationships between the HRS factors more consistent with the toxicity and exposure parameters evaluated in risk assessments.

Where possible, the final rule assigns similar maximum point values to factor categories across pathways. The likelihood of release (likelihood of exposure) factor category is assigned a maximum value of 550; the waste characteristics factor category is assigned a maximum value of 100 (except for the human food chain and environmental threats of the surface water migration pathway); the targets factor category is not assigned a maximum. EPA determined that in general targets should be a key determinant of site threat because the data on which the targets factors are based are relatively more reliable than most other data available at the SI stage.

Likelihood of release. Except in the air migration pathway, the proposed rule assigned the same maximum value to observed release and potential to release. In the final rule, an observed release is assigned a value of 550 points and potential to release has a maximum value of 500 in all pathways. This relative weighting of values reflects the greater confidence (the association of risks with targets) when reporting an observed release as opposed to a potential release. As a result of this change in point values at the factor category level, as well as the new maximums for most pathways, the values assigned to individual potential to release factors have been adjusted.

Waste characteristics. The proposed rule assigned a maximum point value to

hexardous substance quantities of 1.000 pounds. Because some also have incordous substance quantities for in excess of that amount and because it is reasonable to assume that these sites present some additional risk, all else being equal, the final rule elsevates the maximum value to quantities in eccess of 1.000,000 pounds. Even when hexardous waste quantities in eccess documented with precision, EPA concluded that there are diminishing rotums in considering quantities above this amount.

Although the ISIS does not employ the same type and quality of informatis that would be used to support a risk accounting (e.g., pounds of waste and mobility are combined in the ground the pathway as a surregate for long-m magnitude of salenses), as waste characteristics values rise, contamination resulting from conditions at the altes in general about be worse. As a result of using inner scales and cistics velo to a storik of using mater scars and acceptedies of a multiplicative absticable between jugardous weste ty, toxicity, and other waste ectationics factors, the influence of the waste characteristics factor category id be disproperticately large stive to the likelihood of releas inter and ets factor categories in determini I pathway scores. Therefore, EPA ting descels use of a scale formation—the values assigned to he weste characteristics facto category, shown in Table 3-7 of the final HRS, to limit the effect of weste actaciatics on the politivery accres.

While the woote characteristics factor es are limited to values of 0 to 100 in nest cases, the weste characteristics actor cologory may such when of factor category may reach values of up to 1.000 for both the burnen food chain tal threats in the surface d anylas water migration pathway. These exceptions have been made to therey. These plate the bioaccum factor (or ecosystem biseccumulation factor), applied in these threats but not ictor), app Anneys or threats, which can u: piel id up to four orders of megnitude to te waste characteristics factor values efece soduction to the scale values of 0 to 1.400.

Targets. The final rule includes two major structural changes to the targets factor category. Population factor values are not capped as they wave in the proposed rule. This change allows a site with a large population but a low waste characteristics value to receive scores similar to a site with a smaller population but larger waste characteristics value (as would be done in a risk assessment). A second change in the targets factors involves the nearest individual (or intake or well) factors (i.e., the maximally exposed individual factors in the proposed rule). These factors are now assigned values based on exposure to Level I and Level II contamination (30 and 45 points, respectively). Potentially exposed mearest individuals are assigned a maximum of 20 points in all pathways. EPA changed the assigned values for these factors to give more relative weight to individuals that are exposed to documented contamination.

C. Honordous Waste Quantity

In the NPRM. EPA proposed to change the hanardous waste quantity factor to allow the use of four levels of data depending on what data are available and how complete they are. Hazardous waste quantity for a source could be based on (a) hazardous constituent quantity. (b) the total quantity of hazardous wastes in the source. (c) the volume of the source, or (d) the area of the source. Each source at the site would be evaluated separately, based on data available for the source.

EPA received sumerous comments relating to changes in the hazardous waste questity factor. Several commenters agreed that allowing use of waste constituent data, when available, was an improvement over the original HRS. Several also supported the tiered approach to acoring hazardous waste quantity when constituent data were incomplete or unavailable.

Two commenters stated that the nels on hazardous constituent data will require more extensive and expensive site investigations. These status have misunderstood the revisions. The rule does not require the scorer to determine beserdous constituent quantities in all instances. but simply encourages use of those data when they are available. This approach allows a scorer the flexibility to use different types of available data for scoring hezardous waste quantity. At a m, the scorer need only determine the area of a source (or the area of observed contamination), which is routinely done in site inspections. Where better data are available, they may be used in accoring the factor. This approach is in keeping with the intent of Congress that the HRS should act as a screening tool for identifying sites warned g further investigation.

Several commenters stated that the methodology for determining hazardous waste quantity was too complex and time comsuming, and that its administrative costs outweighed its benefits. Others found the proposed rule instructions and tables confusing and hard to follow. EPA strongly disagrees with the claim that the costs of the revised approach to scoring waste quantity outweigh its benefits. The amount of hazardous substances present at a site is an important indicator of the potential threat the sile poses. At the same time, EPA recognizes that cost is an important consideration. In revising the hazardous waste quantity factor, however, the Agency believes it has established an appropriate balance between time and cost required for scoring this factor and the degree of accuracy needed to evaluate the relative risk of the site property.

In response to comments, EPA has modified the hexardous waste quant de geonitiv scoring methodology to make it easie er to inderstand and to use. The chan include elimination of proposed rule Table 3-13, Hazardous Weste Quantity Factor Evaluation Methodology and Worksheet. In addition, the scale for the hazardous waste quantity factor has hazardons waste quanty areas in been divided into ranges that span two orders of magnitude (100x) to reflect the uncertainty inherent in estimates of hazardons waste quantities at typical hezardons waste quantities at typical sites. The practical effect of this scale ch. ge is to reduce the data collection and documentation requirements. See \$5 2.4.3-2.4.2.2. The final rule also clarifies the treatment of westes classified as hezardous under RCRA. Under CERCLA, any RCRA hezardow waste stream is considered a hezardous substance. If this definition were strictly applied in evaluating hazardous waste quantity of BCRA hazardous wastestrooms, hezerdous constituent estity and hexerdous westestreen quantity would be the same because the entire westerstream would be considered Q1 a hezardous substance. The final role makes clear that only the constituents in a RCRA wastestream that are CERCLA hezerdous substances should be evaluated for determining hezerdous constituent quantity, for the other three tiers, however, the entire RCRA westestreen is considered as is any other washestreen.

As discussed in section III Q. EPA will consider removal actions when calculating waste quantities. EPA believes consideration of removal actions is likely to increase incentives for rupid actions. If there has been a removal at a site, and the hazardous constituent quantity for all sources and associated releases is adequately determined, the bazardous waste quantity factor value will be based only on the amount remaining after the removal. This will result in lowering some bazardous waste quantity factor values. Where an adequate determination of the hazardous constituent quantity remaining after the removal cannot be made. EPA has established minimum hazardous waste quantity factor values in order to ensure that the HRS score reflects any continuing risks at the sites. In this case, the assigned hazardous waste quantity factor value will be the current hazardous waste quantity factor value (as derived in Table 2–6), or the minimum value, whichever is greater.

The proposed rule assigned a minimum hazardous waste quantity factor value of 10 when dats on hazardous constituent quantity was not complete. In the final rule, for migration pathways (i.e., not the soil exposure pathway), if the hazardous constituent quantity is not adequately determined, and if any target is subject to Level I or II contamination, the minimum hazardous waste quantity factor value will be 100.

If the hazardous constituent quantity for all sources is not adequately determined, and none of the targets are subject to Level I or II contamination, the minimum factor value assigned for hazardous waste quantity depends on whether there has been a removal action, and what the hazardous waste quantity factor value would have been without consideration of the removal action. If there has not been a removal action, the minimum hazardous waste quantity factor value will be 10. If there has been a removal action and if a factor value of 100 or greater would have been assigned without consideration of the removal action, a minimum hazardous waste quantity factor value of 100 will be assigned. If the hazardous waste quantity factor value was less than 100 prior to consideration of the removal action, a minimum hazardous waste quantity factor value of 10 will be assigned. This will ensure that the Agency provides an incentive for removal actions and that in no case will consideration of removal actions result in an increased hazardous waste quantity factor value score.

D. Toxicity

The proposed HRS substantially changed the basis for evaluating toxicity. The major change was that hazardous substance toxicity would be based on carcinogenicity, chronic noncancer toxicity, and acute toxicity. For each migration pathway and each surface water threat except human food chain and recreation, toxicity was combined with mobility or persistence factors to select the hazardous substance with the highest combined value for toxicity and the applicable mobility or persistence factor. For the human food chain threat, only substances with the highest bioaccumulation values were evaluated for toxicity/persistence. For the recreation threat, only substances with the highest dose adjusting factor values were evaluated for toxicity/persistence. In addition, ecosystem toxicity rather than human toxicity was evaluated for the environmental threat of the surface water migration pathway.

Several commenters expressed concern about or opposition to using the single most hazardous substance at a site to score toxicity, stating that the approach seems overly conservative and unlikely to distinguish sites on the basis of hazard. Some commenters suggested that EPA allow flexibility in weighting the toxicity values of multiple substances either by concentration, waste quantity, or proportion information, whenever such information is available. One commenter suggested basing toxicity on a fixed percentage of the hazardons substances known to be present at a site.

The Agency agrees that, for purposes of accurately assessing the risk to human health and the environment posed by a site, it would be preferable to evaluate the overall toxicity by considering all hazardous substances present, based on some type of dose- (or concentration-) weighted toxicity approach. EPA believes, however, that this approach is not feasible because the data requirements would be excessive. Such an approach would be feasible only when relative exposure levels of multiple substances are known or can reasonably be estimated; however, these data can be obtained only by conducting a comprehensive risk assessment Extensive concentration data would be required to be confident that comparable concentrations are being used for the various substances, and that the multi-substance toxicity of the contaminants is not, in fact, being underestimated. Use of inadequate data could result in underestimating or overestimating the toxicity of substances in a pathway.

EPA considered a number of alternatives to the use of a single hazardous substance to score toxicity (mobility/persistence) and tested some of these on several real and hypothetical sites. The analyses included comparisons between the single most toxic substance and the average toxicity value for all substances, the average toxicity value for the 10 most toxic substances, and the concentrationweighted average value of all substances. These alternatives were also tested using toxicity/mobility

values. The results of these analyses showed that using a single substance approach usually resulted in an assigned value (either toxicity or toxicity/ mobility) that was within one interval in the scale of values of the alternatives tested; for example, the single substance approach would assign a value of 1,000 for toxicity whereas averaging the toxicities would assign a value of 1,000 or 100, the next lower scale value. (The final rule uses linear scales to assign values for toxicity, mobility, and persistence. The scales for toxicity now range from 0 to 10,000 rather than 0 to 5; consequently, the default value for toxicity is now 100 rather than 3.) The Agency recognizes the uncertainty in the use of the single substance approach, but concludes that it is a reasonable approach for a screening model. especially given the general unavailability of information to support alternatives. In making this judgment, the Agency notes that the single substance approach to evaluating the toxicity factor was not identified in SARA as a portion of the HRS requiring further examination, even though it had been used in the original HRS and EPA had received criticism similar to the above comments prior to the enactment of SARA.

Several commenters suggested that additive, synergistic, or antagonistic effects among substances be considered in scoring toxicity when several substances are found at a site. In particular, one commenter suggested increasing the scores for sites with a large number of hazardous substances to account for additive or synergistic effects.

As noted in EPA's 1968 Technical Support Document for the Proposed **Revisions to the Hazard Ranking** System, quantitative consideration of synergistic/antagonistic effects between hazardous substances is generally not possible even in RI/FS risk assessments because appropriate data are lacking for most combinations of substances. Interactive effects have been documented for only a few substance mixtures, and the Agency's risk assessment guidelines for mixtures (51 FR 34014, September 24, 1986) emphasize that although additivity is a theoretically sound concept, it is best applied for assessing mixtures of similar acting components that do not interact. Thus, the Agency believes that consideration of interactive effects in evaluating toxicity in the HRS is not feasible, nor is it necessary to allow use of the HRS as a screening model. The Agency rejects the suggestion that scores should simply be raised for sites

with summerous substances because this approach ignores the technical complexities related to interactions (i.e., the possibility of antegenistic effects.) One commenter suggested that a

One community supported that a waste's testicity should be assessed in terms of its "diagree of risk," and that this could be measured by comparing constituent concentrations at the point of exposure to appropriate toxicity reference lovels. Two communities stated that testicity about he measured at a likely point of luman exposure rather thus at the waste site.

e tendely of a substance, as used in Th the HRS, is an inherent property, often expressed quantitatively as a dose or expense concentration associated with a specific suppose (i.e., a dose susponse p). These texicity veloc **6**, 10 general, are independent of expected environmental expected envelopment are based on laboratory tests on animals. Rick, on the other hand, is a nimels. Risk, on the other hand, is a metion of tunicity, the concentration of substance in environmental media to which humans may be exposed, and the Multimod of exposure to that modifies (and the population likely to be (and the population likely to be exposed). The tendely factor in the waste characteristics factor category of the HRS is intended to reflect only the inherent texticity (i.e., the basic donespense substanship) of substances and at the site. The HRS as a whole is tended to evaluate, to the extent tive risks peeed by sites by tern for Hustihood of Ale. sel ding factors for Ma including inclusion for momentum or release, waste quantity, indicity, and the proximity of potentially exposed commission. If actual contamination (for proximity of potentially exposed populations. If actual contamination (example, of detailing water) has been cied at a site, the measured reasontal concentration of each envices substance is compared with its appropriate health-based or ecological-based concentration limit (i.e., its beachmark). If these appress accentrations equal or encode a inchancel, contain target factors are argued higher values then if al higher values true is remarked concentrations are less then bunchmarks.

Two commentates suggested using Concer Polency Pacters to accre texticity only for Class A and B1 carcinogens, and using soficence doese (RfDo) for scoring Class B2 and C carcinogens (i.e., substances for which there is inadequate or no direct human evidence of carcinogeneous (ity).

of carcinogenericity). In response, EPA believes that because the HES is a screening tool, it should maintain a conservative (i.e., protective) approach to evaluation of potential cancer risks. EPA's 1906 Guidelines for Carcinogen Risk Assessment (E) FR 19014. September 24. 1909 provide for substances in Class A and Class B/both B1 and B2) to be regarded as suitable for quantitative human risk assessment. In general, according to BPA's 1980 Risk Assessment Gaidance for Saperfund: Human Haakh Brahaction Manael Class C substances are evaluated for cancer risks within the Superfund risk assessment process. Thus, the use of cancer risk information for Class B2 and C substances in the HRS is consistent with the objective of maintaining a conservative approach and with other Agency and Superfund program risk assessment guidelines.

In response to comments that the best available data should be used to score sites, that accepted Agency practices be relied on, and that consistency across through the encouraged, the Agency has modified slightly the way the toxicity value for a substance is elected. The final rule requires the use of curcinogenicity and chronic toxicity data, when available, over acute toxicity data, wh data. When average, over mean many data. If both slope factors and RfDs are available, the higher of the values assigned for these types of toxicity eters is used. If neither is available, but acute toxicity data are evailable, the acute toxicity data are used to assign toxicity factor values. EPA decided to give preference to slope factors and RD values because these undergo more extensive Agency review and are based on long-term exposure studies.

E. Rodiomiclides

The proposed HRS assigned radiomuclides a maximum toxicity value, but included no other procedures specific to radiomuclides.

One commenter, the U.S. Department of Energy (DOE), assorted that the proposed HES " * " contains an sitable bias regarding radiomeclides DOE specifically criticized igning maximum toxicity factor values to radiometides. "* is fact, the health impact associated with radiomaclides is associated with the type of decay, the level of decay energy, the balf-life, the mobility, the stration of the radionuclide. internal biological factors, and external pethway factors." DOE proposed using concepts for evaluating radiomachides that were included in its Modified Hasard Ranking System (mHRS). In its ibeequent co ments on the HRS field subsequent comments on the risco near test report, DOE stated that it considered the "" " method of bandling redionuclides in the proposed revised HRS to be a serious flaw in the eres l

evaluation system." In the final rule, EPA has clarified and significantly changed how radionuclides are evaluated, instead of using or adopting the millS directly, however, EPA modified the proposed HBS to account more faily for radioanclides based on EPA's own methods for evaluating them, which are similar to and generally consistent with the radiation analysis concepts underlying the millS.

The final rule evaluates radiosoclides within the same basic structure as other hazardous substances, and the evaluation of many individual HRS factors is the same whether radionuclides are present or not. Table 7-1 of the final rule lists HRS factors and indicates which are evaluated differently for radionaclides. Essentially, radionuclides are simply treated as additional hazardous substances with certain special characteristics that are accounted for by separate scoring rules for some HBS factors. For siles containing only radionactides, the scoring process is very similar to the process at other bezerdous substance sites, except that different scoring roles are applied to a number of substance-specific factors and a few other factors. For sites containing both radionnelides and other hexardous substances, both types of substances are soured for all HRS factors that are substance-specific, with overall factor values based either on combined values or the higher of the values, as appropriate. EPA noise that, although some

radioactive substances are statutorily excluded from the definition of hazardous wests" in both CERCLA and RCRA (specifically, source, special nuclear, and byproduct material as defined in the Atomic Energy Act of generally are, "hazardous subs 1954), such substances may be, and LC. ed in section 101(14) of CERCLA and therefore may be addressed u CERCLA. Radioactive substances red under ~ should be included in HES scoring and section 7 of the final rule is intended to facilitate that analysis. It also should be noted that two narrow categories of releases (either from "nuclear incidents" or from sites designated under the Uranium Mill Tailings Radiation Control Act of 1970) are excluded from CERCLA's delivition of the term "release" (CENCLA section 101(22)), and such mis as should not be scored using the HES.

The major changes to the HRS in the evaluation of radionuclides apply to, establishing observed releases, to factors in the waste characteristics category, and to determining the level of actual contamination in the targets factor category. The HRS components that have been modified are briefly described below. The criteria for establishing an observed release through analysis of samples for radionuclides differ considerably from the criteria used for other hazardous substances. These criteria are divided into three groups: radionuclides that occur naturally or are ubiquitous in the environment; manmade radionuclides that are not ubiquitous in the environment; and gamma radiation (soil exposure pathway only). (See § 7.1.1.)

The hazardous waste quantity factor for sources (and areas of observed contamination) containing radionuclides has been modified to reflect the different units used to measure the amount of radiation (curies, a measure of activity) versus the units used for other hazardous substances (pounds, a measure of mass). KPA believes it is preferable to use activity units rather than mass units because activity is the standard measure of radiation quantity and is a better indicator of energy released and potential to cause human health damage than is mass. In addition, the hierarchy for evaluating the waste quantity factor for sources (and areas of observed contamination) containing radionuclides is limited to Tiers A and B. Tiers C and D, based on source volume and source area, respectively. are not used because adequate data to derive their quantitative relationship to Tier A were unavailable. Thus, the waste quantity factor is based either on radionuclide constituent quantity (Tier A) or radionuclide wastestream quantity (Tier B).

For sites containing only radionuclides, hazardous waste quantity is calculated based on the activi'y content of the radionuclides or radionuclide wastestreams associated with each source. For sites with both radionuclides and other hazardous substances, hazardous waste quantity is evaluated separately for the two type of hazardous substance for each source, and the values are then summed in determining the hazardous waste quantity value. The scale for scoring radionuclide waste quantity was derived based on concepts of risk equivalence between radionuclides and other hazardous substances.

In the proposed rule, all radionuclides were automatically assigned a maximum default value for the toxicity factor. The final rule evaluates radionuclides individually on the basis of human toxicity, across a range of factor values based on the potential to cause cancer (i.e., cancer slope factors). Non-cancer effects are not considered for radionuclides because cancer is generally the most significant toxic effect. Incorporated in the development of cancer slope factors are the type of radioactive decay; energy emitted during decay; biological uptake, distribution, and retention; and radiation dose-response relationship. Thus, across the set of scoring ranges used, radionuclides that are more potent carcinogens per unit activity new receive higher toxicity factor values than those that are less potent. The new toxicity scoring scale for radionuclides was derived in a manner consistent with the derivation of the existing carcinogenicity scale for other hazardous substances. Taken together, the new toxicity and hazardous waste quantity scales for radionuclides result in a risk equivalence between radionuclides and other hazardous substances.

Mobility of radionuclides in both the air and ground water migration pathways is evaluated in the same way as mobility for other hazardous substances; that is, on the basis of the chemical and physical characteristics of the radionuclide. Similarly, the bioaccumulation (and ecosystem bioaccumulation) potential factor is evaluated in the same way for radionuclides as for other hazardous substances. The final rule clarifies that radionuclides should be scored for these factors in all relevant pathways.

The persistence factor in the surface water migration pathway has been modified so that radionuclides are evaluated solely on the basis of half-life, which for HRS purposes is based on both radioactive half-life and volatilization half-life. Sorption to sediments is not considered, nor are hydrolysis, photolysis, or biodegradation. Other than this change in the processes considered to estimate surface water half-life, the scoring of the persistence factor is the same for radionuclides as for other hazardous substances.

The final rule extends to radionuclides the benchmark concept used throughout the HRS for weighting certain targets factor values. Measured levels of specific radionuclides at potential exposure points are compared to benchmark levels, and additional weight is given to targets subject to actual contamination (Levels I and II). This approach for weighting target factors using benchmarks is similar for radionuclides and for other hazardous substances, although both the specific benchmark values used for radionuclides and the methods for deriving the values are different. Benchmarks for evaluating radionuclide contamination parallel those used for

other hazardous substances in that available Federal standards and screening concentrations are used when applicable. At sites with both radionuclides and other hazardous substances, each radionuclide and other substance is evaluated separately. If no individual substance equals or exceeds its benchmark, the ratios of the measured concentrations to the screening concentrations for cancer for radionuclides and other hazardous substances are added. Radionuclides are not evaluated using screening concentrations for non-cancer effects.

Specific benchmark values for radionuclides are in activity units instead of mass units, however, to reflect the appropriate measurement units for the level of radionuclide contamination. Radionuclide benchmarks include drinking water maximum contaminant levels (MCLs) for both the ground water and the surface water/drinking water threat pathways; Uranium Mill Tailings **Radiation Control Act (UMTRCA)** standards for the soil exposure pathway; and screening levels corresponding to 10⁻⁴ individual cancer risk for inhalation or oral exposures, as derived from cancer slope factors, for all pathways and threats incorporating human health benchmarks. The radionuclide benchmarks are consistent with EPA's radionuclide risk assessment methods in that they incorporate standard data or assumptions about contact/consumption rates for various environmental media and radiation dose-response, as well as the specific radionuclide's type of decay, decay energy, biological absorption, and biological half-life. Furthermore, radionuclide benchmarks for the soil exposure pathway account for external exposure (i.e., exposure to radiation originating outside the human body) from gamma-emitting radioactive materials in surficial material as well as from ingestion, which is the sole basis for non-radioactive hazardous substance benchmarks for the soil exposure pathway, because external exposure from gamma-emitting radionuclides can be an extremely important exposure route.

F. Mobility/Persistence

The proposed rule added mobility factors to both the ground water and air migration pathways and modified the persistence factor in the surface water migration pathway to consider a greater number of potential degradation mechanisms.

The Agency received a large number of comments critical of several aspects of the ground water mobility factor. The most common intensis included: • Concern about the use of coefficients of oppose migration to establish a size

 Concerns about the use of coefficients of equeous migration to establish mobility vehace for incorganic coffees and enters;
 Summittees that each tree

cations and anisms; • Suggestions that schubility values, distribution coefficients, and other measures be used to establish mobility values for anisons and cations; and

 Requests that the same measures of mobility be used for organics and incomming.

micromer. Criticism of the use of the coefficients of aqueous migration focused on its obscurity; escept for geochemists, for scientists are familier with the measure. In response to these comments and because coefficients of aqueous migration are not evaluable for all heserieus substances and radiomedidas, the Agency decided to replace coefficients of aqueous migration.

The susjectly of commanders stated a preference for using parameters related other to homodous substance relatese (solubility) or to transport (distribution coefficients) as measures of mability. The ground water mobility factor is intended to select the fraction of a hexatees substance expected to be released from sources, migrate through porous madia, and contaminate aquifers and the detaking water wells that draw from them. Because mobility is concerned with both release and transport, the Agency concluded that mobility for all hexatees and that mobility for all hexatees and transport, the Agency concluded that mobility for all hexatees and point substity and distribution coefficient values. A default value is assigned when none of the hexated can be assigned a mobility factor value based on available data.

be assigned a mobility factor value based on evaluable data. A number of communities raised questions about the persistance factor in the surface water migration pathway. In general, the communities wave divided between these who wanted more degradation mechanisms considered and these who believed the equation in the proposed rule for calculating halflives was too complex. Several communities complex. Several sception of substances by echnomic.

In response to finse comments, EPA has made several changes to the persistance factor. The free-radical axidation half-life has been dropped from the equation used to calculate halflife because the data on which its halflife values are based are typically derived from ideal, laboratory conditions that differ gravity from conditions found in nature, few field validation studies have been conducted to provide a basis for extraociating these laboratory values to natural environments. Thus, BPA concluded that including free-radical oxidation in the persistence equation resulted in an overcomphasis of the influence of freeradical oxidation as a degradation machenian. For hexardous substances that aerb readily to particulates found in natural water bodies, the persistance equation as proposed overemphasized the impartance of degradation mechanisms that occur in the liquid phase. Log Kor, the logarithm of the noctanol-water partition coefficient, has been added to account for sorption to secliments.

The Agency succived several comments concerning the mobility factors in the sir migration pathway. The most significant of the issues raised by commenters were:

 Whether consideration of mobility in both the likelihood of release factor category and the waste characteristics factor category counts mobility twice; Whether the approach used in the

 Whether the approach used in the proposed rule property reflected the dynamics of releases of gases from sources into the atmosphere; and

 Whether the Thornthwaite P-E Index was sufficient as the sole measure of particulate mobility and whether particle size should be included.

In response to these and other related structural and air migration pathway ments, the Agency thoroughly reassessed the adequacy of the mobility factors in the likelihood of release and ste characterístics factor categories. and on this review, EPA has made several changes to the mobility factors in the final rule. In response to the "double counting" issue, the Agency believes there are differences between mobility in the context of likelihood of release and mobility in the context of waste characteristics. The potential to release mobility factor is a measure of the likelihood that a source at a site will nese a substance to the air: the waste characteristics mobility factor, together with the bazardous waste quantity factor, is a measure of the magnitude of release. To highlight these differences, the names of the likelihood of release mobility factors have been changed to in response to comments on air

In response to communits on air mignation pathway mobility and structure. EPA reviewed gas and particulate release rate models to develop revised mobility factors that improve evaluations of release magnitude and duration. The gas and particulate mobility factors in the final rule are a result of that review. The gas mobility factor is based on a simplified release model and is determined by the vapor pressure of the most toxic/mobile becardous substance available for migration to the atmosphere at the site. The particulate mobility factor is based on a simplified fine-particle winderosion model and reflects the combined effects of differing wind speeds and soil moisture. Analyses indicated that soil moisture was dominant over both wind speed and particle size, which are essentially equal in effect. Because of the comparative difficulty of determining particle sizes in an SI, a single particle size was assumed to apply to all size. This constant particle size value was factored into the simplified model yielding the factor in the final rule.

G. Observed Release

The proposed HRS described how to determine whether an observed release was significantly above background levels based on multiples of detection limits and background concentrations.

Some commuters stated that the proposed revisions treated observed release in an overly complex memory. A number of community, primarily from the mining industries, were concerned about the consideration of background concentration in determining an observed release. (See Section III P below for a summary of their concerns and EPA's response.)

As in the proposed rule, observed releases may be established based on either direct observation or chemical analysis of samples. In the case of direct observation, material (e.g. particulate matter) containing hazardown substances must be seen entering the medium directly or must have been deposited in the medium.

EPA has replaced the proposed rule criteria for establishing an observed release by chemical analysis with pler criteria. In the final HIRS, an observed release is astablished when a sample measurement equals or exceeds the sample quantitation limit (SQL) and is at least three times above th background level, and available information attributes some portion of the rolouse of the haza Jour substance to the site. (The SQL is the quantity of a hezerdous substance that can be escently quantiled, given the limits detection for the methods of analysis of detects and sample characteristics that may and sample characteristics out may affect quantitation (e.g., dilution, concentration).) When a background concentration is not detected (i.e., below detection limits), an observed release is established when the sample measurement equals or exceeds the SQL. Any time the sample m is less than the SQL, no observed release is established. Table 2-3 of the

final rule provides the criteria for determining when analytic sampling information is sufficient for establishing an observed release (or observed contamination in the soil exposure pathway). The final rule also provides procedures to be followed when the SQL is unavailable and defines various types of detection and quantitation limits in the context of the HRS. (See § 2.3 of the final rule.)

H. Benchmarks

SARA requires that EPA give highpriority to sites that have led to closing of drinking water wells or contamination of principal drinking water supplies. To respond to this mandate, the proposed rule added health-based benchmarks to the ground water and surface water migration pathways; in addition, ecological-based benchmarks were added to evaluate sensitive environments targets in surface water. In the proposed rule population factors were evaluated at Level I if a health-based benchmark had been exceeded. If actual contamination was present, but the benchmark was not exceeded, populations were evaluated based on two levels of contamination (i.e., Level II and Level III). Sensitive environments in the surface water migration pathway were evaluated based on two levels of actual contamination (exceeding benchmark or not exceeding benchmark). Where several hazardous substances were present below benchmarks, the percentages of their concentrations relative to their benchmarks were added to determine which level was used to assign values.

Of the commenters on this issue, most supported EPA's proposal to give extra weighting to sites where measured exposure-point concentrations exceed benchmarks. One commenter who dissented suggested giving extra weighting to sites where actual contamination is documented: documentation of an observed release (or observed contamination) would be the only criterion for assigning higher values to target factors, and the relationship of the concentration of hazardous substances to benchmarks would not be used. The other dissenting commenter suggested that EPA re-evaluate the role of health-based benchmarks in the HRS because common sense, and other laws, will discourage people from drinking water contaminated above benchmark levels. and because evaluating this factor will entail large resource expenditures for marginal gains in discrimination.

The final rule weights most targets based on actual and potential exposure to contamination across all pathways and threats, including those for which benchmarks were not originally proposed, because EPA believes that this approach both improves the ability of the HRS to identify sites that pose the greatest threat to human health and the environment and increases the internal consistency of the HRS. (See §§ 2.5, 2.5.1, 2.5.2, 3.3.1, 3.3.2, 4.1.2.3.1, 4.1.2.3.2, 4.1.3.3.1, 4.1.3.3.2, 4.1.4.3.1, 4.2.2.3.1, 4.2.2.3.2, 4.2.3.3.1, 4.2.3.3.2, 4.2.4.3.1, 5.1.3.1, 5.1.3.2, 63.1, 83.2, 8.3.4, 7.3.1, 7.3.2.) In the final rule, both the population factors and the factors reflecting the hazard to the nearest individual (or well or intake) are evaluated in relation to health-based benchmarks in all pathways. The sensitive environment factor in the surface water environmental threat is weighted in relation to ecological-based benchmarks; however, in the soil exposure and air migration pathways, the sensitive environment factor is weighted simply on the basis of exposure to actual contamination, and no benchmarks are used.

The Agency chose to use benchmarks in all pathways in response to comments that specifically suggested such a change; it is also responding to comments that the HRS should better reflect relative risks and that the approaches in all pathways should be consistent. The Agency has concluded that the concerns expressed by commenters outweigh the concerns about uncertainties in the evaluation of samples collected in air and soil and about the lack of regulatory standards and criteria on which to base soil or air benchmarks that led the Agency not to include benchmarks for those pathways in the proposed rule. In short, EPA carefully considered this point and concluded that the consistent application of benchmarks across all pathways provides for the most reasonable use of data given the purpose of the HRS as a screening tool.

EPA generally selected specific criteria based on applicable or relevant and appropriate requirements (ARARs), excluding State standards, that have been selected for the protection of public health and the environment as outlined in the NCP (55 FR 8686, March 8, 1990). In the HRS NPRM, EPA proposed to use MCLs, maximum contaminant level goals (MCLGs), and screening concentrations (SCs) based on cancer slope factors as drinking water benchmarks, and Food and Drug Administration (FDA) Action Levels as benchmarks for the human food chain threat. EPA also proposed to use Ambient Water Quality Criteria

(AWQC) as ecological-based benchmarks for the environmental threat. EPA received 21 comments from 12 commenters on which benchmarks the HRS should use and whether additional information should be considered in establishing benchmarks. Opinion was divided on the use of specific types of benchmarks: three commenters supported the use of MCLs; three did not. Two commenters supported the use of MCLGs, two opposed such use, and one suggested that EPA consider the economic impact of using the value of 0 (i.e., the MCLG for a carcinogen) as a health-based benchmark. Two commenters suggested including relevant State drinking water standards, and one suggested including concentrations based on RfDs. One commenter expressed concern that the current lack of water quality standards for many substances might make the benchmark system ineffective in Identifying sites that pose a significant threat to human health. Two commenters suggested that carcinogen weight of evidence should be used in establishing SCs (e.g., the individual risk level should be lower for a Class A carcinogen than for a Class B2 carcinogen). Two commenters suggested considering other important routes of exposure (e.g., inhalation of hazardous substances volatilized from water, or dermal contact with contaminated water) in establishing drinking water benchmarks.

EPA conducted a number of analyses on specific benchmarks and on the modification of factors to consider in establishing HRS benchmarks. As a result of public comments and these analyses, EPA has concluded that the HRS is improved by including concentrations based on nationally uniform standards, criteria, or toxicity values as health-based or ecologicalbased benchmarks in all pathways and threats. EPA's conclusion is based on several considerations. First, the addition of benchmarks across all pathways and the use of ARARs for those benchmarks improves linkages with the RI/FS process. That is, the HRS benchmarks will be those used most frequently during RI/PSs, and the additional points provided by equalling or exceeding a benchmark will aid in identifying areas requiring follow-up in the RI/FS. Second, the internal consistency of the HRS is improved by using benchmarks because concentrations measured at or above benchmark levels are treated in a parallel manner across all pathways, allowing more consistent and fuller use of the relatively costly sampling data

collected during the SL Third, the number of hexardous substances for which at least one handh-based or ecological-based binchmark is available is increased, allowing for more uniform accessment of situe actionwide.

seconsenent of siles anticarvide. The banchmark criteris that the Agency has concluded are most appropriate for each pathway and threat are listed balow. As discussed above, EPA agrees with comments suggesting that banchmarks also be used in the soil exposure and air migration pathways and has selected criteria for these pathways based upon the kinds of factors discussed above. While EPA believes the criteria for the soil exposure and air migration pathways in the final rule are appropriate, it is open to any comments that members of the public may wish to submit regarding these criteria and specifically solicits such comments at this time. EPA eaks that any such commants be submitted on balors (30 days after the date of publication in the Pulseal Register).

For the final rule; BPA has selected the following types of banchmarks in each pathency and threat, subject to any revisions in the celturie for air and soil exposure that may be made in response to comments. (Banchmarks for redissurchides are discussed in Section III E of this preamble.)

reflection common one wave III II of this preamble.) • Benchmarks in the ground weter migration pathway and the surface water drinking water threat include MCLs, non-area MCLGs, accussing concentrations (SCs) for non-concer effects based on RDs for analexposures, and SCs for concer based on shope factors for ceal exposures and 10⁻⁴ individual concer risk (see Table 3-10). Because SCs based on RDs and slope factors are used as drinking water banchmarks. MCLGs with a value of 0 have been dropped as HRS banchmarks. • Benchmarks in the surface water

 Buchmerks in the surface water human food chain threat include PDA Action Lovels for fish or shellfish. SCs for non-concer effects based on RIDs for oral exposures, and SCs for cancer based on aloge fecture for eral exposures and 10⁻⁴ individual cancer risk (see Table 4-17).
 Banchmerks in the surface water

 Benchmerks in the surface water environmental threat include AWQC and Ambient Aquestic Life Advisory Concentrations (AALACa): AALACa will be considered as they become evalishing (see Table 4-22).
 Benchmerks in the set

• Buchmarks in the soil exposure pethway include SCs for non-cancer effects based on RDs for anal exposures, and SCs for cancer based on slope factors for oral exposures and 10⁻⁶ individual cancer risk (see Table 5-3).

Bonchmerks in the air migration
pathway include National Ambient Air

Quality Standards, National Emission Standards for Hazardous Air Pollutants (NESHAPs) that are expressed in ambient concentration units. SCs for non-cuncer effects based on RfDs for inhalation exposures, and SCs for cuncer based on slope factors for inhalation exposures and 10⁻⁴ individual cancer risk (see Table 6-14).

Several commenters suggested technical refinements for deriving health-based benchmarks. Although qualifying information is useful and important and is, in fact, used extensively in the RI/FS process, the benefits of including such information in the HRS must be balanced egainst its limited scope and purpose as well as the limited data available to determine concentration at the point of exposure. Consequently, in the final rule:

 All health-based benchmarks are set in reference to the major exposure concern for each pathway or threat (e.g., benchmarks in the air migration pathway are set in reference to inhalation only; benchmarks in drinking water, the human food chain threat, and the soil exposure pathway are set in reference to ingestion), except for radiomodides for which external exposure is also considered in the soil exposure pathway;
 All benchmarks are set in reference

 All benchmarks are set in reference to uniform exposure assumptions that are consistent with RI/PS procedures (e.g., water consumption is assumed to be two liters per day, body weight is assumed to be 20 ket.

 State water quality standards and other State or local regulations are not included as benchmarks because they would introduce regional variation in the HRS;

 A hiszarchy has been developed to provide a single banchmark concentration for each hazardous enhetenes by methods and therest and

substance by pathway and threat; and • Qualitative weight-of-evidence is

not used in deriving SCs for carcinogens. In the NPRM, EPA requested

nts on how many tiers (levels) of CDE actual contamination to consider when iting populations relative to clamarks (i.e., which of three beach alternative methods presented should be adopted). EPA received two comments on this issue and three related mis regarding the weighting factors for each level. One comments supported Alternative 2 (i.e., use of two levels of observed contamination and one level of potential contamination). Another commenter suggested that Level II and Level III concentrations be combined to include the range of contaminant levels above background. but below health-hand benchmarks. A third commenter suggested that the

weighting factors for each level be reconsidered. A fourth communiter suggested that ½000 of a benchmark factor is inappropriate because it is excessively conservative and difficult to detect. The fifth commenter suggested that because Level III represents concentrations with cancer risks below 10⁻⁷, populations exposed to Lovel III concentrations should not be considered in the population category of drinking water threats.

EPA conducted a number of analyses on the subject of benchmark tiers and has dropped Level III contamination. In the final rule, Level I contamination is defined as concentration levels for targets which meet the criteris for actual contamination (see § 2.5 of the final rule) and are at or above media-specific benchmark levels; Level H contamination is defined as concentration levels for targets which either meet the criteria for actual contamination but are less than mediaspecific benchmarks, or most the criteria for actual contamination based on direct observation; and potential contamination is defined as targets that are potentially subject to releases (i.e., targets that are not associated with actual contamination for that pathway or throat). These three tiers are used to sign values to both the nearest individual (or well or intake) and th population factors. As a result of EPA's analyzes of benchmark issues, the weighting assigned to Level I and Level II contamination has been changed and mode consistent across pathways. For example, Level I populations are now multiplied by a factor of 10 in all pethways. As in the proposed rule, potentially contaminated populations and nearest individuals (or wells or intakes) are distance or dilution weighted.

The proposed rule summed the ratios of all hexandous substances to their individual banchmarks as a means of defining the level of actual commants on the appropriateness of this approach to scoring multiple substances detected in drinking water. Of the 30 commants in response to this proposal, nine strongly opposed the proposal approach, particularly when applied to drinking water standards (i.e., MCLG), MCLGs, and noncercinogens. One commands a supported the proposed approach.

EPA has decided to retain the summing of ratios of hezerdows substances to their individual benchmarks, but in a modified form. The final rule sums measures of carcinogenicand noncarcinogenic effects separately: concentrations specified in regulatory limits (e.g., NAAQ8, MCLs, or FDA Action Levels) are not included in the summing algorithm. KPA recognizes that a more precise estimate of relative risk would be obtained by summing the ratios of hazardous substances to their individual RfD-based concentrations by segregating substances according to major effect, target organ, and mechanism of action. In fact, such a segregation is recommended during the RI/FS. However, health-based benchmarks are used in the HRS to provide a higher weight to populations exposed to hazardous substances at levels that might result in adverse health effects. As a consequence, EPA believes that use of the summed ratios of hezardous substances within pathways and threats to their individual RfDbased benchmark levels is appropriate for the screening purpose of the HRS.

EPA proposed and solicited comments on a range of 10⁻⁴ to 10⁻⁷ for individual cancer risk levels of concern in establishing levels of actual contamination with respect to health based benchmarks. EPA received eight comments concerning this risk range Four commenters suggested restricting the range to 10⁻⁴ to 10⁻⁴, primarily because this range would be consistent with risk levels identified in the NCP and used by other EPA regulatory programs. Three commenters said the SCs for carcinogens should be the 10⁻⁴ individual cancer risk level. One commenter stated that 10"* to 10"7 generally is the risk range considered for Superfund response. The final rule defines only two levels of actual contamination: significantly above background and equal to or above benchmark, and significantly above background but less than benchmark. When an applicable or relevant and appropriate requirement does not exist for a carcinogen, EPA selects remedies resulting in cumulative risks that fall within a range of 10⁻⁴ to 10⁻⁶ incremental individual lifetime cancer risk based on the use of reliable cancer potency information. EPA has selected the 10⁻⁴ acreening risk level in defining the HRS benchmark level for cancer risk because it is the lower end of the cancer risk range (i.e., 10" to 10" identified in the NCP and used by other EPA regulatory programs.

Two commenters objected to assigning releases of substances with no benchmarks to Level II as a default value. One suggested assigning unknowns to Level III because substances that are frequently released or are known or suspected to cause health problems are studied before those that are not. The other objected because "the absence of data is not data."

Because EPA has decided to adopt a benchmark system incorporating only two levels of actual contamination, the default level is Level II. If none of the hazardons substances eligible to be evaluated at a sampling location has an applicable benchmark, but actual contamination has been established, the actual contamination at the location is assigned to Level II.

I. Use Factors

The proposed HRS included factors to assign values to uses of potentially affected resources in the three migration pathways: ground water use (drinking water and other) in the ground water migration pathway, drinking water and other use and fishery use in the surface water migration pathway, and land use in the air migration pathway.

EPA received a number of comments on each of these factors. The commenters raised specific objections to distinctions drawn among various potential uses and to the weights assigned to those uses. For example, for the ground water use factor, some commenters asserted that the HRS should not delineate between private and public water supply contamination. For the surface water use factors, a commenter recommended a range of assigned values for irrigation of commercial food or forege crops because of variations in rates of uptake of hazardous substances. For the land use factor, two commenters urged giving greater consideration to institutional land use because of the sensitive populations that would be exposed.

Partly in response to these comments. and in an effort to simplify the HRS, EPA has substantially revised the method of incorporating resource use information in targets factor categories. The field test indicated that collecting data on each of the use factors involved considerable effort at many sites. In addition, because of weighting factors applied to potentially contaminated populations, at sites with no actual contamination, use factors were contributing more to the targets value than were large populations. As some commenters pointed out, the use factors mixed concerns about human health with concerns about the value of the resource and, therefore, were partially redundant with population factors. To avoid redundancy with human health concerns as evaluated through the population factor, EPA has made major changes in how resource uses are evaluated and scored in the final rule.

In each migration pathway, the use factors have been replaced by a resources factor that assigns values to resources appropriate for the pathway. In addition, a resources factor has been added to the soil exposure pathway. The resources factor for a pathway is assigned a maximum of five points if any of the resource uses for that pathway exists within the target distance limit in the ground water or surface water migration pathway, within one-half mile of a source in the air migration pathway, or within an area of observed contamination in the soil exposure pathway. If none of the uses exists, the factor is assigned a value of A.

The resources factor in the ground water migration pathway astigns a value of 5 for wells supplying water for irrigation of commercial food or commercial forage crops (five-acre minimum), watering of commercial livestock, as an ingredient in commercial food preparation, or as a supply for commercial equaculture or for a major or designated water recreation area (excluding drinking water use)—for example, water parks (see § 3.3.3). A value of 5 is also assigned if the water in the aquifer is usable for drinking water, but not used.

The resources factor in the drinking water threat of the surface water migration pathway assigns a value of 5 if the surface water is designated by a State for drinking water use but not used, or is usable but not used for drinking water. In addition, points may be assigned for intakes supplying water for irrigation of commercial food or commercial forage crops (five-acre minimum), watering of commercial livestock, as an ingredient in commercial food preparation, or if the water body is used as a major or designated water recreation area (see § 4.1.2.3.3). The fishery use factor has been deleted to avoid double-counting of fisheries.

In the air migration pathway, the resources factor is assigned a value of 5 if there is commercial agriculture or commercial silviculture, or a major or designated recreation area within a half mile of a source (see § 6.3.3). The distance of one-half mile for the agricultural, silvicultural, and recreational areas was determined by the distance weighting factors for the air migration pathway, which reflect the rapid diminishing of air contaminant concentrations beyond one-half mile from a source. Therefore, resources beyond this distance are not considered in this pathway.

A second of factor has also been added to the restingt population threat of the self exposure petitoray. The factor is estimated a value of 5 if there is commercial agriculture, commercial silviculture, or commercial investock production or gracing on an area of observed contamination at the site.

J. Sensitive Revironments

The projected rule explanded the list of semilitive environments considerably and, for the sufface water and air petroveys, counted all semilitive environments within the target distance limit, tather than just the one with the highest assigned value; for the soil exposure judiway, only the semilitive environment assigned the highest value was counted. Potentially contaminated semilitive environments were distance/ distion weighted; in the sufface water contamination of semilitive environments was evaluated on the basis of ecological-based backmarks. EPA presived substruty few

EPA secolved velocitively few comparate on introspeciated to sensitive environments. However, participants in the field test sequential classification of these categories of sensitive environments involving spavning arons, migratory politively, and feeding arons critical for the melatanance of a fish species within a river system, constal embayment, it estuary. In particular, critical migratory politivelys and feeding arons were difficult to identify and seemed to provide little discrimination among service volters in some arons of the causity.

the country. EPA has redstined critical spawning a was to include shellbak bods, and has limited the areas to those used for istance or concentrated spowning by a given species. Critical migratery patronys and feeding areas have been combined into a single congory and limited to anadouncus fish (i.e., fish their accound from the ocean to spawn), which face special problems in migrating substantial distances between the ocean and their spewping areas. These feeding areas are further metricted to only these areas in which the fish spand extended periods of time. Examples include areas where jeveniles of anadroness species feed for prolonged periods (e.g., weaks) as they propuse to migrate from fresh vestor to the ocean, and holding areas along the schalt migratery pethways. Termetrial areas used for breeding by

Turnestrial aroses used for breeding by increase appropriations of vertebrates (a.g., increase reachery, see lion breeding breech) have been added to the list of semeltive environments to perallel the spectral general listed for fish species. Water segments designated by a State as not attaining texic water quality standards have been removed because these environments are already degraded and this are not analogous to the other sensitive environments listed. Also, the assigned value for State designated areas for protection or maintenance of aquatic life has been changed from 50 points to 5 points (see Table 6-23 in final rale) to be consistent with the points assigned under the resources factor for State designated areas for drinking water use.

In response to public comment, National Monuments have been added to the 200-point category on the list of terrestrial sensitive anvironments considered under the soil exposure pethway. "State designated natural arons" and "particular areas, relatively sell in size, important to the mek number of unique biotic mounities" were also added to the hist of terrestrial sensitive environments in response to public comment. These latter two categories were already considered in the air and surface water pathway evaluation of sensitive refrontments. (See Table 5-5.) The method for evaluating wetlands environi

has been revised, partially because participants in the field test had difficulty identifying discrete wetlands. Some wetlands were patchy and could satified as one large or many small be ch tlands. Other wetlands were divided 100 by rivers or roads, or changed from one type of wetland to another, making it or whether more than one wetland could be counted. To eliminate these difficulties, wetlands are now evaluated on the basis of size and level of mination. In the air migration cost pathway, wetlands are evaluated based ge and level of contamination (see § 8.3.4); in the surface water nation pathway, wetlands are instead by linear frontage along the surface water bezardous substance ignation path and level of 1 staminetics (see § 4.1.4.3.1) œ Distinguishing among wetlands on the basis of size and level of contamination should improve the discriminating ability of the sansitive environments factor. In the drier portions of the country, where even small wetlands (e.g., prairie potholes) are very important, anali wetlands may also alify an "particular areas, relatively all is size. important to the meintenance of unique biotic communities."

Sensitive environments other than wetlands are not evaluated on the basis of size for several reasons. Most other HRS sensitive environments tend to be less common and less widely distributed nationally than wetlands (e.g., ec. EPA's 1900 Field Test of the Proposed Revised HRS) and, therefore, their numbers and boundaries tend to be easier to identify. In addition, the value of many sensitive environments is independent of size; for example, the size of a critical habitat of an endangered species may very solely due to the type of species present. Purthermore, potential or actual contamination of even a smeal portion of many sensitive environments—for example, a wildlife refinge—tends to be viewed as unacceptable.

An ecceystem biseccumilatio potential factor has been added to the waste characteristics factor category of the surface water environmental threat in response to comments that hazardons substances that demonstrate an ability to bind to sediments and/or to bioaccumulate (e.g., PCBs, mercury) tend to pose the greatest long-birm threats to equatic organisms. The accumulation of ezardous substances in the equatic food chain can result in adverse effects in equatic species and in other animals that ingest equatic species (e.g., waterfowl). The ecosystem bioaccumulation potential factor differs slightly from the bioaccumulation potential factor in the human food chain threat, primarily in that all BCP data are considered in deriving it and not just BCF data for human food chain organisms.

The EPA ambient equatic life advisory concentrations (AALACs) have been added to the data hierarchy used to assign the ecception texicity value (see § 4.1.4.2.1.1). The Natural Heritage Program alternative sensitive environment rating factors have been removed from the rule because of problems that arose during the field tests; field test participants found that the availability of information varied substantially emong States. However, a Natural Heritage Program Data Center can assist in identifying many of the sensitive servicement types listed in Tables 4-23 and \$-5.

K. Use of Available Data

A number of commenters stated that all available data should be used when scoring a site. Several cited the tiered approach to hexardous waste quantity as a model that could be applied to other factors. Under this method, where data are available, they would be used; where data are not available, defaults or more generalized approaches would be applied. Several commenters specifically suggested using this approach for ground water flow direction and for scoring mining sites. These commenters argued that it would be less expensive and time-commenting to use available data when scoring a site than to wait until the remedial investigation to consider the additional information.

EPA considered modifying the HRS to allow the use of additional data, but determined that further expanding the HRS to account for varying levels of data availability is inconsistent with the HRS's role as an initial screening tool. Adding tiers to various factors to accommodate the use of all available data would make the HRS considerably more difficult to apply and could lead to substantial inconsistencies in how sites are investigated and evaluated. EPA Regions and States would have to determine, for each set of data presented, whether the data quality was good enough for the data to be considered. Debates over decisions on data quality could delay scoring and. ultimately, delay cleanup at sites. Therefore, the Agency believes that the limited use of tiers in the final HRS represents a reasonable tradeoff between the need to limit the complexity of the system and the desire to accommodate risk-related information that is generally outside the scope of a site inspection.

L. Ground Water Migration Pathway

The proposed rule included a number of significant changes in the ground water migration pathway: new hydrogeologic factors were added; populations were distance weighted unless exposed to actual contamination; a maximally exposed individual (MEI) factor was added; the target distance limit was extended; a mobility factor was added and combined with toxicity; and a wellhead protection area factor was added. Figure 5 shows the proposed ground water migration pathway and the final rule pathway.

Ground water flow direction. Neither the original HRS nor the proposed HRS directly considered ground water flow direction in evaluating targets. The proposed HRS indirectly considered ground water flow direction by weighting populations based on actual and potential contamination of drinking water wells.

EPA received 50 letters from 40 commenters on this issue; 27 letters responded to the ANPRM, 21 to the NPRM, and two to the field test report. Commenters included eight States, three Federal agencies, the mining, petroleum, chemical, and cement industries, utilities, and professional engineers. The commenters supported the consideration of ground water flow direction data, at least in some circumstances. Numerous commenters urged the use of ground water flow direction data when they are either available or easily obtained. They suggested several methods to incorporate flow direction, including:

• Considering use of a radial impact area when directional release routes can be determined. Only a half circle with a three-mile radius for the downgradient portion (and a half-mile radius for the rest of the circle) should be considered when scoring:

• Differentiating between upgradient and downgradient areas using topographic maps, evaluating water levels at wells, and noting the presence of major surface water bodies;

 Expending the effort to obtain accurate data and considering selected upgradient locations as a precaution against unanticipated anomalies;

 Excluding drinking water wells where analytical data prove no contamination is present;

 Having a "professional" review available information and conduct a site visit;

• Using available flow direction data and developing regionally based defaults when no data are available;

• Installing piezometers to determine flow direction in the PA/SI phase and when no ground water flow data are available:

• Incorporating ground water flow direction into the "depth to aquifer" and "distance to nearest well/population served" scores; and

• Affording responsible parties the opportunity to determine flow direction.

Ground Water Migration Pathway

PROPOSED HRS

Likelihood of Release X	Waste Characteristics - X	Targets
Observed Release	' Toxicity/Mobility Hazardous Waste Quantity	Maximally Exposed Individual Population
Potential to Release		Ground Water Use
Containdocat		Wellhead Protection Area
Net Precipitation		
Depth to Aquifer/		
Hydraslic Conductivit	У	. ·
Sometive Capacity		

FINAL HRS

Likelihood of Release X	Waste Characteristics X	Targets
Observed Release or Potential to Release Containment Net Precipitation Depth to Aquifer Travel Time	Toxicity/Mobility Hazandous Waste Quantity	Nearest Well Population Resources Wellhead Protection Area

Commenters suggested that data on ground water flow are either readily available or can be easily obtained at reasonable cost and are no more imprecise than other aspects of the HRS. Some commenters stated that the level of effort required to estimate the direction of ground water flow is no greater than that required to determine other hydrogeologic parameters in the HRS.

EPA reviewed a range of options for considering ground water flow direction in evaluating targets. For the reasons discussed above under "Use of Available Data," the Agency decided that it was not feasible to adopt a tiered approach in the targets factors for evaluating ground water flow direction. EPA does not agree that increased accuracy warrants the increased complexity of accounting for ground water flow direction, because this level of accuracy is not required for a screening tool that is intended to assess relative risk. This level of accuracy, however, is needed to determine the extent of remedial action and, therefore, is appropriate at the time of the RL

EPA disagrees with the argument that determining ground water flow direction is no more difficult than determining other ground water factors. Aquifer interconnections and discontinuities as well as hydraulic conductivity and depth to aquifer, which are evaluated in the final rule, are geologic features that are unlikely to change over the shortterm. In contrast, ground water flow direction can be influenced by factors such as seasonal flows and pumping from well fields. In addition, the ground water flow direction may be different in each aquifer at the site, and the direction of hazardous substance migration is not always the same as the direction of ground water flow. Therefore, data on ground water flow direction would need to be considerably more extensive than would the data required to document the other hydrogeologic factors. EPA notes that in the final rule, many of the other hydrogeologic factors considered have been simplified and the sorptive capacity factor has been dropped. EPA also notes that ground water flow direction was not identified in SARA as a portion of the HRS requiring further examination, even though ground water flow direction was not considered in the original HRS and the Agency had received criticism similar to the above comments prior to enactment of SARA.

Although the final rule does not consider ground water flow direction directly in evaluating targets, it does consider flow direction indirectly in the method used to evaluate target populations. If wells have not been contaminated by the site, as the commenters assume upgradient wells would not be, the population drawing from those wells is distance weighted and, thus, populations drawing from the wells would have to be substantial before a large number of points could be assigned. Moreover, in addition to providing a measure of the population at risk from the site, the target factors afford a measure of the value of the ground water resources in the area of the site and of the potential need for expanded uses of the ground water.

Aquifer interconnections. Aquifer interconnections facilitate the transfer of ground water or hazardous substances between aquifers. The final rule specifies that if aquifer interconnections occur within two miles of the sources at the site (or within areas of observed ground water contamination attributed to sources at the site that extend beyond two miles from the sources), the interconnected aquifers are treated as a single aquifer for the purposes of scoring the site. Thus, for example, when an observed release to a shallow aquifer has been identified. targets using deeper aquifers interconnected to the shallow aquifer are included in the evaluation of the combined aquifer. This approach is common to the original as well as the revised HRS.

In practice, EPA has found that studies in the field to determine whether aquifers are interconnected in the vicinity of a site will generally require resources more consistent with remedial investigations than SIs, especially where installation of deep wells is necessary to conduct aquifer testing. Thus, EPA has in the past relied largely on existing information to make such determinations and the Agency finds it necessary to continue that approach. Examples of the types of information useful in identifying aquifer interconnections were given in the proposed r. le. This information includes literature or well logs indicating that no lower relative hydraulic conductivity layer or confining layer separates the aquifers being assessed (e.g., presence of a layer with a hydraulic conductivity lower by two or more orders of magnitude); literature or well logs indicating that a lower relative hydraulic conductivity layer or confining layer separating the aquifers is not continuous through the two-mile radius (i.e., hydrogeologic interconnections between the aquifers are identified): evidence that withdrawals of water from one aquifer (e.g., pumping tests,

aquifer tests, well tests) affect water levels in another aquifer; and observed migration of any constituents from one aquifer to another within two miles. For this last type of information, the mechanism of vertical migration does not have to be defined, and the constituents do not have to be attributable to the site being evaluated. Other mechanisms that can cause interconnection (e.g., boreholes, mining activities, faults, etc.) will also be considered. While the descriptive fext has been removed from the rule, the approaches mentioned in the proposed rule will be used in making aquifer interconnection determinations. In general, EPA will base such determinations on the best information available; in the absence of definitive studies and where costs of field studies are prohibitive, the Agency will rely on expert opinion (e.g., U.S. Geological Survey staff or State geologists). In the absence of such information, EPA assumes that aquifers are not interconnected.

Ground water potential to release factors. EPA proposed replacing the depth to the aquifer of concern and permeability factors of the original HRS with depth to aquifer/hydraulic conductivity and sorptive capacity factors. EPA received more than 75 comments on these factors, in addition to general comments on evaluating ground water potential to release in response to the ANPRM.

Several commenters supported consideration of depth to aquifer in evaluating the ground water migration pathway. One commenter stated that use of a depth to aquifer/hydraulic conductivity matrix, which was intended to reflect travel time to ground water, was an improvement over considering these two parameters individually and additively. Concerns were raised, however, about how to determine depth to aquifer. In addition, commenters stated that the two-mile radius for evaluating hydrogeologic factors should be extended to four miles. while others commented that the distance should be measured from vertical points as near to the source as possible.

Commenters generally supported the proposal to include hydraulic conductivity, although many believed that the proposed method was too complicated; several commenters suggested that the single least conductive layer(s) should be used. Another concern was the lack of data for determining hydraulic conductivity. One commenter stated that unless data can confirm that the geologic strata extend throughout the easter area of a site, contening a hydroxile conductivity value is highly quantionable.

v commentate effered alternetive iches to svelasting hydroxiic tivity. These included posed method with:

of "confidence levels" tied to • 🔥 al estimates based on regional te and judgment; • Cansideration of actual travel time

in the unseturated sone, or

the unsure of maximum • An asympton of maximum phonic contactivity enoug the atom geological leputs below the site. The second second

on the surptive capacity factor, but there in little consensu 8 8 ي ال e an. A number of our 68 of that the factor should be added. n stated that the approach was not stated enough and that more wast-ad sto-specific information should be and. Other communities agreed that e foctor was an impo t, but said at surptive capacity should be apped because the wester and site ecific information needed for an accurate evaluation cannot be collecte ring a screening process. Others said at it was too complex as proposed and hat it was too comp

should be dropped. Based on these comments and the field test results, EPA examined the white aquifer/hydraulic conductivity d surplive capacity factors. The camination showed that the lowest hydraulic conductivity layer(s) ted for almost all of the travel 8000 e to the aquifer if a one-foot or threeet ministum layer thickness was used. Accordingly, in the final rule, the depth to aquifer/hydraulic conductivity factor has been ruplaced with a simpler factor, travel time, which is determined using a metrix of the hydroulic conductivity and thickness of the lowest hydroulic conductivity layer(s) with at least a three-fost thickness. (See § 3.1.2.4 and Table 3-7 of the final rule.)

To conform with the change limiting to travel time factor to the last ctive layer(s), and to meet the goal **C** of simplification, a change to the scriptive capacity factor was necessary. The proposed rule evaluated this factor

using all layers between the source and the squifer. In remaining this factor, EPA concluded that depth to aquifer is one of the major parameters affecting total sorbant content, at least within the HRS ranges for the factor. Depth to aquifer also indirectly reflects ochunical retardation mechanisms ecouse, all else being equal, the effect of these retardation mechanism use as the dapth to squifer increased in the second increases. At the field test sites, using only the layer(s) of lowest hydraulic ctivity decreased the calculated COR sorbent content between 10 and 90 percent. For these reasons, EPA h decided to replace the scrptive capacity factor with a depth to equifer factor. [See] 3.1.2.3 and Table 3-5 of the fine! rale).

M. Surface Water Migration Pathway

The proposed rule made major gas to the evaluation of relea and releases to surface water. thread t The pathway was divided into four te: drinking water, human food chain, recreational use, and environmental. Other changes included consideration of flood potential; revision of potentiel overland flow: addition of dilution weights for potentially contaminated populations: extension of the target distance limit to 15 miles; revision of the persistence factor to consider more degradation mechanics revisi addition of a bioaccumulation factor for evaluation of human food chain toxicity/persistence and populations; addition of ecceystem toxicity to evaluate the environmental threat; and addition of a maximally exposed individual factor (MEI) factor to the drinking water threat. Figure 6 shows the proposed rule and the overland flow/flood migration component of the surface water migration pathway in the final rale.

Recreational use threat. SARA stated that the HRS should consider threats to surface water used for recreation and drinking water, and the proposed HRS included a recreational use threat in the surface water migration pathway. A aber of States, several companies and trade associations, and two Federal egencies identified problems with the proposed recruticized use thront. Some commenters objected to weighting it as heavily as the delaking water threat, while others suggested that evaluation the threat was too complicated for use in a screening tool. Many commenters said that proposed methods for assigning values to recreation areas were too broadly drawn and that a limited number of recreation areas should be considered. Two company suggested using octual attendance data, and one commenter suggested that recreational uses be canaideard in other pathways as well.

EPA's field test indicated that the recreational use threat evaluation was too complex for HRS purposes and, at the same time, was not very accurate. Several field test participants commented that the recreation target population was difficult to evaluate and that the approach for determinin 2 population was inscounts and time consuming. Is addition, the population lation factor did not provide meaningh discrimination among alter. The proposed rule used the physical characteristics (e.g., capital improvements) of a succession nai site às the basis for determining the distance tor owner ar ordermany we distance limit used to evaluate population, but because major and minor alter may have the same types of capital improvements (e.g., best range, picnic facilities), the same distance limit coold be associated with a minor recreation area and a impor recreation area. The alternative approach would be to require actual use data to evaluate an however, the specific tatgi pulation data are not available for my recreation areas, making it DODU difficult to obtain accusate estimates of the population at risk. The target cistance limits, which ranged from 10 to 125 miles, also contributed to the problems with evaluating targets. The Agency invited comments on relining these calculations; no alternative app vaches were suggested, and EPA did not identify viable alternatives.

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Surface Water Migration Pathway

PROPOSED HRS

Likelihood of Release		Drinking Wate	r Threat
Observed Release or Potential to Release By Overland Flow		Waste Characteristics X Toxicity/Persistence Hazardous Waste Quantity	Targets Maximally Exposeu Individual Population Surface Water Use
Runoff Distance to Surface Water		+ Human Food Cl	hain Threat
By Flood Containment Flood Frequency		Waste Characteristics X Toxicity/Persistence/ - Bioaccumulation Hazardous Waste Quantity	Targets Population Fishery Use
•		+	· · · ·
		Recreational U	Use Threat
		Waste Characteristics X Toxicity/Persistence/Dose Adjusting Factor Hazardous Waste Quantity	Targets Population

Environmental Threat

Targets Sensitive Environments

Surface Water Migration Pathway -Overland Flow/Flood Component

FINAL HRS

Likelihood of Kelesse	L Drinking Wa	ter Threat
Observed Release or Potential to Release By Overland Flow	Waste Characteristics X Toxicity/Persistence Hazardous Waste Quantity	Targets Nearest Intake Population Resources
Containment Runoff Distance to Surface Water	+ Human Food (Chain Threat
By Flood Containment Flood Frequency	Waste Characteristics X Toxicity/Persistence/ Bioaccumulation Hazardous Waste Quantity	Targets Food Chain Individual Population

Environmental Threat

Waste Characteristics	X	Targets
Ecosystem Toxicity/		Sensitive Environments
Persistence/Bioaccumulat	ion	
Hazardous Waste Quantity	,	

EPA is also concerned that many qualities of recreation areas (e.g., uniqueness, attractiveness, value) cannot be readily quantified or measured, which poses significant problems for a screening tool. Therefore, the recreational use threat has been removed from the final rule. Instead, factors related to recreational use are being included in the assessment of resource factors in the air, surface water, and ground water migration pathways. (See the discussion of resources factors above and §§ 3.3.2 41233 42233 and 6.88 of the rule.) Recreational use is also a major component of the evaluation of the attractiveness/accessibility factor in the soil exposure pathway (see § 5.2.1.1 of the rule).

Human food chain. SARA requires that EPA consider "the damage to natural resources which may affect the human food chain * *" Accordingly, the surface water migration pathway of the proposed rule included evaluation of threats to human health via the aquatic food chain.

A number of commenters suggested that terrestrial food chain threats should also be evaluated because most of the food eaten in the United States originates on land, and the terrestrial human food chain is, therefore, more important than the aquatic human food chain. Commenters specifically stated that the HRS should account for human food chain threats involving irrigated crops, livestock, and game animals. One commenter stated that the SARA mandate would not be fulfilled if only aquatic human food chain threats were evaluated.

After conducting an investigation into possible methr ds, EPA determined that it would not be practical to include a separate evaluation of terrestrial human food chain threats in the HRS. The terrestrial food chain is more complex and site-specific and is less understood than the aquatic food chain, and its assessment requires considerably more data. These factors render evaluation of the relative risks associated with the terrestrial human food chain well beyond the capability of a screening system such as the HRS. The final rule, therefore, does not separately evaluate terrestrial human food chain threats. These threats are, however, considered indirectly under the resources target components in the air migration pathway, ground water migration pathway, soil exposure pathway, and drinking water threat portion of the surface water migration pathway.

The proposed rule required the estimation of bioaccumulation potentials for hazardous substances posing threats via the human food chain. One commenter stated that the estimation of biosccumulation potentials requires excessive time and resources, and that this step should be dropped from the HRS.

EPA disagrees and considers the bioaccumulation potentials of hazardous substances to be among the most important factors determining the degree of human health threat posed by substances via the human food chain. Substances that do not bioaccumulate pose less of a threat via the human food chain than substances that bioaccumulate, all else being equal. Conversely, substances with high bioaccumulation potentials can pose very significant threats via the human food chain even if they are only moderately toxic, or are present in modest quantities. EPA believes that compiling bioaccumulation potential tables will reduce the effort and resources required to score this factor.

EPA received several comments stating that bioaccumulation potential was not given sufficient weight in the evaluation of human food chain threats. EPA evaluated the use of bioaccumulation potential during the field test and determined that there was considerable uncertainty related to this factor, in part because of major differences in uptake associated with different species in different environments. In addition, bioconcentration values have been computed for only a few species for most substances. In light of this uncertainty, EPA decided that bioaccumulation potential should not be given additional weight in the HRS. In addition, as part of the structural changes discussed in Section III B, the bioaccumulation potential factor was moved from the targets factor category to the waste characteristics factor category so that it is evaluated consistently with the other waste characteristics factors that reflect exposure. As part of these changes, the use of the bioaccumulation potential factor in selecting the substance posing the greatest hazard also has been modified.

The final rule broadens the definition of actual contamination of the human food chain by modifying one criterion and adding a new criterion defining actual contamination. The proposed rule defined a fishery as actually contaminated if (1) the fishery was closed as a result of contamination and a substance for which the fishery was closed had been documented in an observed release from the site, or (2) a tissue sample from a human food chain organism from the fishery was found to contain a hazardous substance at a concentration level exceeding the FDAAL for that substance in fish tissue and the substance had been documented in an observed release from the site. In both cases, at least a portion of the fishery must be within the boundaries of the observed release.

Under the final rule, the former criterion (closed fishery) remains essentially unchanged. The latter criterion (tissue contamination) has been modified: A fishery is considered actually contaminated if the concentration of a hazardous substance in tissue of an essentially sessile benthic human food chain organism from the watershed is at a level that meets the criteria for an observed release from the site and at least a portion of the fishery is within the boundaries of the observed release. A new criterion has also been added: A fishery is considered actually contaminated if a hazardous substance having a bioaccumulation potential factor value of 500 or greater either is present in an observed release established by direct observation or is present in a surface water or sediment sample at a level that meets the criteria for an observed release from the site and at least a portion of the fishery is within the boundaries of the observed release. Only the portion of a fishery within the boundaries of an observed release is considered actually contaminated.

EPA broadened the definition of actually contaminated fisheries on the basis of field test results. With the more narrow definition in the proposed rule, few actually contaminated fisheries were identified because:

(1) Closed fisheries did not exist at most sites;

(2) Hazardous substance concentration data from tissues of applicable organisms were available for only a small portion of fisheries; and

(3) FDAALs exist for only a relatively small number of hazardous substances. The final rule also introduces two

levels of actually contaminated fisheries or portions of fisheries:

• Level I: Applicable when concentrations of site-related hazardous substances meeting the criteria for actual contamination of the fishery equal or exceed the benchmark concentration levels established in the final rule based on FDAALs, screening concentrations corresponding to elevated cancer risks, and screening concentrations corresponding to elevated chronic, non-cancer toxicity risks via oral exposures. The final rule allows Level 1 contamination to be established based on hazardous substance concentrations in tieres samples from "expenience other then essentially seasile benchic organisms" (e.g., fish, lobaters, crabs), even though these organisms cannot be used to establish observed releases or actual contamination.

 Level II: Applicable to all actually contaminated fisheries (or perions of actually contaminated fisheries) not meeting Level I criteria.

The final rule arright immun food chain populations associated with Lovel I concentrations tenfold greater weight than these associated with Lovel II concentrations. The final rule also describes the procedures for determining, where applicable, the part of a fishery subject to Lovel I concentrations, the part subject to Lovel II concentrations, and/or the part subject to potential contamination.

ived serveral con EPA nice mintant with the ig that, to be con other threats, a maximally exposed individual factor should be incorporated interview income seven to incorporate interview have food chain throat. The Agency agrees, and to provide this consistency the final rule incorporates a maximally exposed individual factor (the food chain individual) into the nan food chain targets factor agery. As with similar factors in other pathways and threats, the food chain individual is assigned points according to the level of contaminatio -ination. Where actual contamination of a fishery is documented, the food chain individu factor is assigned 50 points for Level 1 and 45 points for Level 11 concentrations. Where no actual contamination of a fishery is documented, but there is dam tation of an observed release of a hazardous substance having a bioaccumulation potential factor value of 380 or grooter to a watershed of Stoor ground to a voluments containing a fishery within the target distance limit, the food chain individual is assigned a value of 20 points. Where

 there are no observed releases to surface water or no observed release of a hazardous substance with a biseccumulation potential factor value of 300 or greater, but a fishery is present (i.e., there is a potentially contaminated fishery) within the target distance himit, the food chain individual is assigned points ranging from 0 to 20, depending on the dilution weight assigned to the associated surface water body.

The proposed rule estimated human food chain production of actually contaminated or potentially contaminated fisheries based on harvest data or stocking data for those fisheries, if available, Where such data were not available, production estimates were based on productivity of the surface water body or the estimated standing crop of aquetic biota in the fisheries. The proposed rule included a table of standing crop default values for estimating human food chain production of the fishery.

EPA received sumerous comments to the effect that the standing crop default table was difficult to use, provided several different values for some water bedies and nose for others, and provided unreliable data. Several meers stated that standing crop COM values are not an appropriate basis for estimating equatic human food chain production. One commenter pointed out that standing crop estimates do not correlate well with harvest for variou water body types. Another commenter stated that estimates of harvest from fish and game officials are preferable to standing crop default values because standing crop is a measure of biomass (weight of all edible living organisms in the water body) rather than productivity.

EPA agrees with the commenters. In the final rule, estimates of fishery burnen food chain production are based on fish harvest data (including stocking data) as opposed to standing crop data. When sits-specific data are not available, hervest rates are to be estimated based on the average hervest per unit area for the perticular water body type under assessment and the geographic area in which the water body is located.

Ground water discharge to surface water. A number of commenters and field test participants suggested that the HRS should consider the potential impact of ground water discharges to surface water because contaminated ground water can be a significant source of surface water contamination. Field test participants noted that some sites have no overland flow routs, but surface water can be contaminated through ground water discharges.

EPA agrees and has added a ground water to surface water migration component to the surface water adgration pathway. Figure 7 shows the structure of this component. The surface water migration pathway, therefore, now inclu des two components: The rland flow/flood migration spenant, which retains the structure overland flow/flood m COM of the surface water migration pathway as proposed (except for the changes discussed in this pressible), and the new ground water to surface water migration component. Either or both comp may be scored; if both are scored, the may be scored; it woos are scored, die surface water migration pethway score is the higher of the two scores. EPA selected the higher of the two scores rather than combining these because, if scores were combined, the amount of hazardous substances at the site available to migrate via each component would have to be apportioned between the two components. The site-specific data needed to detunning the appropriate apporticument are rarely available.

Surface Water Migration Pathway -Ground Water to Surface Water Component¹

FINAL HRS

Likelihood of Release X

Drinking Water Threat

Observed Release or Potential to Release Containment Net Precipitation Depth to Aquifer Travel Time

Waste Characteristics X Toxicity/Mobility/Persistence Hazardous Waste Quantity

Targets Nearest Intake Population Resources

Human Food Chain Threat

Waste Characteristics X Toxicity/Mobility/Persistence/ Bioaccumulation Hazardous Waste Quantity Targets Food Chain Individual Population

Environmental Threat

Waste Characteristics X Ecosystem Toxicity/Mobility/ Persistence/Bioaccumulation Hazardous Waste Quantity

Targets Sensitive Environments

New component.

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The ground water to surface water gration component evaluates three ste: drinki g weter, hu bool nea chain, and environmental. The nt is scared only if: (1) A n of the surface water is withi ile of any source at the site that 00e z could release to ground water; (2) there is no discustinuity in the uppermost equifer between the source and the portion of the surface weter within one ile of the source; and (3) the bottom of e surface water is at or below the too of the squifer. The target distance limit for the component is determined the for the country e way as for the overland flow/ flood on ponent. For each threat, ibood of release is based on either avad release or potential to release. An observed release is established if. d only if, there is an observed rele to the uppermost equifer, while potential to release is based on ground water potential to release factors, except that nly the u permost squifer is dered (See § 422.12)

The hezardous waste quantity factor is scared in the same way it is accored for e overland flow/flood a igration wast, except that only sources hat could release to ground water are sidered (see § 6.2.2.2.2). Toxicity. and water mobility, and surface er persistence are considered in ing the substance potentially ing the grostest hexard in drinking r (see § 4.2.2.1). By considering and water mobility, the final rule acts the fraction of a hezardous ebstance expected to be released from the sources and to migrate through ad water to the surface water body. man food chain and sevironmental threats, bioaccumulation (or ecosystem bioeccumulation) tial is also considered in selecting enhotence potentially posing the test learned (see § 4.2.3.2.1). .

The targets factors in this component re evaluated in the same way as ---gets factors in the everland flow/ id migration component, except inden-weight adjustment is abland with the surface water ent, except that لحق ع ien weights for pepulations potentially exposed to contamin The dilution-weight adjustment nant was d because the HRS and ne that es substa nious substances migrate via ad water in all directions from a te. Under this assumption, except in these instances where the surface water body completely surrounds the site, only a portion of the hazardous substances can be assumed to reach the surface weter through the ground water. The dilution-weight adjustment accounts for the portion of the inzardous substances

assumed to be available to migrate to surface water through ground water. The probable point of entry is defined as ortest straight-line distance, the s within the aquifer boundaries, from the sources at the site to the surface water body. Therefore, the actual targets considered may differ somewhat from targets evaluated in the overland flow/ flood migration component because the two probable points of entry may differ. This approach might allow evaluation of intakes, fisheries, and sensitive environments that may be exposed to contamination from a site but are upstream from the point of overland flow entry.

N. Soil Exposure Pathway

The ensite exposure pathway, which a added to the HRS in the proposed rule, has been renamed the soil exposure pathway in the final rule. The pathway was primarily designed to assess the potential threats posed by direct exposure to wastes and contaminated surficial materials at a site. It evaluated two threats-the ident population and the Deproy population. In the proposed tale, the resident population threat included three types of targets: Linch risk palation on a property with observed contamination, all other residents and people attending school or day care on a property with observed cents ination. and terrestrial sensitive environments in which there is observed continuination. The nearby population was based on people who live or a taged school within a case-saile travel distance and who did not most the criteria for resident population. Figure 8 summarizes the proposed and final roles.

A sumbor of commenters supported the inclusion of the pathway, but raised issued selected to its evaluation. For example, commenters objected to avaluating the waste characteristics factor category solely on taxicity. Three commenters objected to limiting the high risk population to children under seven. Other commenters stated that collecting data on the high risk populat. In would be difficult. A number of commenters questioned how the onsite area and area of commenters would be defined and how accessibility of the site was evaluated.

In response to these comments and to the field test results, EPA has made a sumber of changes to the soil exposure pathway. The name of the pathway has been changed to be more consistent with terminology used in the Superfund human health evaluation process.

As suggested by commenters, the final rule limits the area within which human tangets are evaluated for the resident population threat to locations within property boundaries and within a distance limit of 200 feet from an area of observed contamination. The 200-foot limit accounts for those situations where the property boundary is very large, and exposure to contaminated surficial materials is unlikely or infrequent because of the distance of residences, achools, or work places from an area of observed contamination on the some property.

To make the pathway consistent with the other pathways and in response to comments, the final rule includes hazardoes waste quantity in the waste characteristics factor category and multiplies it by the factor value for toxicity. New factors, resident individual and nearby individual, have been added to make the pathway consistent with the other pethways, all ---of which assign values for the maximelly exposed individual (e.g. neariest individual or intake). Popul -lation is evaluated using two levels of actual contamination based on health-based benchmerka. Separate consideration of the high risk population (children under-seven) has been eliminated because the field test indicated that this factor could greatly add to the time and expense of scoring a site yet resulted in little discrimination among sites. This change also makes the soil exposure pathway more consistent with the other pethways.

In the nearby population threat, the hexardous waste quantity factor in the likelihood of exposure factor category has been renamed "area of instica" to reflect both the intent contex of the factor and how it is evaluated. The accessibility/irequency of use factor has been revised and renamed the "attractiveness/accessibility" factor. The revised factor emphasi recreational uses of areas of observed contamination because they are most likely to result in exposures to contaminated sufficial materials. In addition, the weighting of the nearby population relative to the reside ef e ulation has been reduced to better reflect the relative levels of exposure for those threats.

A number of communities questioned whether workers should be counted when evaluating target populations in the soil exposure pathway. One commenter suggested that soil exposure scoring should "not include activities at facilities that presently are regulated under the Occupational Safety and Health Administration (OSHA)." Other commenters, however, stated that workers should be counted in the target population. One commenter argued that not counting a facility's work force is inconsistent with other population counting techniques. Another commenter said that workers should be included in the resident population because the proposed method of calculating soil exposure pathway scores can result in inappropriately low scores when onsite workers are exposed to wastes or contaminated soil.

In response to these comments, the Agency investigated statutory, regulatory, and policy conditions that might restrict the inclusion of workers in the target population for the soil exposure pathway. This analysis found no broad statutory or regulatory authority for excluding workers covered by OSHA regulations from consideration as targets in the HRS. Although the definition of a release under CERCLA section 101(22) excludes "any release which results in exposure to persons solely within a workplace * * *" it only does so for purposes of claims by workers who are already covered by State worker compensation laws. The legislative history of section 101(22) specifically anticipated that authority under CERCLA might, in appropriate cases, be used to respond to releases within a workplace. Thus, the Agency concludes that there are no broad statutory or regulatory restrictions against consideration of activities at OSHA-regulated facilities.

Soil Exposure Pathway

PROPOSED HRS

Resident Population Threat

Likelihood of Exposure	X	Waste Characteristics	X	Targets
Observed Contamination		Toxicity		High Risk Population Total Resident Population Terrestrial Sensitive Environments

Nearby Population Threat

Likelihood of Exposure X	Waste Characteristics	X	Targets
Waste Quantity Accessibility/Frequency of Use	Toxicity		Population Within 1 Mile

FINAL HRS

Resident Population Threat

Likelihood of Exposure	X	Waste Characteristics	x	Targets
Observed Contamination		Toxicity Hazardous Waste Quantity		Resident Individual Resident Population Workers Resources Terrestrial Sensitive Environments

+

Nearby Population Threat

Likelihood of Exposure 3	K	Waste Characteristics	x	Targets	
Attractiveness/Accessibility Area of Contamination		Toxicity Hazardoos Waste Quantity		Population Within 1 Mile Nearby Individual	

Federal Register / Vol. 55, No. 241, / Friday, December 14, 1990 / Rules and Regulations 51563

The soil exposure pathway is designed to account for exposures and health risks resulting from ingestion of contaminated surficial materials. Recause ingestion exposures are comparable for some types of workers and residents, the Agency has decided to include workers in the resident population threat. However, substantial variability in the kinds of workers and work activities at sites (e.g., indoor and outdoor) leads to considerable variability in exposure potential. The Agency believes that determining specific categories or types of workers is beyond the scope of HRS data collection. Thus, workers are assigned target points on a prorated basis: 5 points are assigned for sites with up to 100 workers; 10 points for sites with 101 to 1,000 workers, and 15 points for greater than 1,000 workers. Prorating workers will reduce the data collection effort. Evaluation of workers is not affected by health-based benchmarks. (See § 54.3.3.) Nearby workers are not counted in the nearby population because the Agency considers it unlikely that workers from nearby workplaces would regularly visit contaminated areas outside the property boundary of their workplace during the workday, and because there is no way to estimate accurately the number of workers who might.

O. Air Migration Pathway

The proposed rule mede several significant changes to the air migration pathway in the original HRS. In response to the SARA mandate to consider potential as well as actual releases to air, the proposed rule included an evaluation of the potential to release. The proposed rule also added a mobility factor to the waste characteristics factor category and an MEI factor to the targets category. Finally, the proposed rule added explicit distance weighting factors for evaluating all factors in the targets category. Figure 9 shows the proposed air migration pathway and the final rule pathway.

The public provided numerous comments on these changes and raised new issues as well. The most significant new issue concerned the structural inconsistency in the treatment of gases and particulates in the proposed air migration pathway. For example, commenters observed that in the potential to release evaluation, it was possible to assign a high containment value to a source with good gas containment and poor particulate containment while assigning high source type and mobility values based on the presence of gaseous hazardous substances. This combination would yield an inappropriately high potential

to release value. This concern was also noted in discussions with field test personnel.

The Agency agrees with these commenters and investigated methods to better reflect the differences between gases and particulates. As a result of these analyses, EPA has made several changes to the final rule in both the likelihood of release and waste characteristics factor categories.

In the likelihood of release factor category, the final rule evaluates source potential to release separately for gases and particulates. Only those sources containing gaseous hazardous substances are evaluated for gas potential to release, and only those sources containing hazardous substances that can be released as particulates are evaluated for particulate potential to release. This change in potential to release structure necessitated other changes in the scoring of potential to release including development of separate gas and particulate source type factors and migration potential factors. The names of these latter factors were also changed to highlight the differences between potential to release "mobility" and waste characteristics "mobility." (See \$\$ 6.1.2.1.3, 6.1.2.2.3.)

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Air Migration Pathway

PROPOSED HRS

Likelihood of Release	X	Waste Characteristics	X	Targets
Observed Release or Potential to Release Source Containmen Source Type Source Mobility	ot	Toxicity/Mobility Hazardous Waste Quantity		Maximally Exposed Individual Population Land Use Sensitive Environments

FINAL HRS

Likelihood of Release X	Waste Characteristics	X	Targets
Observed Release or Potential to Release	Toxicity/Mobility Hazardous Waste Quantity		Nearest Individual Population Resources Sensitive Environments
Gas Gas Containment Gas Source Type Gas Migration Potential Particulate Particulate Containment Particulate Source Type Particulate Migration Potential	•		

In addition to these changes in the basic structure of the potential to release factors, the final rule includes several additional changes in the source type list, migration potential factors, and containment factors. Based on the experience gained in the field test, EPA added several source types to the source type list. Some of these additions (e.g., surface impoundment (not buried/ backfilled): dry) simply clarify classifications that were implied in the proposed source type list. Other additions, such as source types involving biogas release, were considered early in the development of the proposed HRS but were not included originally in the interest of simplicity. Field test experience, however, indicated that their inclusion in the final rule was necessary. Finally, new distinctions within some source types (e.g., the various types of piles) were added partly in response to comments and partly as a result of field test experience. As applicable, source type values were also revised. (See §§ 6.1.2.1.2, 6.1.2.2.2 and Table 6-4.)

The revised gas and particulate migration potential factors are very similar to the proposed likelihood of release gas and particulate mobility factors. Several commenters questioned the need for including dry relative soil volatility in the final gas migration factor. A simplification analysis indicated that dry relative soil volatility was redundant, as it was almost completely determined by vapor pressure. Hence, the final gas migration potential factor includes only vapor pressure and Henry's law constant. The particulate migration potential factor in the final rule is simply the particulate component of the proposed potential to release mobility factor.

The containment factors were also changed as a result of the field test, a review of recent information on covering systems, the examination of air release rate models, and the public comments on the need for simplicity in the final rule. The final list of containment descriptions eliminated many redundant descriptions and changed others, retaining only those distinctions that are necessary based on type of source. (See §§ 6.1.2.1.1, 6.1.2.2.1 and Tables 6-3, 6-9.) As discussed in Section III F above, two new mobility factors were developed for the waste characteristics factor category.

Commenters generally supported the concept of distance weighting target factors. However, several disagreed with the approach used to develop the proposed factor values. Some commenters suggested basing the factor values on long-term meteorology and the size of the site, while others suggested that additional atmospheric phenomena (e.g., particulate deposition) be reflected in the final values. As a result of these comments. EPA has revised the distance weighting factors used in the final rule to reflect long-term atmospheric phenomena. Analyses indicated that particulate deposition and other similar phenomena as well as site size were not sufficiently significant within four miles of a site to warrant their inclusion in the final factor values. EPA also notes that the distance weighting factor values are now incorporated in the population factor value table. (See § 6.3.2.4 and Table 6-17.)

P. Large Volume Wastes

Mining woste sites. A number of commenters representing mining companies, trade associations, and State and Federal agencies commented on how the proposed HRS would score mining waste sites; commenters representing waste management facilities raised similar issues in regard to their sites. This section summarizes and addresses the major issues addressed by these commenters.

Commenters raised several concerns regarding the appropriate consideration of background levels of metals in documenting direct or indirect releases from mining waste sites. One commenter recommended that in determining direct releases from a mining waste site. BPA should consider the natural characteristics of the site prior to mining and the changes in migration rates resulting from mining. The commenter explained that the concentration of metals in a mining waste pile may be similar to or less than natural concentrations in soil or rocks below and adjacent to the pile. To document indirect releases, the commenter suggested that KPA require collection of detailed information on site geology and hydrological gradients to ensure proper consideration of background levels. Finally, the commenter asserted that although it is appropriate to weight observed releases more heavily than potential releases at sites with synthetic organic hazardous substances, the criteria used to define observed release are not valid at sites with natural sources of metals. Another commenter agreed and suggested that because of background levels of inorganic elements, the proposed HRS could identify as an observed release concentrations unrelated to mining activities.

. EPA recognizes that natural background concentrations of metals in soil or rocks can affect the measured concentration necessary to establish an observed release at a mining waste site. This consideration is reflected in the requirement that concentrations significantly above background be shown to establish an observed release. Moreover, EPA has clarified the observed release criteria in the final rule to explain that they specify minimum differences necessary to establish an observed release by chemical analysis.

Several commenters questioned the treatment of metals in the ground water mobility factor. One commenter stated that the proposed HRS is biased against mining waste sites because it gives greater consideration to the accurate assessment of the mobility of organic substances than to that of naturally occurring metals. The commenter noted that the proposed persistence factor for the surface water migration pathway accounts for the degradation of hazardons substances in the environment through four processes. None of these processes, according to the commenter, applies to metallic elements, which received a default value of 3 (the highest possible score for persistence). Another commenter stated that decreased mobility was considered only for organic compounds, even though inorganic compounds are immobile in some situations.

One commenter stated that adding a metals mobility factor, as EPA's Science Advisory Board (SAB) recommended, would allow the HRS to reflect more accurately the potential for metallic elements to migrate in the aqueous phase. Two commenters were concerned that metals would be assigned a "worstcase" default value for mobility. On the other hand, another commenter stated that consideration of the mobility of metals in the revised HRS would at least partially rectify the bias in the current HRS against high-volume, lowconcentration mining wastes.

A number of these commenters appear to have misunderstood the proposed rule. Metals were not automatically assigned the maximum value as a default in the ground water mobility factor, but rather were assigned values based on their coefficient of aqueous migration. The final rule automatically assigns the maximum value for mobility only to metals establishing an observed release by chemical analysis, which is the same way organics and nonmetallic inorganics are evaluated. For metals and metal compounds not establishing an observed release by chemical analysis, mobility is based on water solubility and distribution coefficient (K4), the same as for organics and nonmetallig
insegnatics. If name of the hexardous substances (including metals, organics, and nonmetallic integratics) eligible to be evaluated for the site can be assigned a mobility factor value based on available data, § 3.2.1.2 of the final rule assigns a mobility factor value of 0.002 for all of the hexardous substances. This value was subsidied based on a review of the range of mobility factor values assigned to these hexardous substances (including metals) for which data were available for assigning mebility factor values. The value of 0.002 is clearly not a west-case default (which would be 1.01.

EPA believes that the persistence factor is not blooved against metals. Elemental metals do not degrade and, therefore, should receive higher accres for persistence than other substances subject to degradation processes. One community claimed that the soil

One communities claimed that the soil expressive pathway is likely to bias the HES scores of mining works sites toward higher values because such sites contain large volumes of waste covering large surface across, and because of geographic factors, these large areas are soldom ascared against direct public access. In addition, according to the commenter, the public may be attracted to mining weste sites. The commenter regested that the soil exposure pedoway incorrectly assumes there is an exposure because there is access to mining waste sites.

EPA does not agree that the soil exposure pathway is biased against mining waste alter. The pathway evaluates exposures of people via contact with sufficial bezardons substances. The Agency believes that, all clee being equal, large contaminated surface arress with public access, including those sesectiated with mining waste size, should receive higher scores for the soil exposure pathway than smaller sizes with more nestricised access. Even sizes with large contaminated surface areas are unlikely to be accessed high scores are unlikely to be accessed bigh scores are unlikely to be accessed bigh scores are unlikely to be accessed high scores are unlikely to be accessed bigh scores are unlikely to be accessed high scores are unlikely to be accessed high scores are unlikely to be accessed bigh scores are unlikely to be accessed bight scores are accessed and the part. As a commentation are accessed and the part minimum and are accessed and the bight are accessed and the part minimum are accessed and the accessed are accessed and the bight are accessed and the accessed are accessed and the accessed are accessed and the accessed are access

Three commenters stated that the original HES was blased against sites such as mining waste sites that are characterised by high volumes of waste with substively low concentrations of tenic constituents. Two of these commenters suggested that mining wastes would be appropriate for heserclous constituent questity determination because such wastes are relatively homogeneous (compared to other wastes) and, therefore, have fairly consistent concentrations. One of these two commenters also stated that the hezerdows waste quantity factor equations in Table 3-14 of the proposed rule should be revised to be less conservative. The remaining commenter suggested that the proposed HRS was still biased against mining waste sites because they are still scored based on the quantity of waste rather than on the concentration of the waste at the point of exposure.

EPA does not agree that the HRS is bissed against high-volume, lowconcentration waste sites. The final rule incorporates concentration data in three factors: (1) Likelihood of release (concentration data can be used for stablishing an observed release); (2) hexardoes weste quantity (concentration data, if available and adequate, can be used for calculating hexardous constituent quantity); and (3) tarnets (concentrations of hezardous tances present in drinking water wells or at other exposure points can be ed to determine weightings for nearest individuals (or wells or intakes). opulations, and sensitive environments factors). EPA has not explicitly required concentration data for all sites because of the substantial costs for obtaining these data and the very high degree of uncertainty associated with data collected during Sis.

EPA requested that the SAB review issues related to large-volume waste sites before the NPRM was published. The SAB final report is available in the CERCLA dockst. Two commenters stated that the Agency did not adequately consider the SAB's recommendations for revising the HRS, specifically those concerning the use of mobility data. The SAB, in its review of the original

The SAB, in its review of the original -HRS, examined whether large-volume waste sites (e.g., mining waste sites) had been treated differently than other waste sites and concluded that insufficient data were presented to demonstrate that the original HRS was biased age²-set mining waste sites. However, the SAB noted that the original HRS had the potential for such a bias, particularly when acoring potential to release, because the original HRS did not consider mobility, concentration of hazardous constituents, and transport. The SAB suggested several possible modifications to improve the application of the HRS to mining waste sites. Based in part on the SAB suggestions.

Based in part on the SAB suggestions. EPA proposed several changes to the overall scoring process to make the HRS more accurately reflect risks associated with mining wasts sites, notably, addition of a mobility factor to the air and ground water migration pathways, changes in the persistence factor, incorporation of a tiered hazardous waste quantity factor that can account for waste concentration data, and addition of health-based beschmarks for evaluating population. As explained in the NPRM, determining speciation of metals and pH, as the SAB had suggested, is not feasible given the temporal and spatial variations at hazardous waste sites and the limitations on SI data collection. Moreover, determining speciation is not feasible for most substances given EPA's current analytical procedures; requiring speciation analyses would add substantially to the cost of data collection.

unions stated that the Two cor proposed HRS can significantly overestimate risks associated with ining waste size that consist of hi volume, low-concentration wastes. One of these commenters recommended a "preliminary evaluation system" to more accurately reflect the actual risks associated with such sites and remove any bias in the HES relative to other types of siles. This commenter also suggested that in proposing the HRS revisions, EPA had ignored the results of its own studies under RCRA sections 3001 and 8002, which the cos enter believed to be more focused efforts to quantify risks from mining waste sites than the HRS revisions.

EPA does not believe that a separate "preliminary evaluation system" for accoring mining waste sites would be appropriate. A single HRS can be applied uniformly to all sites, allowing the Agency to evaluate sites relative to each other with respect to actual and potential hexards. The Agency examined the BCRA studies cited by the commenter before proposing HRS revisions. Those studies, which focus on the management of wastes at active facilities, couchded that many special study waste size (e.g., mining) do not present very high risks, while others may present substantial risks. EPA believes that the conclusions of these studies and the Agency's subsequent regulatory determinations (i.e., not to regulate most mining wastes under RCRA Subtitle C) are not inconsistent with a determination that some mining waste releases can require Superfund response actions. Furthermore, the HRS is designed so that it can be applied to closed and abandoned sites as well as active sites.

Other large volume waste sites. Several commentars suggested that the proposed HRS did not seet CERCLA section 125 requirements for sites involving fossil fuel combustion wastes. These commenters generally agreed that section 125 requires EPA to consider the quantity and concentration of hazardous constituents in fossil fuel combustion wastes and that the proposed HRS had not adequately addressed this requirement.

One commenter supported the Agency's proposal to allow consideration of concentration data when such data are available. Three commenters stated that the proposed HRS would often assign fossil fuel combustion waste sites high scores in part because of the worst-case assumptions or "default values" for certain factors (i.e., hazardous waste quantity, toxicity, target populations). The commenters claimed that fossil fuel combustion waste sites receive high scores merely because of the large quantity of waste, although this waste presents no significant adverse environmental effects, and that these high scores are inconsistent with EPA's findings in the RCRA section 8002 study. One of the three commenters suggested that the proposed HRS retained certain deficiencies of the original HRS, such as assuming that all hazardous substances in the waste consist of the single most toxic constituent in the waste.

EPA does not believe that the approach taken in the final rule creates a bias against fossil fuel combustion wastes. Partly because concentration data are considered in the final rule. fossil fuel combustion waste sites are not expected to score disproportionately high when compared with other types of sites. The HRS assumes that it is not possible to determine in a consistent manner the relative contribution to risk of all hazardous substances found at sites. Given this assumption, EPA has determined that basing the toxicity of the combination of substances at a site on the toxicity of the substance posing the greatest hazard is a reasonable and appropriately conservative approach. In many cases, the substance posing the greatest hazard is not several orders of magnitude more toxic than other hazardous substances at the site. Therefore, the effect of this approach on the toxicity factor value-which is evaluated in one order of magnitude scoring categories-is not as great as some commenters have suggested (see also section III D). In addition, as noted above, worst-case defaults are not assigned for mobility; population factors bave no default values.

Two commenters suggested that because CERCLA section 125 contains no statutory deadlines, EPA should take as much time as necessary to adequately respond. These commenters recommended that EPA extend the tiered approach of the hazardous waste quantity factor to other factors to take advantage of the extensive data on fossil fuel combustion wastes generated by the electric utility industry.

The Agency does not agree that the tiered approach used in the hazardous waste quantity factor should be extended to other factors for fossil fuel combustion waste sites [see also section III K). EPA believes that creating a separate HRS to score certain types of sites would not allow the Agency to provide a uniform measure of relative risk at a wide variety of sites, as Congress intended.

One commenter recommended that EPA consider using fate and transport models currently under development to incorporate quantitative representations of specific processes and mechanisms into the HRS. EPA carefully examined this possibility and concluded that although the use of fate and transport models could conceivably increase the accuracy of the HRS for some pathways. collection of the required site-specific data would be far too complex and costly. Fate and transport models are appropriate for a comprehensive risk assessment, but not for a screening tool such as the HRS. In addition, EPA's review suggested that it would be more difficult to achieve consistent results among users of such models than with the HRS. EPA points out that it used fate and transport models to develop the distance weighting factors used in the HRS target calculations, and also that the HRS incorporates several hazardous substance parameters (e.g., mobility) and site parameters (e.g., travel time) that are components of fate and transport models.

Two commenters expressed concern that the proposed HRS fails to account for the leachability of hexardous constituents as required by CERCLA section 125: According to the commenters, some hexardous constituents pose no risk via ground water because they will never be released to that medium. Thus, even if hexardous waste quantity and concentration are considered adequately, hexardous waste quantity scores for fossil fuel combustion sites will be erroneously high unless leachability is considered as well.

EPA examined the availability of leachate data and the feasibility of using such data for calculating hazardous substance quantity for all types of sources and wastes. The Agency decided against using leachate concentrations because: • Leachate data are not available for all sources and wastes, and available leachate data on high-volume wastes and some landfills have limited applicability for estimating the quantity of leachable hazardous substances;

• Leachate data derived from lab studies are limited and do not realistically represent the universe of field conditions such as heterogeneity of wastes, chemistry of leachate, and density and pore volume of disposed wastes; and

 Any method for using leachate data could not be consistently or uniformly applied to all sites.

EPA also examined the feasibility of developing site-specific leachate data for estimating leachable hazardous substance quantity for the ground water migration pathway. EPA decided against this option because reliable estimation of leachable hazardous substance quantity requires comprehensive sampling of site-specific heterogeneous waste, which would be prohibitively expensive and not feasible. In some cases, such sampling would be technically unfeasible and unsafe.

EPA evaluated alternatives for developing a surrogate for estimating leachable hazardous substance quantity. The Agency found that adding the mobility factor to the ground water migration pathway, based both on solubilities and distribution coefficients (Kas) of hazardous substances, and multiplying it by the hazardous waste quantity factor would be a feasible alternative for approximating the fraction of hazardous substance quantity expected to be released to ground water.

Q. Consideration of Removal Actions (Current Versus Initial Conditions)

The original HRS based the evaluation of factors on initial conditions. In the preamble to the proposed rule, **KPA** specifically requested comments on whether sites should be scored on the basis of initial or curre vt conditions. The principal question is whether the effect of response actions, such as the removal of some quantity of the waste, should be considered when sites are scored. Initial conditions are defined by the timing of the response action; that is, initial conditions are the conditions that existed prior to any response action. For sites where no response action has occurred, initial and current conditions are the same for evaluating sites.

Of the 25 commenters responding to this issue, 15—including all industry commenters—supported scoring on current conditions. In the preamble of the proposed rule. EPA presented two approaches for considering response actions in HRS scores: (1) Consider these actions only for those pathways and factors for which they are most appropriate; and (2) consider these actions in all pathways, but make exceptions at situs where initial conditions more accurately reflect risks. These who stated a tradingere

Those who stated a preference fevered the second, specifying that the ecceptions should be clearly defined in the final rule. These commenters stated that scoring all pathways on current conditions would encourage responsible parties to clean up sites quickly. They reasoned that if channys are delayed, the threat of migration of the hazardous substances increases; therefore, scoring on current conditions is consistent with the intent of CERCLA because it encourages rapid remedial action. One commenter and that scoring on initial conditions made little same when, as a result of the cleanup, the level of residual contamination was below the level required by CERCLA.

Soveral proponents of acoring on current conditions stated that EPA's concern that responsible parties would clean up size just enough to avoid being listed on the NPL was unfounded. They argued that the proposed scoring system is too complicated to membulate, and that predicting the effect of partial cleanups on the final score would be difficult. Others suggested that where contamination remeines, sampling during an SI will discover it.

Ten commenters did not faily support scoring on current conditions. Only one opposed any consideration of current conditions. Several commenters supported scoring the soil exposure and air migration pathways on current conditions. Others stated that response actions should be considered only when the actions are conducted under Federal or State direction, or when the action constitutes a complete cleanup. Several added that State actions should not be considered because it would penalize Status with active remedial programs. One current and initial conditions: if the response action had addressed all herards, than the current conditions score should be used.

Based on public comment, EPA has decided to change its policy on consideration of removal actions. The Agency agrees that consideration of such actions in HES scores is likely to increase incontives for rapid actions by responsible parties, reducing risks to the public and allowing for more cost effective expanditure of the Pund. In making this decision, EPA tried to balance the benefits of considering removal actions in HRS scores (e.g., increased incentives for rapid actions) while also ensuring that the HRS score reflects any continuing risks at sites where contamination occurred prior to any response action.

Therefore. EPA will calculate waste mantities beesd on current conditions. However, EPA believes the accuracy of this approach depends on being able to determine with reasonable confidence the quantity of basardous constituents remaining in sources at the site and the quantity released into the environment. As a consequence, where the Agency does not have sufficient information to estimate the quantity of hazardous constituents remaining in the sources at the site and in the associated releases, a minis un factor value may be assigned to the hezerdous waste quantity factor value. Thus, removal actions may not reduce waste quantity factor values as the quantity of hazardous mb constituents remaining in sources and in releases can be astimated with somable confidence.

In addition to providing incentives for early response, this approach also provides incentives for potentially responsible parties to ascertain the extent of the remaining contamination at a. Potentially responsible parties undertaking removal actions will have the primary responsibility for collecting any data needed to support a ination of the quantity of detern bezardous constituents remaining. EPA expects responsible parties may need to conduct su upling and analyses to determine the extent of hazardous substance migration in soils and other dia in order to estimate with somable confidence the quantity of hezerdous constituents remaining.

EPA decided not to limit the considuration of response actions to certain pathways (e.g., the soil exposure pathway) because this would overstate the risk at sites where removal of wastes has eliminated threats in all pathways. Moreover, a more limited approach to consideration of response actions would provide less incentive for rapid ...aponse action. EPA will evaluate a site based on

EPA will evaluate a site based on current conditions provided that response actions actually have removed wastes from the site for proper disposal or destruction in a facility permitted under the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TSCA), or by the Nuclear Regulatory Commission. HRS accering will not consider the effects of responses that do not reduce waste quantities such as providing alternate drinking water supplies to populations with drinking water supplies contaminated by the site. In such cases, EPA believes that the initial targets factor should be used to reflect the adverse impacts caused by contamination of drinking water supplies; otherwise, a conta minated squifer could be artificially shielded from further remediation. This decision is consistent with SARA section 118(a). which requires that EPA give high priority to sites where containing tion from the site results in closed drinking water wells. Similarly, if residents are relocated or if a school is closed because of contamination due to the . site, EPA will consider the initial targets in scoring the site.

As noted in the proposed rale pressible, EPA would only consider removals conducted prior to an SL EPA believes that the SI is the appropriate time to evaluate conditions, because it is the source of most of the data used to score a site. Because response action at sites may be an engoing process, it would be burdensome to recalculate scores continually to reflect such actions.

In response to commenters, EPA also considered whether response actions should be considered in HRS scores only if they are performed under a State or EPA order. EPA decided not to choose this approach for two reasons. First, it would dissinish the incentive for an expeditious response at the site if a signed order were required. Second, because a response action must be conducted before the SI to be conditions upon which this order could be based.

EPA has also decided not to differentiate between response actions initiated by States and those conducted by other parties. The Agency believes this approach will help cam nt application of the HRS by consis avoiding situations where two sit sites are scored using different sets of reles. Moreover, although the Agency is sympethetic to concerns about disincentives to States for initiating actions, it believes that such cases will be rare. Many State (and Poderal) removal actions are interim me designed to stabilize conditions at the site. Given the more limited definition of response action noted above (e.g., removal of waste from the site fo disposal or destruction in a RCRA-permitted facility), many actions conducted by States would not be considered in HRS scoring. In addition, in many cases, State and Pederal removal actions are undertaken after an SI has been conducted. As noted above,

EPA will only consider removals conducted before the SI in the HRS score.

R. Cutoff Score

In the NPRM preamble, EPA proposed that the cutoff score for the revised HRS be functionally equivalent to the current cutoff score of 28.5. The Agency also requested comment on three proposed options for determining functional equivalence:

• Option 1: Score sites using both the original and final rule, then use statistical analysis to determine what revised HRS score best corresponds to 28.5;

• Option 2: Choose a score that would result in an NPL of the same size as the NPL that would be created by using the original HRS; and

• Option 3: Identify the risk level that would correspond to 28.5 in the original HRS and then determine what revised HRS score corresponds to that risk level.

Some commenters stated that there cannot be a functional equivalence if the revisions have any meaning. They argued that if the revisions meet the statutory mandate to make the HRS more accurate, the scores should be different and, therefore, cannot be related. Several commenters supported the use of a functional equivalent, but were divided about which option should be used. One commenter stated that the 28.5 score should be evaluated to determine whether it reflected minimum risk levels. If it did, the commenter suggested that a functional equivalent would be appropriate and should be determined using equivalent risk levels (option 3), but also with an eye toward keeping the NPL to a manageable size (option 2).

Commenters not supporting the use of a functional equivalent suggested a variety of alternative approaches, including:

including:
Establish the cutoff score based on risk, without regard to the current cutoff level or a functional equivalent;

Leave the score at 28.5;

• Propose a new cutoff score and a description of methodology in a public notice with a 60-day public comment period;

• Lower the cutoff score to provide an incentive to responsible parties to undertake remedial efforts and make it possible for sites where a removal action has taken place to make the NPL, thus reducing the controversy over whether to score sites based on current conditions;

Raise the cutoff score by at least 20 points;

• Eliminate the present cutoff score by creating categories of sites instead of individual ranks as a means of prioritizing NPL sites;

• Amend the NPL annually to include only those sites that deserve priority attention (e.g., orphaned sites) and are likely to receive Superfund financing, or

• Rank all sites showing any degree of public health and/or environmental risk on a relative scale and perform remedial activities based on available funding.

In addition, four commenters felt that the cutoff score for the final rule should not be fixed until the technical merits and potential scores of representative sites are tested and compared using both the current and proposed HRS. Further, one commenter noted that the field test did not indicate the relationship between the revised HRS score for a given site and the current score; another added that until this equivalency issue is clarified, meaningful comment on any proposed revisions cannot be made.

Based on an analysis of 110 test sites. EPA has decided not to change the cutoff score at this time. This conclusion was reached after applying all three approaches to setting a cutoff score that would be functionally equivalent to 28.5. In its analysis, the Agency scored field test sites with both the original and revised HRS. The data from these test sites show that few sites score in the range of 25 to 30 with the revised HRS model. The Agency believes that this range may represent a breakpoint in the distribution of site scores and that the sites scoring above the range of 25-90 are clearly the types of sites that the Agency should capture with a screening model. Because the analysis did not point to a single number as the appropriate cutoff, the Agency has decided to continue to employ 28.5 as a management tool for identifying sites that are candidates for the National **Priorities List.**

EPA believes that the cutoff score has been, and should continue to be, a mechanism that allows it to make objective decisions on national priorities. Because the HRS is intended to be a screening system, the Agency has never attached significance to the cutoff score as an indicator of a specific level of risk from a site, nor has the Agency intended the cutoff to reflect a point below which no risk was present. The score of 28.5 is not meant to imply that risky and non-risky sites can be precisely distinguished. Nevertheless, the cutoff score has been a useful screening tool that has allowed the Agency to set priorities and to move forward with studying and, where appropriate, cleaning up hazardous

waste sites. The vast majority of sites scoring above 28.5 in the past have been shown to present risks. EPA believes that a cutoff score of 28.5 will continue to serve this crucial function.

IV. Section-by-Section Analysis of Rule Changes

Besides the changes discussed above, EPA has made substantial editorial revisions in the rule being adopted today. Source characterization is discussed in section 2 of the final rule, along with factors that are evaluated in each pathway. These factors include hazardous waste quantity, toxicity, and evaluation of targets based on benchmarks. The order of presentation of the pathways has been changed to ground water, surface water, soil exposure, and air. Following the four sections describing the pathways, a section has been added explaining how to evaluate sites that have radionuclides either as the only hazardous substances at the site or in combination with other hazardous substances.

In general, descriptive text that provided background information has been removed as have references and data sources; the sections have been rewritten to make the rule easier to read and to apply. The figures presenting overviews of the pathways and the scoring sheets have been revised throughout to reflect changes in the rule and assigned values.

This section describes, for each section of the rule and each table, the specific substantive changes; editorial changes that do not affect the content of the rule are not generally noted.

Section 1 Introduction

The text explaining the background of the HRS and describing the rule has been removed. Definitions of a number of additional terms used in the rule have been added for clarity. The definition of "hazardous substance" has been revised for clarification. The definition of "site" has been clarified and now indicates that the area between sources may also be considered part of the site. The definition of "source" has been revised to explain that those volumes of air, ground water, surface water, or surface water sediments that become contaminated by migration of hazardous substances are not considered a source, except contaminated ground water plumes or contaminated surface water sediments may be considered a source if they cannot be attributed to an identified source. In addition, the definition of source now includes soils contaminated by migration of hazardous substances.

EPA will only consider removals conducted before the SI in the HRS score.

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Under the original HRS, the Agency took the approach that all feasible efforts should be made to identify sources before listing a site on the NPL If, after an appropriate effort has failed to identify a source, the Agency believed that the contamination was likely to have originated at the type of source that would be addressed under Superfund, such sites were listed. Subsequent investigations after listing have generally identified a specific source. In some cases, EPA has not listed contaminated media without clearly identified sources because it appeared the source of pollution would not be addressed by Superfund programs; an example of such a source would be extensive, low-level contamination of surface water sediments caused by pesticide applications. EPA has found this approach to be generally workable and will continue to evaluate, on a case-bycase basis, whether sites with no identified sources should be listed.

Where contaminated media with no identified sources exist, the final rule enerally assigns a bazardous waste quantity factor value to such contamination, with the value depending on whether there are any targets subject to Level I or Level II concentrations. For contaminated sediments in the surface water migration pathway, if there is a clearly defined direction of flow, target distances are measured from the point of observed sediment contamination that is farthest upstream. For ground water plumes and for contaminated sediments where there is no clear direction of flow, the center of the observed ground water or sediment contamination is used for the purpose of measuring target distance limits.

Section 2 Evaluations Common to Multiple Pathways

This section covers factors and evaluations common to multiple pathways. The major changes to these factors include: observed release criteria have been revised; the toxicity factor has been changed to a linear rather than a log scale; scales for hazardous waste quantity have been made linear and expanded, and the hazardous waste quantity minimum value has been changed; the waste characteristics factor category score is now obtained by multiplying the factor values and using a table to assign the final score; use of benchmarks has been extended to all pathways and to the nearest individual (well/intake) factor; and the methods for comparisons to benchm rks have been changed as have the benchmarks used. The purpose of this part is to make the rule less repetitious by presenting full explanations of the evaluation of certain factors only once rather than in each pathway in which they occur.

Exceptions related to radionuclides are noted throughout the rule and referenced to Section 7.

Section 2.1 Overview. Introduces the pathways and threats included in HRS scoring.

Section 2.1.1 Calculation of HRS site score. Provides the equation used to calculate the final HRS score.

Section 2.1.2 Calculation of pathway score. Indicates, in general, how pathway scores are calculated and includes a sample pathway score sheet (Table 2-1).

Section 2.1.3 Common evaluations. Lists evaluations common to all pathways.

Section 2.2 Characterize sources. Introduces source characterization and references Table 2-2, the new sample source characterization worksheet.

Section 2.2.1 Identify sources. Explains that for the three migration pathways, sources are identified, and for the soil exposure pathway, areas of observed contamination are identified.

Section 2.2.2 Identify hazardous substances associated with a source. Covers information previously provided in the introduction to the waste characteristics factor category.

Section 2.2.3 Identify hazardous substances available to a pathway. Explains which hazardous substances may be considered available to each pathway. For the three migration pathways, the primary limitation on availability of a hazardous substance to a pathway is that the substance must be in a source with a containment factor value, for that pathway, greater than 0; that is, the hazardous substance must be available to migrate from its source to the medium evaluated. For the soil exposure pathway, the primary limitation is that the substance must meet the criteria for observed contamination and, for the nearby threat, it must also be accessible.

Section 2.3 Likelihood of release. Specifies the criteria for establishing an observed release (discussed in section III G of this preamble) and explains that p tential to release factors are evaluated only when an observed release cannot be documented. Table 2--3. which replaces Table 2--2 in the proposed rule, provides the revised observed release criteria for chemical analyses for the migration pathways. Table 2-3 is also used in establishing observed contamination for the soil exposure pathway.

Section 2.4 Waste characteristics. Defines the waste characteristics factor category.

Section 2.4.1 Selection of substance potentially posing greatest hazard.

Explains how to select the substance potentially posing the greatest hazard.

Section 2.4.1.1 Toxicity factor. Explains how to assign toxicity values. Changes in the approach to scoring toxicity are discussed in section III D of this preamble. Table 2-4 (proposed rule Table 2-11) has been revised to make the assigned factor values linear rather than logarithmic values; however, the relationship among the values has not changed. A provision to always assign lead (and its compounds) an HRS toxicity factor value of 10,000 was added as a result of changes since the time of the proposed rule in the way EPA develops chronic toxicity values for lead (i.e., reference doses, in units of intake (mg/kg-day), are no longer developed for lead).

Section 2.4.1.2 Hazardous substance selection. Lists which factors are combined, in each pathway or threat, to select the hazardous substance potentially posing the greatest hazard. For each migration pathway, each substance eligible for consideration is evaluated based on the combination of toxicity (human or ecosystem) and/or mobility, persistence, and bioaccumulation (or ecosystem bioaccumulation) potential. The substances selected for each pathway or threat are those with the highest combined values. For the soil exposure pathway, the substance with the highest toxicity value is selected from among substances that meet the criteria for observed contamination for the threat being evaluated. The use of bioaccumulation in the selection of substances in the human food chain threat has changed as a result of the structural changes discussed above. In the proposed rule, only substances with the highest bioaccumulation values were evaluated for toxicity/persistence; in the final rule, the substance with the highest combined toxicity/persistence/ bioaccumulation value is selected in the human food chain threat of the overland flow/flood migration component. For the ground water to surface water migration component, mobility is also considered. This revised method better reflects the overall threat.

Section 2.4.2 Hazardous waste quantity. Describes how to calculate the hazardous waste quantity factor value. as explained in section III D of this preamble. The explanation has been simplified from that presented in the proposed rule, and a discussion of unallocated sources has been added. A discussion clarifying the method for evaluating hazardous waste quantity in the soil exposure pathway was also added. and clarifying language on this

t was inserted describent the actions of § 2.4.2. Table 3-13 from sint wee inerted three e proposed raje has been eliminate Saction 24.2.1 Source honordour hete

aste quantity. Details the mot does waste quantity for a source tity for a source er area of observed cash aninetica.

Section 242.1.1 Henerdows constituent quentity. Explains how to m a value to the hazardous disant quantity factor. An anotion of the trackment of RCRA ardone wastes has been added to equi clarify the scoring of these we us Waste Q Table 3-6, Hazy a a títe Evaluation Equations (proposed raio Table 2-14), has been revised in several ways. The constant divisor of 10 has een moved from these equations and is sw incorporated into the factor values and using Table 3-6. Two types of ce impoundments are now listed to ce impoundments are se that butied surface undmants are treated concistely. The term "tanks" h an added to containers other th me to clarify how tanks should be " dr rouse to contry now wants amount or valuated. Also, equations for advalating herardous waste quantity used on area have been revised based in a study of waste shot. The study adjusted that new depth accumptions would be used for some sources; the ad treatment equation was revised used on data from the same study bout typical loading rates in land t operations.

Section 24212 Hanado estream quantity. Explains how to a value for hexerdous trees quality based on the an startuum. An explanation of sent of RCRA hexardous 4 e wieles the treat the has been added to clerify the g of these we

Section 2.4.2.1.3 Volume Explains

w to assign a value for source volume Section 24214 Area Exploins how assign a value for source an Section 24.2.1.5 Calculation

a of source heseratous seeste quantity value. Replains how to easign a value to source nious weste qu

Section 24.22 Colculation of henerdous weeke quantity factor value. Explains how to assign a factor value to herestions wests quantity using Table 2-4. The values in Table 5-6 include several changes. The cas analised to the several changes. The cap applied to the factor value (i.e., the lowest besterdous e quantity value required to assi assimum factor value) has been و عله and to reflect more accurately the of hexardous substance quantities in case ge of home nd at waste sites. The cap is set based on the maximum quantity found at current NPL sites. Rather than being assigned a maximum of 100, as in the

proposed rule. the assigned factor values range to 1.000.000. Each factor value loss than the cap is assigned for mantities that range across two orders itude. The two-order-ofà s or impletence. I be two-orcier-or-megnitude ranges reflect the uncertainty in estimates of both quantity and concentration of the bezardous substances in sources and associated releases as well as uncertainty in identifying all sources and associated unses. Using the ranges also uplifies documentation requirements. **pal** Non-maro values below 1 are rounded to 1 to ensure that sites with small amounts of hezardous substances will receive a non-suro acore for waste encletistics. When hezardous constituent quantity data are incomplete, the missions hazardous rasie quantity factor value is 10, except for: [1] Migration pathways that have any target subject to Level 1 or II concentrations; and (2) migration pathways where there has been a removel action and the hazardous waste quantity factor value would be 100 or greater without consideration of the removal action. In these cases, the minimum hezardous waste quantity factor value has been changed to 100 (see sections III C and III O above for further discussion of the new minimum valmest

Section 24.3 Waste characteristics factor category value. Explains how to assign a value to the waste characteristics factor category. As discussed above, the final waste characteristics factor value is capped at 100 (1,000 with bioeccumulation potential). Values are assigned by placing the product of the waste characteristics factors into ranges of one order of magnitude, to a cap of 10⁶ (10¹² if bioaccumulation potential is considered).

Section 2.4.3.1 Pactor collegory value. Explains how to use Table 2-7 to a value to waste characteristics when bioaccumulation (or accepten bioaccumulation) potential is not considered.

Section 2.4.3.2 Pactor category value, considering bioaccumulation potential Explains how to use Table 2-7 to assign a value to waste characteristics when bioaccumulation (or acception bioaccurrelation) stential is considered. Section 2.5 Targets. Explains how DO

targets factors are evaluated. This approach generally involves three levels of evaluation (Level I, Level E, and Potential) and the use of media-specific concentration bunchmarks, as discussed in section III H of this preamble. Level III has been dropped: use of benchmarks has been extended to all pathways and to factors that assign values to the nearest individual (well/intake). Also discusses assigning level based on direct observation and describes when tissue samples that do not establish actual contamination may be used in comperisons to benchme ales.

Section 2.5.1 Determination of level of actual contamination at a sampling location. Explains the approach used for evaluating the level of actual contamination at a sampling location; changes have been made to allow the level of actual contamination in the man food chain threat to be based on tissue samples from aquatic food chain organisms that cannot be used to organi establish an observed release.

Section 2.5.2 Comparison to benchmorks. Lists benchmarks and explains how to determine whether beachmarks have been equalled or exceeded (see section III H of this prounble; changes have been made to allow the level of actual continuination in the human food chain threat to be based on tissue samples from aquatic food chain experience that cannot be used to establish an observed release.

Section 3 Ground Water Migration Pathway

The ground water migration pathway evaluates threats resulting from releases evaluates threats resulting from releases or potential releases of hazardons substances to aquifers. The major changes specific only to this pethway include replacement of the depth to aquifer/hydroulic conductivity and sorptive capacity factors with travel time and depth to aquifer factors; a revised approach for assigning mobility values; removal of the ground water use factors and their replacement by a resources factor; evaluation of the nearest well factor based on benchmarks, and revisions to scoring of sites having both karst and non-karst squifers present.

Section 3.0 Ground Water Migration Pathway. Descriptive text has been removed. Figure 3-1 has been revised to reflect revisions to the factors evaluated, and Table 3-1 has been revised to reflect the new factor category values throughout.

Section 3.8.1 General considerations. The title has been changed.

Section 3.0.1.1 Ground water target distance limit. An explanation of the treatment of contaminated ground water plumes with no identified source has been added. For these plumes, measurement of the target distance limit begins at the center of the area of observed ground water contamination;

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51572 Federal Register / Vol. 55, No. 241, / Friday, December 14, 1990 / Rules and Regulations

the center is determined based on available data.

Section 3.0.1.2 Aquifer boundaries. Descriptive text has been removed.

Section 3.0.1.2.1 Aquifer interconnections. Descriptive text has been removed as have examples of information useful for identifying aquifer interconnections.

Section 3.0.1.2.2 Aguifer discontinuities. Descriptive text has been removed.

Section 3.0.1.3 Karst aquifer. Descriptive text has been removed, and references to factors have been revised to reflect changes in factors. Text was added to clarify that karst aquifers underlying any portion of the sources at a site are given special consideration. Section 3.1 Likelihood of release.

Section 3.1 Likelihood of release. Descriptive text has been removed.

Section 3.1.1 Observed release. Description of the criteria for establishing an observed release has been revised as discussed in Section III G of this preamble.

Section 3.1.2 Potential to release. Text has been revised to reflect changes in the factors evaluated and to clarify that karst aquifers underlying any portion of the sources at a site are given special consideration in evaluating depth to aquifer and travel time.

Section 3.1.2.1 Containment. Explanatory text has been removed and the ground water containment table is referenced. Only sources that meet the minimum size requirement (i.e., that have a source hazardous waste quantity value of 0.5 or higher) are used in assigning containment factor values. This requirement has been added to ensure that very small, uncontained sources do not unduly influence the score. For example, a site might have a large, but highly contained source and a very small, uncontained source; without a minimum size requirement, potential to release could be assigned the maximum value based on the very small source, which could overestimate the potential hazard posed by the site. If no source meets the minimum size requirement, the highest ground water containment factor value assigned to the sources at the site is used as the factor value. Table 3-2-Containment Factor Values for Ground Water Migration Pathway, has been simplified by combining repetitious items and has been moved from an attachment to the proposed rule into the body of the rule.

Section 3.1.2.2 Net precipitation. A new map has been added as Figure 3-2 to assign net precipitation factor values. The equation for calculating monthly potential evapotranspiration was clarified. Descriptive text has been removed. Section 3.1.2.3 Depth to aquifer. As described in section III L of this preamble, the depth to aquifer factor has replaced the sorptive capacity factor and is no longer combined in a matrix with hydraulic conductivity for scoring. Table 3-5 is new and provides the factor values. The depth to aquifer factor reflects the geochemical retardation capacity of the subsurface materials, which generally increases as the depth increases. Depth to aquifer factor values are assigned to three depth ranges. Clarifying language was added related to karst aquifers.

Section 3.1.2.4 Travel time. As discussed in section III L of this preamble, this factor replaces the depth to aquifer/hydraulic conductivity factor and is based on the least conductivity layer(s) rather than on the conductivities of all layers between the hazardous substances and the aquifer. Table 3–7 has been revised to reflect these changes. Table 3–5 from the proposed rule has been renumbered as Table 3–6. Text on how to obtain information to score this factor has been removed. Clarifying language was added related to karst aquifers.

Section 3.1.2.5 Calculation of potential to release factor value. Text has been revised to reflect new factor names.

Section 3.1.3 Calculation of likelihood of release factor category value. New maximum value of 550 based on observed release has been added.

Section 3.2 Waste characteristics. Descriptive text has been removed. Section 3.2.1 Toxicity/mobility.

Descriptive text has been removed.

Section 3.2.1.1 Toxicity. References § 2.4.1.1.

Section 3.2.1.2 Mobility. As discussed in sections III F and III P of this preamble, the method for assigning mobility values to hazardous substances has been revised. Table 3-8 has been revised. Mobility values are now linear rather than categorical place holders and are assigned in a matrix combining water solubility and distribution coefficients. Mobility values may now vary by aquifer for a specific hazardous substance. The maximum mobility value is no longer assigned based on observed release by direct observation. A factor value of 0 is no longer assigned for mobility, as had been the case under the proposed rule, where categorical placeholder values were used; because mobility is now multiplied by toxicity and hazardous waste quantity, assigning a 0 value would result in a pathway score of 0. This result could understate the risk posed by a site with a large volume of highly toxic hazardous

substances with low mobility. Furthermore, given the uncertainties about estimates of mobility in ground water and their applicability in sitespecific situations, BPA determined that a 0 value should not be assigned to the mobility factor under any conditions.

Section 3.2.1.3 Calculation of toxicity/mobility factor value. Text has been simplified. Table 3-9 (proposed rule Table 3-10), the matrix for assigning factor values, has been revised to reflect the linear nature of the assigned values. Values for a specific hazardous substance may now vary by aquifer.

Section 3.2.2 Hazardous waste quantity. References § 2.4.2.

Section 3.2.3 Calculation of waste characteristics factor category value. Text has been revised to indicate the multiplication of the factors, the new maximum value, and the table used to assign the factor category value.

Section 3.3 Targets. Text has been revised to reflect the new names for factors. Descriptive text has been removed. Table 3-10 (Table 3-12 in the proposed rule) has been modified to list the revised benchmarks in this pathway.

Section 3.3.1 Nearest well. Title has been changed from maximally exposed individual. Text has been added to explain how to evaluate nearest wells with documented contamination [at Level I and II) and those potentially contaminated. Text was added to assign Level II contamination to any drinking water well where an observed release was established by direct observation. This section also explains how to evaluate wells drawing from karst aquifers. Table 3-11 has been renamed and the factor values have been changed. See section III B of this preamble for a discussion of the changes to assigned values for this factor.

Section 3.3.2 Population. As discussed in section III H, population is evaluated using health-based benchmarks for drinking water. For populations potentially exposed, population ranges are used to evaluate the factor. This section explains whom to count for population. Populations served by wells whose water is blended with that from other drinking water sources are to be apportioned based on the well's relative contribution to the total blended system. The rule includes instructions on the type of data to use when determining relative contributions of wells and intakes. This change is intended to reflect more accurately the exposure to populations through blended systems. The rule also includes instructions on how to apportion population for systems with standby wells or standby surface water intakes.

Section 2.2.2.1 Level of contamination. Explains how to evolvets population based on concentrations of basedous substances in samples. Text was added to assign Level II contamination to any drinking water wells where there is an observed release by direct observation.

Section S.1.2.2 Level | concentrations. Boplains how to evaluate populations exposed to Level I concentrations. The scoring cap was eliminated, and the multiplier (i.e., weight) is new 10.

Section 22.2.5 Level II concentrations. Explains how to evaluate populations exposed to Lovel II concentrations. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 3.3.2.4 Potential material states and the sector of the sector above to populations potentially spood to contamination from the site. copies w communication near the sec-The formula for calculating population values has been medified to reflect both the revised method for evaluating harst aquifiers (see below) and the use of distance-ordipled population values from Table 3–12, which has been added to assign distance-weighted values for populations in each distance category. The values are determined for each distance category and are than added across distance calegories, and the su is divided by 10 to derive the factor value for potentially contaminated population. The assigned values in population. The assigned values in Table 3-12 ware determined by tical simulation to yield the same statio intion value, on everage, as the m population value, on average, as use use of the formulas in the proposed role. The use of range values has been adopted as part of the simplification discussed in section III A. The rounding raises have also changed. The method for evaluating langt equilars has been simplified and is ed in this section n. Table 3-14 in e proposed zale, which included lation weighting factors for the ge õ an ei case and for two special cases, has been removed, and the two special knext cases are no league evaluated. (The generally applicable dilution factors for facet have a ot changed and are all corporated into the distance-weight operation values in Table 3-12.) The scoring cap was eliminated, and the multiplier (i.e., weight) in now 0.1. Section 3.3.2.5 Calculation of

Section 3.3.2.5 Calculation of population factor value. Has been revised to reflect the changes in the evaluation of actually contaminated wells. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 3.3.3 Resources. Describes how points are assigned to resource uses of ground water. Points may be assigned if there are no drinking water wells within the target distance limit, but the water is usable for drinking water. This scoring allows for consideration of potential fature uses of the aquifers. (See section III I of this preamble for a discussion of the relative weighting of these factors.)

Section 3.3.4 Wellheod protection area. Explains how to assign values to this factor. The maximum value is assigned when a source or an observed ese lies partially or fully within a wellhead protection area applicable to the aquifer being evaluated, and this value has been changed from 50 to 20 to adjust for scale changes. A new criterion for scoring this factor has been added. If a wellhead protection area applicable to the aquifer being evaluated is within the target distance limit and neither of the other conditions is met, a value of five is assigned. This change allows the HRS to place a value on the resource.

Section 3.3.5 Calculation of targets foctor category value. Has been revised to reflect changes in the factor nemes. The rounding rule has been changed, and the scoring cap was eliminated.

Section 3.4 Ground water migration accre for an aquifer. Text has been revised to reflect the new divisor for normalizing pathway accres.

Section 3.5 Calculation of ground water migration pathway score. Text has been simplified.

In addition to the above noted changes, the scriptive capacity factor has been eliminated and replaced by the depth to aquifer factor, as have the tables used to assign values to this factor (Tables 3-6 and 3-7 in the proposed rule). The ground water use factors have also been eliminated as have the tables used to assign their values (Tables 3-15 and 3-16 in the proposed rule). Figures 3-2, 3-3, and 3-4 and Tables 3-6, 3-6, 3-8, 3-13 of the proposed rule have been removed.

Section 4 Surface Water Migration Fothway

The surface water migration pathway evaluates threats resulting from releases or potential releases of hazardous substances to surface water bodies. One major change to this pathway is the addition of a new component for scoring ground water discharge to surface water: either this component or the overland flow/flood migration component or both may be scored. For each component, three threats are evaluated: drinking water threat, human fcod chain threat, and environmental threat. Other major changes specific to this pathway include elimination of the recreational use threat, simplification of overland flow potential to release factors: modifications to the human food chain threat including addition of a food chain individual: medifications to the treatment of bioaccumulation potential and addition of a similar factor, -ecosystem bioaccumulation potential, to the evaluation of the environmental threat; modifications to the persistence factor; revisions to the dilution weights; additions of banchmarks, extension of benchmarks to evaluation of the nearest intake, and addition of levels of contamination to the human food chain. targets; modifications to criteria for establishing actual food chain contamination; elimination of the surface water use factor; addition of a resources factor to the targets evaluation in the drinking water threat; and revisions to sensitive environments

Section 4.0 Surface Water Migration Pathway. New structure of the pathway is explained. Descriptive text has been removed. Figure 4-1 has been revised to reflect revisions to the factors evaluated, and Table 4-1 has been revised to reflect the new factor. category values throughout.

Section 4.8.1 Migration components. Explains how to score the two migration components.

Section 4.8.2 Surface water congenies. A definition of constal tidal waters has been added. Some surface water bodies that belong in this new category were listed in other categories in the proposed rule (e.g., bays and wetlands contiguous with oceans). Isolated parenuisi wetlands have been added to the definition of lakes; salt arbors largely protected by water h segwalls have been removed from the definition of lakes. Ocean has been defined more precisely as are seaward from the baseline of the Territorial Son. Contignous bays have been removed from, and wetlands contiguous to the Great Lakes have been added to ocean and ocean-like bodies. These definitional changes/ clarifications more accurately reflect the different characteristics of the water bodies.

Section 4.1 Overland flow/flood migration component. As discussed in section III M of this preamble, the surface water migration pathway has been divided into two components. The overland flow/flood component is essentially the surface water migration pathway as proposed except that the recrustional use throat has been eliminated.

Section 4.1.1 General considerations. Consists of several subsections. Section 4.1.1.1 Definition of the hazardous substance migration path for overland flow/flood migration component. Text has been simplified.

Section 4.1.1.2 Target distance limit. Explains target distance limits for sites in general and adds an explanation of how to calculate the target distance limit for contaminated sediments with no identified source. For these latter sources only, when there is a clearly defined direction of flow, the target distance limit is measured beginning at the observed sediment contamination farthest upstream; when there is no clearly defined direction of flow, the target distance limit is measured from the center of the area of observed sediment contamination. Discusses the determination of whether surface water targets are subject to actual or potential contamination. Also, text was added to assign Level II to targets subject to actual contamination based on direct observation.

Section 4.1.1.3 Evaluation of the overland flow/flood migration component. Explains that for multiple watersheds, highest score assigned to a watershed is used instead of summing watershed scores as proposed.

Section 4.1.2 Drinking water threat. Descriptive text has been removed.

Section 4.1.2.1 Drinking water threat—likelihood of release. Text has been simplified to clarify when potential to release factors need to be evaluated.

Section 4.1.2.1.1 Observed release. Text has been revised to reflect the changed maximum value.

Section 4.1.2.1.2 Potential to release. Text has been revised to reflect the changed maximum value and has been simplified.

Section 4.1.2.1.2.1 Potential to release by overland flow. Explains when overland flow potential to release is not evaluated.

Section 4.1.2.1.2.1.1 Containment. Text has been revised to reflect changes in the numbering of the containment table. Only sources that meet the minimum size requirement (i.e., that have a source hazardous waste quantity value of 0.5 or higher) are used in assigning containment values. This requirement has been added to ensure that very small, uncontained sources do not unduly influence the score. For example, a site might have a large, but highly contained source and a very small, uncontained source; without a minimum size requirement, the potential to release could be assigned the maximum value based on the very small source, which could overestimate the potential hazard posed by the site. If no source meets the minimum size requirement, the source with the highest

surface water containment factor value is used. Descriptive text has been removed. Table 4-2, Containment Factor Values for Surface Water Migration Pathway, has been simplified by combining repetitious items and has been moved from an attachment to the proposed rule into this section of the final rule.

Section 4.1.2.1.2.1.2 Runoff. Text on evaluating rainfall has been simplified by removing explanatory references. The runoff curve number has been simplified by substituting a soil group designation in its place. Table 4-4 (proposed rule Table 4-2) has been revised to list only the soil group designations. Based on analyses of runoff and actual drainage area sizes Table 4-3 (proposed rule Table 4-3) has been revised by changing the divisions of drainage area size. Table 4-5 (proposed rule Table 4-4) has been revised to reflect the changes related to the use of soil group designations. Table 4-6 (proposed rule Table 4-5) has been revised so that the heading in the table reads Rainfall/Runoff Value; the values assigned have been adjusted on the basis of both the higher maximum value assigned to the factor category and the analyses described above. Explanatory text has been removed.

Section 4.1.2.1.2.1.3 Distance to surface water. Values assigned to distance to surface water factor values in Table 4-7 (proposed rule Table 4-6) have been revised to adjust for the higher maximum assigned to the factor category.

Section 4.1.2.1.2.1.4 Calculation of the factor value for potential to release by overland flow. Has not been changed except for assigned value.

Section 4.1.2.1.2.2 Potential to release by flood. Descriptive text has been removed.

Section 4.1.2.1.2.2.1 Containment (flood). Text in Table 4-8 (proposed rule Table 4-7) has been revised to incorporate new language on required documentation on containment. The requirement for certification by an engineer has been dropped. The new documentation requirements have been added to make the rule consistent with RCRA requirements.

Section 4.1.2.1.2.2.2 Flood frequency. Values assigned to this factor by Table 4-9 (proposed rule Table 4-8) have been revised to better reflect probabilities and to adjust for the higher maximum assigned to the factor category. Descriptive text has been removed.

Section 4.1.2.1.2.2.3 Calculation of the factor value for potential to release by flood. Has been revised to reflect a minimum size requirement for sources. Section 4.1.2.1.2.3 Calculation of potential to release factor value. Text has been simplified, and the assigned value has been changed.

Section 4.1.2.1.3 Calculation of drinking water threat—likelihood of release factor category value. Text has been simplified. The maximum value has been changed, and the maximum for potential to release is no longer equal to the maximum for observed release.

Section 4.1.2.2 Drinking water threat-waste characteristics. Descriptive text has been removed.

Section 4.1.2.2.1 Toxicity/

persistence. Editorial changes have been made.

Section 4.1.2.2.1.1 Toxicity. References § 2.4.1.1.

Section 4.1.2.2.1.2 Persistence. As discussed in section III F of this preamble, several changes have been made to this factor, including the deletion of free-radical oxidation as a decay process and the inclusion of consideration of Kee to account for sorption to sediments. Table 4-10 (proposed rule Table 4-9) has been revised to change the values assigned from categorical numbers to linear scales. The divisions among the halflives for rivers, oceans, coastal tidal waters, and Great Lakes have changed based on a study of travel time, and the text has been modified to clarify the procedure for determining whether to base the persistence factor on lakes or on rivers, oceans, coastal tidal waters, and Great Lakes. A factor value of 0 is no longer assigned for persistence, as had been the case under the proposed rule, where categorical place-holder values were used; because persistence is now multiplied by toxicity and hazardous waste quantity, assigning a 0 value would result in a pathway score of 0. This result could understate the risk posed by a site with a large volume of highly toxic hazardous substances with low persistence. Furthermore, given the uncertainties about half-life estimates and their applicability in site-specific situations, EPA determined that a 0 value should not be assigned to the persistence factor under any conditions. The text has been modified to clarify selection of an appropriate default value: Table 4-11-Persistence Value Log Kow, has been added. Descriptive text has been removed.

Section 4.1.2.2.1.3 Calculation of toxicity/persistence factor value. Table reference has been changed to reflect the change in numbering. Table 4-12 (proposed rule Table 4-10) has been changed to reflect the multiplicative relationship. Section 4.1.2.2.2 Honordous waste quantity. Beforences § 2.4.2.

Section 4.1.2.2.3 Calculation of drinking water threast-waste characteristics factor category value. Text has been reviewd to indicate the multiplication of the factors, the new mustiplication of the factors, the new mustimum value, and the table used to assign the factor category value.

Section the factor category value. Section 4.1.2.9 Drinking water threat—targets. Descriptive text has been removed. Text was added to assign Lovel II to actual contamination based on direct observation.

Section 4.2.2.1 Nearest intoke. Title and the factor mane have been changed. As discussed in Section III B of this preamble, this factor is now assigned values based on basils-based banchmarks. Instructions for how to assign dilution weights to closed lakes and lakes with no surface flow entering have been added. Table 4-13, Surface Woter Dilution Weights (proposed rule Table 4-11), has been revised to add more types of surface water bodies and to change the dilution weights. These changes have been made to reflect more accurately the flow ranges of water bodies and are based on analysis of data on flow rates and dilution.

data on 1000 mms una unaccession Section 4.1.2.3.2 Population: As explained above, population is evaluated based on two levels of actual contaminated are distict on veighted and are assigned values based on renges. Populations served by intakes which are blanded with water from other drinking water sources are to be apportioned based on the intake's relative contributions to the total blanded system. The rule incidence interactions on the type of data to use when determining relative contributions of intakes and wells. This change is intended to reflect serve accustly the exposure of populations through blanded systems. The rule also includes instructions on the how to apportions the populations through blanded systems. The rule also includes instructions on the systems with standby wells or standby surface water intakes.

Section 4.1.2.2.2.1 Level of contamination. Replains how to evaluate population based on the level of contamination to which they are exposed.

Section 4.1.2.3.2.2 Lovel I concentrations. Descriptive text has been removed. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 4.1.2.2.2 Level II concentrations. Text has been simplified and revised to reflect the changes discussed above. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 4.1.2.3.24 Potential tomination. Equation used to 00 calculate this factor has been revised as discussed above. A new table, Table 4-14, Dilution-Weighted Population Values for Potential Contamination Pactor for Surface Water Migration Pathway, has been added to assign values, which are a added across different surface th water body types and divided by 10 to derive the value for potentially contaminated population. The assigned values in Table 4-14 for each population range category were determined by statistical simulation to yield the same population value, on average, as the use of the formulas in the proposed rule. The use of range values has been added as part of the simplification discussed in ection III A. The rounding rule has also an changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 4.1.2.3.2.5 Calculation of population factor value. Explains how to combine values assigned to the three population groups. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 4.1.2.3.3 Resources. As discussed in section III] of this preamble, this factor has been added to account for the potential impact of surface water contamination on resource uses.

Section 4.1.2.3.4 Calculation of drinking water threat—targets factor category value. Has been revised to reflect the changes in this factor category. The rounding rule has also been changed, and the scoring cap was eliminated.

Section 4.1.2.4 Calculation of drinking water threat score for a watershed. Text has been simplified. The divisor has changed.

Section 4.1.3 Human food chain threat. Descriptive text has been removed.

Section 4.1.3.1 Human food chain threat—likelihood of release. Section references have been changed.

Section 4.1.3.2 Human food chain threat—waste characteristics. Text bas been simplified.

Section 4.1.3.2.1 Toxicity/ persistence/bioaccumulation. Text has been simplified and modified because of the change in the use of bioaccumulation potential in selecting the substance potentially posing the greatest hazard.

Section 4.1.3.2.1.1 Toxicity. Has been changed to reference § 2.4.1.1. Also changed so that evaluation of toxicity is not limited to substances with the highest bioaccumulation potential.

Section 4.1.3.2.1.2 Persistence. Clarifies how to evaluate persistence for contaminated sediment sources, and adds constal tidal waters as a category of surface water. Also changed so that evaluation of persistence is not limited to substances with the highest bioaccumulation potential.

Section 4.1.3.2.1.3 Bioaccumulation potential. As described in section III M of this preamble, the method of accounting for bioaccumulation potential in the selection of the substance potentially posing the greatest hazard has been changed. In the final rule, bioaccumulation potential is considered together with toxicity and persistence rather than as a primary selection criterion. This change was made because all three factors are now scored on linear scales. In addition. where data exist, separate bioconcentration factor values are assigned for salt water and fresh water; the text now clarifies that the higher of these values is used for fisheries in brackish water and for sites with fisheries present in both salt water and fresh water. The adjustment for biomagnification has been dropped because it tunded to double cour bioaccumulation. Both Table 4-15 (Table 4-14 in the proposed rule) and the text have been modified to clarify the data hierarchy for assigning bioaccumulation potential factor values. Also, Table 4-15 now makes it clear that the assigned values for bioaccumulation potential are on a linear scale.

Section 4.1.3.2.1.4 Calculation of twicity/persistence/bioaccumulation factor value. Explains how to calculate a twicity/persistence/bioaccumulation value. Table 4-10. Tunicity/Persistence/ Bioaccumulation, has been added to sonign the factor value.

Section 4.1.3.2.2 Hazardous waste quantity. References § 4.1.2.2.2.

Section 4.1.3.2.3 Calculation of human food chain threat—wasie characteristics factor category value. Text has been revised to indicate the multiplication of the tootcity/persistence and hazardons waste quantity factor values, subject to a maximum, and the forther multiplication of that product by the bioaccumulation potential factor value, subject to a maximum for this second product, and to reference the table for assigning the factor category value.

Section 4.1.3.3 Human food chain throat-targets. Has been revised to reflect addition of the new food chain individual and the deletion of the fishery use factor. As discussed in section III M of this preamble, criteria for establishing a fishery subject to actual contamination have been revised. Text was added to describe the additional tissue samples that can be used to establish Level I contamination.

Section 4.1.3.3.1 Food chain

individual. As discussed in section III M of this preamble, this factor is new. This section explains how to assign a value to the factor.

Section 4.1.3.3.2 Population. Has been changed as discussed in section III M of this preamble.

Section 4.1.3.3.2.1 Level I concentrations. The approach to calculating this factor value has been revised as discussed in section III M of this preamble. The rounding rule has been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 4.1.3.3.2.2 Level II concentrations. Explains how to assign values as discussed in section III M of this preamble. The rounding rule has been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 4.1.3.3.2.3 Potential human food chain contamination. The approach to calculating this factor value has been revised as discussed in section III M of this preamble. The rounding rule has been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 4.1.3.3.2.4 Calculation of the population factor value. Text has been revised to omit the maximum. The rounding rule has been changed, and the scoring cap was eliminated.

Section 4.1.3.3.3 Calculation of human food chain threat—targets factor category value. Explains how to calculate the targets value. The rounding rule has been changed, and the scoring cap was eliminated.

Section 4.1.3.4 Calculation of human food chain threat score for a watershed. Text has been simplified. The divisor has changed.

Section 4.1.4 Environmental threat. Descriptive text has been removed.

Section 4.1.4.1 Environmental threat—likelihood of release. Section references have been changed.

Section 4.1.4.2 Environmental threat—waste characterisu •.

Descriptive text has been removed. Section 4.1.4.2.1 Ecosystem toxicity/ persistence/bioaccumulation. Text has been revised to include the addition of ecosystem bioaccumulation potential as a multiplicative factor.

Section 4.1.4.2.1.1 Ecosystem toxicity. The approach for evaluating ecosystem toxicity has been revised. Additions have been made to the data hierarchy (see section III J of this preamble), and a default value of 100 was added to cover the situation where appropriate aquatic toxicity data were unavailable for all of the substances being evaluated. Table 4–19 (proposed rule Table 4–23) has been revised to make the factor linear and to eliminate the rating category of 0 (except when data are unavailable for a given substance); these changes make the ecosystem toxicity factor more consistent with the toxicity factor in the other pathways and threats. Text was added to clarify the evaluation of ecosystem toxicity for brackish water.

Section 4.1.4.2.1.2 Persistence. Section references have been changed. Clarifies how to evaluate persistence for contaminated sediment sources, and adds coastal tidal waters as a category of surface water.

Section 4.1.4.2.1.3 Ecosystem bioaccumulation potential. As explained in section III J of this preamble, this factor is new for this threat and is evaluated similarly to (but with several key differences from) the bioaccumulation potential factor in the human food chain threat.

Section 4.1.4.2.1.4 Calculation of ecosystem toxicity/persistence/ bioaccumulation factor value. Section references have been changed. Table 4-20 (proposed rule Table 4-24) has been changed to reflect the changes in the values for the factors. Table 4-21. Ecosystem Toxicity/Persistence/ Bioaccumulation Values, is new and assigns values for the combined toxicity/persistence/bioaccumulation factor.

Section 4.1.4.2.2 Hazardous waste quantity. Section references have been changed.

Section 4.1.4.2.3 Calculation of environmental threat—waste characteristics factor category value. Text has been revised to indicate the multiplication of the ecosystem toxicity/ persistence and hazardous waste quantity factor values, subject to a maximum, and the further multiplication of that product by the ecosystem bioaccumulation potential factor value, subject to a maximum for this second product, and to reference the table for assigning the factor category value.

Section 4.1.4.3 Environmental threat—targets. Descriptive text has been removed.

Section 4.1.4.3.1 Sensitive environments. Explains how to evaluate sensitive environments. Table 4-22, Ecological-Based Benchmarks for Hazardous Substances in Surface Water, has been revised as described in section III H of this preamble. The rounding rule has also been changed.

Section 4.1.4.3.1.1 Level I concentrations. Explains the new method of evaluating wetlands based on wetland frontage. or, in some situations, wetland perimeter. Table 4–23, Sensitive Environments Rating Values, has been revised as discussed in section III J of this preamble. Table 4–24, Wetlands Rating Values for Surface Water Migration Pathway, has been added to assign values to wetlands based on the total length of wetlands. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 4.1.4.3.1.2 Level II concentrations. Has been revised to reflect the method of evaluating wetlands. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 1.

Section 4.1.4.3.1.3 Potential contamination. Has been revised to reflect the method of evaluating wetlands. The rounding rule has also been changed, the scoring cap was eliminated, and the multiplier (i.e., weight) is now 0.1.

Section 4.1.4.3.1.4 Calculation of environmental threat—targets factor category value. Has been revised to remove the maximum from the targets factor category. The rounding rule has also been changed.

Section 4.1.4.4 Calculation of environmental threat score for a watershed. Divisor for the threat has changed. A cap of 60 was explicitly placed on the environmental threat score, which results in the same maximum possible threat score as in the proposed rule. (In the proposed rule, environmental threat targets were capped at 120, which resulted in an environmental threat score maximum of 60.) However, in the final rule the targets category is uncapped and can score higher than 120 to compensate for low scores in other factor categories.

Section 4.1.5 Calculation of overland flow/flood migration component score for a watershed. Explains how to calculate the score for the watershed.

Section 4.1.6 Calculation of overland flow/flood migration component score. Explains how to calculate the score for the component based on the highest watershed score (in the proposed rule watershed scores were summed).

Section 4.2 Ground water to surface water migration component. As discussed in section III M of this preamble, this component has been added to the rule to account for contamination of surface water bodies through ground water migration of hazardous substances. Thus, all sections referring to this component are new.

Section 4.2.1 General considerations.

Section 4.2.1.1 Eligible surface waters. Explains the conditions that must apply before this component is scored. In general, this component is scored only when there is a surface water within one mile of a source, the top of the upperment equilier is at or above the bottom of the surface water, and no equilier discontinuity is established between the source and the portion of surface water within one mile of the source. Exceptions are also explained.

Section 4.2.1.2 Definition of the hazardous substance migratics path for ground water to surface water migration component. Exploits that the migration path is defined as shortest straight-line distance, within the aquifer boundary. from a source to surface water.

Section 42.1.3 Chearved release of a specific hazardous substance to surface water in-water segment. Explains that before an observed substance can be established to the surface water inwater cognont, the substance smut most the criteria for an observed veloce south most for a substance sout most the ground water and to surface water (this requirement does not affect the actual souring of observed veloce). Also clarifies the use of samples from the surface water in-water angument.

Section 4.2.14 Target distance limit. Explains the criteria for determining the target distance limit and for establishing whether targets are subject to actual or potential contemination.

Section 4.2.15 Evaluation of the ground water to surface water asig-ation component. Explains the general approach for evaluating this component. Figure 4-2, Overview of Ground Water to Surface Water Migration Component, is new. Table 4-25, which is new, provides the accoring shoets for this component.

Section 4.2.2 Drinking water threat. Explains the general approach for evaluating this threat.

Section 4.2.2.1 Drinking water threat-likelihood of release. Explains the general approach for evaluating this factor category.

Section 4.2.2.1.1 Observed release. Explains that scaring an observed release is based on selesses to ground weigr.

Section 4.2.2.2 Potential to release. Explains that scoring is based on the scoring of potential sclease to uppermost equifer.

Section 4.2.2.1.3 Colculation of drinking water threat-likelihood of release factor cotopery value. Explains how to assign the factor category value.

Section 4.2.2.2 Drinking water threat-waste characteristics. Explains the general approach for evaluating this factor cologory. Section 4.2.2.2.1 Toxicity/mobility/ persistence. Explains the approach for evaluating these factors.

Section 4.2.2.2.1.1 Toxicity. Explains that toxicity values are assigned to all hazardous substances evailable to migrate to ground water.

Section 4.2.2.2.1.2 Mobility. Explains that the mobility value is assigned to all hazardous substances available to migrate to ground water.

Section 4222.1.3 Persistence. Explains that this factor value is assigned as in the drinking water throat for the overland flow/flood migration component for all hazardous substances available to migrate to ground water.

Section 4.2.2.2.14 Calculation of taxicity/mobility/parsistence factor value. Explains that the factor value is the highest value assigned to any hazardous substance evaluated using Table 4-28, which is new.

Section 4.2.2.2 Hazardous waste quantity. Explains that bezardous waste quantity is calculated for hazardous substances available to migrate to ground water.

Section 4.2.2.3 Calculation of drinking water thread-waste characteristics factor category value. Explains how to calculate the factor cotagory value.

Section 4.2.2.3 Drinking water thread-targets. Explains the general approach for evaluating this factor category.

Section 4.2.2.3.1 Nearest intake. Explains how to determine the dilution weight adjustment using Table 4-27, which was added, and how to assign factor values. Figure 4-3 was added to illustrate deterministion of the ground vester to surface water angle. (See section EI O of this promble for a discussion of this adjustment.)

Section 42232 Population. This section parallels other population factor sections.

Section 4.2.2.3.2.1 Level I concentrations. Parallels the population factor sections in the overland flow/ flood migration component.

Section 4.2.2.3.2.2 Leve/ II concentrations. Parallels the population factor sections in the overland flow/ flood migration component.

Section 4.2.2.3.2.3 Potential contamination. Purallels the population factor sections in the overland flow / flood migration component, except for addition of the dilution weight adjustment.

Section 422224 Calculation of population factor value. Parallels other population factor sections.

Section 4.2.2.3.3 Resources. Parallels other resources factor sections. Section 4.2.2.3.4 Calculation of the drinking water threat—targets factor cotegory value. Explains how to calculate the factor category value. Section 4.2.2.4 Calculation of

Section 4.2.2.4 Calculation of drinking water threat score for a watershed. Explains how to calculate the score for a watershed.

Section 4.2.3 Human food chain threat. Lists the factors evaluated.

Section 4.2.3.1 Human food chain threat-likelihood of release. Explains how to assign the factor category value.

Section 4232 Human food chain threat—waste characteristics. Lists the factors evaluated.

Section 4.2.3.2.1 Toxicity/mobility/ persistence/bioeccumulation. Explains how to calculate these factor values using Table 4-28, which is new.

Section 4.2.3.2.1.1 Toxicity. Explains how to calculate this factor value.

Section 4.2.3.2.1.2 Mobility. Explains how to calculate this factor value.

Section 4.2.3.2.1.3 Persistence. Explains how to calculate this factor value.

Section 4.2.3.2.1.4 Biooccumulation potential. Explains how to calculate this factor value.

Section 4.2.3.2.1.5 Calculation of toxicity/mobility/persistence/ bioaccumulation factor value. Explains how to calculate this value using Tables 3-0, 4-20, and 4-20.

Section 4.2.3.2.2 Hozardous waste quantity. Explains how to assign the factor value.

Section 42323 Calculation of humon food chain threat—waste characteristics factor category value. Explains how to calculate this factor category value.

Section 4.2.1.3 Human food chain threat-targets. Explains the factors to be evaluated.

Section 4.2.3.3.1 Food chain individual Explains how to easign the factor value.

Section 4.2.3.2. Population Explains how to calculate this factor value.

Section 4.2.3.3.2.1 Level I concentrations. Parallels the population factor in the human food chain threat for the overland flow/flood migration component.

Section 4.2.3.3.2.2 Level II concentrations. Parallels the population factor in the human food chain threat for the overland flow/flood migration component.

Section 423323 Potential human food chein contamination. Parallels the population factor in the human food chein threat for the overland flow/flood component, except for addition of the dilution weight adjustment. Section 4.2.3.3.2.4 Calculation of the population factor value. Explains how to calculate this factor value.

Section 4.2.3.3.3 Calculation of human food chain threat—targets factor category value. Explains how to calculate this factor category value.

Section 4.2.3.4 Calculation of human food chain threat score for a watershed. Explains how to calculate the score for a watershed.

Section 4.2.4 Environmental threat. Lists the factors evaluated.

Section 4.2.4.1 Environmental threat—likelihood of release. Explains how to calculate this factor category value.

Section 4.2.4.2 Environmental threat—waste characteristics. Explains how to calculate this factor category value.

Section 4.2.4.2.1 Ecosystem toxicity/ mobility/persistence/bioaccumulation. Explains how to calculate these factor values.

Section 4.2.4.2.1.1 Ecosystem toxicity. Explains how to calculate this factor value.

Section 4.2.4.2.1.2 Mobility. Explains how to calculate this factor value. Section 4.2.4.2.1.3 Persistence.

Explains how to calculate this factor value.

Section 4.2.4.2.1.4 Ecosystem bioaccumulation potential. Parallels the ecosystem bioaccumulation evaluation in the overland flow/flood component, except expands the species considered as discussed in section III J.

Section 4.2.4.2.1.5 Calculation of ecosystem toxicity/mobility/ persistence/bioaccumulation factor value. Explains how to calculate this factor value using Tables 3-9, 4-29, and 4-30, which were added.

Section 4.2.4.2.2 Hazardous waste quantity. Explains how to calculate this factor value.

Section 4.2.4.2.3 Calculation of environmental threat—waste characteristics factor category value. Explains how to calculate this factor category value.

Section 4.2.4.3 Environmental threat-targets. Explains how to calculate this factor category value.

Section 4.2.4.3.1 Sensitive environments. Explains how to calculate

this factor value.

Section 4.2.4.3.1.1 Level I concentrations. Parallels factor sections in the overland flow/flood migration component.

Section 4.2.4.3.1.2 Level II concentrations. Parallels factor sections in the overland flow/flood migration component.

Section 4.2.4.3.1.3 Potential contamination. Parallels factor sections in the overland flow/flood migration component, except for addition of the dilution weight adjustment.

Section 4.2.4.3.1.4 Calculation of environmental threat—targets factor category value. Explains how to calculate the value for the factor category.

Section 4.2.4.4 Calculation of environmental threat score for a watershed. Explains how to calculate this threat score for a watershed.

Section 4.2.5 Calculation of ground water to surface water migration component score for a watershed. Explains how to calculate a watershed score for this component.

Section 4.2.8 Calculation of ground water to surface water migration component score. Explains how to calculate this score based on the scores for watersheds evaluated for this component.

Section 4.3 Calculation of surface water migration pathway score. Explains how to assign the pathway score.

In addition to the above noted changes, the recreational use threat has been eliminated. The drinking water use and other use factors have also been eliminated as have the tables (4–12 and 4–13 in the proposed rule) that related to scoring these factors. Figures 4–1, 4–2, and 4–3 as well as Tables 4–15, and 4–17 through 4–22 from the proposed rule have been eliminated.

Section 5 Soil Exposure Pathway

The soil exposure pathway evaluates threats resulting from contamination of surface material. The major changes specific to this pathway include revision of the name of the pathway; elimination of children under seven as a population that must be counted and evaluated separately; addition of hazardous waste quantity to the waste characteristics factor category; inclusion of workers in the evaluation of resident population targets; weighting of resident population based on benchmarks; inclusion of the nearest individual factor in both the resident and nearby targets factor category; inclusion of a resources factor in the resident population evaluation: and revisions to the sensitive environments factor.

Section 5.0 Soil Exposure Pathway. The name of the pathway has been changed from onsite exposure to soil exposure. Descriptive text has been removed. Figure 5-1 has been revised to reflect revisions to the factors evaluated. Table 5-1 has been revised to reflect the new factor category values throughout, which were made more consistent with the other pathways. Section 5.0.1 General considerations. Has been revised to reflect the redefinition of source, discussed in section III N of this preamble. The methods for establishing areas of observed contamination and for determining the hazardous substances associated with an area of observed contamination have been clarified. The instructions have been revised to make clear that any part of a site that is covered by a permanent or otherwise maintained impermeable material such as asphalt is not considered in evaluating the pathway.

Section 5.1 Resident population threat. Has been revised to specify when the resident population threat should be evaluated. The requirements state that this threat is scored when there is an area of observed contamination within the property boundary and within 200 feet of a residence, school, day care center, or workplace, or within the boundaries of terrestrial sensitive environments and specified resources.

Section 5.1.1 Likelihood of exposure. Text has been simplified.

Section 5.1.2 Waste characteristics. Evaluation of waste characteristics has been changed to include hazardous waste quantity as well as toxicity. Hazardous waste quantity was added to the factor category in response to comments that the pathway did not consider the dose relationship; the combination of hazardous waste quantity and toxicity is a surrogate for that relationship and makes the pathway more consistent with the rest of the rule. The text has been revised to reflect the change.

Section 5.1.2.1 Toxicity. References the section explaining how to assign toxicity factor values.

Section 5.1.2.2 Hazardous waste quantity. This section is new and explains how to assign a value to this factor. Table 5-2, Hazardous Waste Quantity Evaluation Equations for Soil Exposure Pathway, is a revision of Table 2-14 from the proposed rule. This table differs from Table 2-5 of the final rule because generally only the top two feet of an area of observed contamination are considered in evaluating the pathway. Landfills, contaminated soils, waste piles, land treatment areas, dry surface impoundments, and buried/backfilled surface impoundments, which can be evaluated based on their volume in Table 2-5, are evaluated for this pathway using the area measure because the area measure now has a two-foot depth built into the equation. Surface impoundments containing

hazardous substances present as liquide. tooks, and containers may be evaluated based on volume because it is possible that a person could wade, swim, reach, or fall to a depth greater than two feet.

Section 5.1.2.3 Calculation of waste characteristics factor category value. Explains how to combine the toxicity and hezardous waste quantity factor values, subject to the new maximum.

Section 6.1.3 Targets. This factor category has been revised substantially. As discussed in section III N above, the high-tisk target population has been eliminated, and workars have been added as targets. Table 5-8. Health-Based Banchmarks for Hazardous Substances in Soils, has been added to list banchmarks appropriate for this pathway.

Section 6.1.3.1 Resident individual The resident individual factor has been added for consistency with other petwers.

Section 5.1.3.2 Resident population. Explains how to evaluate the resident population using health-based benchmarks, described in section III H above, and how to estimate this population.

Section 5.13.2.1 Level I

concentrations. Explains how to assign a value for this new factor.

Section \$1322 Level II

concentrations. Explains how to assign a value for this new factor.

Section 8.1.3.2.3 Colculation of resident population factor value. Explains how to calculate this factor value.

Section 5.1.3.3 Workers. Explains how to evaluate workers.

Section 5.1.3.4 Resources. Explains how to assign values if the area of observed contamination includes land used for commercial agriculture, commercial efficienture, or commercial livesteck spation or production.

restock grazing or production. Section \$1.3.5 Terrestrial sensitive onts. The value activ mad for ويؤرجهم this factor has been revised so that the value is based on the sum of the values ned to torrestrial sensitive nts in areas of observed and i contamination, rather than on the at scoring terrestrial sensitive environment. The meximum value that can be assigned to this factor is limited. but is higher than under the proposed but is higher then under the proposed rule. The limit is determined by scoring the pathway with only sensitive ts in the targets factor any in pary; the pathway score under these 0 ms may not exceed 60 points. The sensitive environments listed in Table 5-5 have been modified. The text has been simplified and references changed to correspond to changes in the rule. The rounding rule has been changed. Section 5.1.3.6 Calculation of

Section 5.1.3.6 Calculation of resident population targets factor category value. Explains how to calculate the factor category value from the revised factors. The rounding rule has been changed.

Section 5.1.4 Calculation of resident population threat score. Has only minor editorial changes. Section 5.2 Nearby population

Section 5.2 Nearby population threat introductory text has been clarified.

Section 5.2.1 Likelihood of exposure. Lists the factors evaluated.

Section 5.2.1.1 Attractiveness/ accessibility. As explained in section III N of this preamble, the name of this factor has changed as have the criteria used to assign values. This factor now emphasizes the use of the area by the general public. Descriptive text has been removed. Table 5-6 (proposed rule Table 5-4) has been changed by redefining the criteria and the assigned values, and by adding a value of 0 for sites that are physically inaccessible to the public.

Section 5.2.1.2 Area of contamination. The title of this section has been changed. This factor is now based solely on area of contamination, which relates to the likelihood of exposure, unlike hazardous waste quantity, which serves as part of the surrogate for dose. Values are assigned using Table 5-7, which is new.

Section 5.2.1.3 Likelihood of exposure factor category value. Text has been revised to reflect the new names of the factors. Table 5-8 (proposed role Table 5-5) has been revised in response to the changes noted above for the attractiveness/ accessibility and area of contamination factors.

Section 5.2.2 Waste characteristics. Text has been revised to reflect changes in the factor category.

Section 5.2.2.1 Toxicity. Explains how to evaluate the toxicity factor for the nearby population threat.

Section 5.2.2.2 Hazardous waste quantity. This section is new, as is consideration of this factor in this threat. As discussed above, this factor has been added in response to comments and to make the pathway more consistent with the other pathways. The section explains how to assign the factor value.

Section 5.2.2.3 Calculation of waste characteristics foctor category value. Explains how to combine the toxicity and hazardous waste quantity factor values, subject to the new maximum.

Section 5.2.3 Targets. Descriptive text has been removed.

Section 5.2.3.1 Nearby individual. This section is new and explains how to assign a value to the nearby individual (i.e., resident or student with shortest travel distance) if there is no resident individual. The factor has been added to make the nearby threat consistent with other pathways. Table 5-0, Nearby Individual Factor Values, is new.

Section 5.2.3.2 Population within one mile. This section is new and includes the text that previously appeared under the Targets section. The section explains how to assign a value using Table 5-10. The text has been revised for clarity. Table 5-10, Distance-Weighted Population Values for Nearby Population Threat, is new. The table assigns distance-weighted values forpopulation in each travel distance category. The values in the table were determined by statistical simulation to yield the same population, on average, as the use of the formulas in the roposed rule. The distance weights have been modified as follows: fo travel distance of >0 to ¼ mile, the assigned distance weight is 0.025; for > % to ½ mile, 0.0125, and for > ½ to 1 mile, 0.00625. The use of population ranges has been adopted as part of the simplification discussed in section III A.

Section 5.2.3.3 Calculation of nearby population targets factor category value. Text has been revised to reflect the changes in the targets factor category and in the rounding rule.

Section 5.2.4 Calculation of nearby population threat score. Minor editorial changes only.

Section 5.5 Calculation of the soil exposure pathway score. Has been changed to reflect the change in the value used as a divisor.

In addition to the above noted changes, Pigures 5-2 and 5-3 and Tables 5-4 and 5-6 from the proposed rule have been removed.

Section 6 Air Migration Pathway

The air migration pathway evaluates the relative threat resulting from releases or potential releases of hazardous substances, either as gases or particulates, to the air. The major changes specific to this pathway include separate evaluation of gas and particulates in the likelihood to release factor category; inclusion of benchmarks to evaluate population and the nearest individual; weighting of sensitive environments based on actual or potential contensionsion; revision of the distance weights; deletion of a resources factor and inclusion of a resources factor in the evaluation of population; and revisions to the mobility factor. Section 6.0 Air Migration Pathway. Descriptive text has been removed. Figure 6-1 has been revised to reflect revisions to the factors evaluated, and Table 6-1 has been revised to reflect the new factor category values throughout. Section 6.1 Likelihood of release.

Section 6.1 Likelihood of release. Has been revised to eliminate explanatory text and to add instructions about which factors to evaluate for this factor category.

Section 6.1.1 Observed release. As discussed in section III G of this preamble, the specific criteria have been revised.

Section 6.1.2 Potential to release. As explained in section III O of this preamble, the method for evaluating this factor has been revised. Gas potential to release and particulate potential to release are evaluated separately. The explanatory text has been removed:

Section 5.1.2.1 Gas potential to release. Explains how this factor is evaluated. Table 6-2 (proposed rule Table 2-3) has been revised to apply chly to the gas potential to release factors.

Section 6.2.2.1.1 Gas containment. Descriptive text has been removed. Table 6-3 (proposed rule Table 2-5) has been simplified. The depth requirements and other containment requirements have been revised based on public comment, the field test, and a review of recent information on covering systems. Consideration of biogas releases has been added. Assigned values have been revised and also reflect the revised maximum value for the factor.

Section 6.1.2.1.2 Gas source type. New source types have been added to Table 5-4 (proposed rule Table 2-6), and the assigned values have been revised. As explained in section III O of this preamble, new source types and subgroups for specific types have been added, in response to comments and the field test, to make this factor easier to evaluate. Treatment of sources when no source meets the minimum size has been clarified.

Section 6.1.2.1.3 Gas migration potential. As explained in section III O of this preamble, this section has been renamed and the approach for assigning values changed slightly. This section explains how to assign values to each substance and subsequently to the source using Tables 6-5, 6-6, and 6-7. Dry soil relative volatility has been removed as a measure of gas migration potential. The footnotes have been removed from Table 6-5 (proposed rule Table 2-7) and the name has been changed to "Values for Vapor Pressure and Henry's Constant." The titles of Tables 6-6 and 6-7 have been changed. The values assigned have also been

changed to reflect the revised maximum value for the factor category. Descriptive text has been removed.

Section 6.1.2.1.4 Calculation of gas potential to release value. Explains how to calculate this value.

Section 6.1.2.2 Particulate potential to release. Explains how this factor is evaluated. Table 6-8 (proposed rule Table 2-3) has been revised to apply only to the particulate potential to release factors.

Section 6.1.2.2.1 Particulate containment. References Table 6-9 (Table 2-5 from the proposed rule). The criteria and values assigned using this table have been changed, as discussed in section III O of this preamble. Considerations of depth have been added for particulates.

Section 6.1.2.2.2 Particulate source type. In response to comments, new kinds of source types and subgroups of source types have been added to make this factor easier to score. The values assigned have been revised to reflect the changed factor category maximum. Treatment of sources when no source meets the minimum size has been clarified.

Section 6.1.2.2.3 Particulate migration potential. Has been remawed. Descriptive text has been removed. Proposed rule Figure 2-3 has been simplified, expanded, and renumbered as Figure 6-2. Proposed rule Table 2-0 has been renumbered as Table 6-10.

Section 6.1.2.2.4 Calculation of particulate potential to release value. Describes how to calculate this value.

Section 6.1.2.3 Calculation of potential to release factor value for the site. Text has been simplified and modified to account for gas and particulate potential to release.

Section 6.1.3 Calculation of likelihood of release factor category value. Describes calculation procedure.

Section 6.2 Waste characteristics. Descriptive text has been removed.

Section 6.2.1 Toxicity/mobility. Text has been simplified.

Section 6.2.1.1 Toxicity. Descriptive text has been removed and § 2.4.1.1 is referenced.

Section 6.2.1.2 Mobility. As explained in section III F of this preamble, the scoring of this factor has changed. Gas mobility is now based only on vapor pressure. The maximum value assigned for particulate mobility is no longer the same as the maximum assigned for gas mobility. The particulate mobility values are assigned based on Figure 6-3 or the equation in the text along with Table 6-12. The values assigned have been put on linear scales to be consistent with the new structure of the waste characteristics factor category. The text has been simplified.

Section 6.2.1.3 Calculation of toxicity/mobility factor value. Table 6-13, proposed rule Table 2-12, the matrix for assigning toxicity/mobility factor values has been revised to reflect the changes in values assigned to both factors.

Section 6.2.2 Hazardous waste quantity. Descriptive text has been removed and § 2.4.2 is referenced.

Section 6.2.3 Calculation of waste characteristics factor category value. The text has been revised to indicate the multiplication of the component factors, the new maximum value, and the table used to assign the factor category value.

Section 6.3 Targets. The target distance limit has been modified to include targets beyond four miles when an observed release extends beyond that distance. Text has been added to explain how to evaluate populations and sensitive environments exposed to actual contamination. Text was added to clarify that actual contamination based on an observed release established by direct observation should be considered Level II. Table 6-14. Health-Based Benchmarks for Hazardous Substances in Air, has been added to list the benchmarks used for this pathway. Table 6-15, Air Migration Pathway Distance Weights (proposed rule Table 2-16), has been revised to reflect changes in the distance weights discussed in section III O of this preamble.

Section 6.3.1 Nearest individual. The title has been changed from maximally exposed individual. As discussed above, this factor is now evaluated based on actual contamination and potential contamination. The name of Table 6-16 (proposed rule Table 2-15) has been changed and the values have been revised based on changes to the distance weights. Descriptive text has been removed.

Section 6.3.2 Population. Evaluation of population based on health-based benchmarks has been added as discussed in section III H of this preamble.

Section 6.3.2.1 Level of contamination. Explains how to evaluate population based on concentrations of hazardous substances in samples.

Section 6.3.2.2 Level I concentrations. Explains how to evaluate populations exposed to Level I concentrations. The scoring cap was eliminated, and the multiplier (i.e., weight) is now 10.

Section 6.3.2.3 Level II concentrations. Explains how to evaluate populations exposed to Level II concentra

Section 6.3.2.4 Potential contamination. Explains how to assign values to populations potentially exposed to contamination from the site ation from the site. e formule for calculating population has been revised. Table 8-17, TÌ hich assigns distance-weighted values r populations in each distance for popu category, has been added. The values in the table were determined by statistical invision to yield the same population, a average, as the use of the formulas in he proposed rule. The use of population the proposed rule. The use of population ranges has been adopted as part of the simplification discussed in section III A. The rounding rule has been chang nd, the scoring cap was eliminated, and the scoring cap was eliminated, and the subliplier (i.e., weight) is now 0.1. Section 6.3.2.5 Calculation of the population factor value. Explains how to

calculate the factor value. The scoring cap was eliminated.

Section 6.3.3 Resources. Explains bow to assign points to resources, which in this pathway is based on the presence of commercial agriculture, commercial allviculture, and major or designated alice are

Section 6.3.4 Sensitive ervirenments are evelopted based on excitation and potential contamination. The maximum value that can be assigned to this factor is limited, but is greater than in the proposed rule. The limit is determined by accoring the pathway with only sensitive environments in the targets factor category; the pathway score under these conditions may not exceed 40 points. Succise 63.4.1 Actual

contamination. Explains how to assign factor values for sensitive environment ents. subject to actual contamination and how to assign values to wetlands based on total across. A new Table 6–18. Wetlando Rating Values for the Air Migration Pathway, has been added to a values to wetlands based on

Section 6.3.4.2 Potential estemiestics. Explains how to calculate the factor value for potentially insted sensitive environments 60 nd how to assign values to wetlands seed on total acroage within each istance compony. The rounding rule has an channed. n che

Section 8.3.4.3 Colculation of nitive anvironments factor value. Joins how to calculate the factor Explains how to concern the been value. The rounding rule has been nd.

Section 6.3.5 Colculation of targets factor category value. Text has been revised to reflect the new names for factors.

Section 6.4 Calculation of air nigration pathway score. Text has been revised to reflect the new divisor.

In addition to the above noted changes, the land use factor. Figure 2-2, and Tables 2-2, 2-3, 2-13, 2-17, and 2-19 in the proposed rule have been removed.

Section 7 Sites Containing Rodioactive Substances

This entire part of the rule is new. As used in section III E of the ðisci preamble, this section has been added to provide direction on evaluating sites ining radioactive substances. Table 7-1 lists factors evaluated differently for such sites.

Section 7.1 Likelihood of release/ likelihood of exposure. Explains the approach to evaluating the factor category.

Section 7.1.1 Observed release/ observed contamination. Explains how to evaluate observed release (observed contamination) for radionuclides. The evaluation differs for radionuclides that occur naturally or are ubiquitous in the environment, for men-made radionactides without obsquitous background concentrations in the environment, and for gamma-emitting radionuclides in the soil exposure pathway. This section also explains the appropriate procedures for sites with ixed radioactive and other hazardous substances.

Section 7.1.2 Potential to release Explains that potential to release factors are evaluated on the physical and chemical properties of radiomaclides, not their redicectivity.

Section 7.2 Waste characteristics. Lists the factors evaluated.

Section 7.2.1 Hamon toxicity. Explains how to assign toxicity values to redicactive substances and describes appropriate procedures for sites containing mixed radiosuclides and other hezerdous substances.

Section 7.2.2 Ecosystem toxicity. Explains that ecosystem toxicity for radionuclides is assigned a value in the ne way as is human toxicity except that the default value is 100 rather than 1.088

Section 7.2.3 Persistence. Explains that radioactive substances are assigned ersistence values based solely on halfhis-radioactive half-life and volatilization half-life. Explains how to evaluate persistence for mixed radioactive and other hazardous enhatences.

Section 7.2.4 Selection of the substance potentially posing greatest hazard. The section explains how to select the substance potentially posing the greatest bazard.

Section 7.2.5 Hazardous waste quantity. Explains how to evaluate the hazardous waste quantity factor for sites containing radioactive substances.

Section 7.2.5.1 Source hozardous waste quantity for radionuclides. Describes differences between the migration pathways and the soil exposure pathway.

Section 7.2.5.1.1 Radionuclide constituent quantity (Tier A). Explains how to evaluate radioauclide constituent quantity for radionuclides."

Section 7.2.5.1.2 Radionuclide wastestream quantity (Tier B). Explains how to evaluate radioanclide wastestream quantity for radionuclides.

Section 7.2.5.1.3 Calculation of source hazardous waste quantity value for radianuclides. Explains how to sign a source valu

Section 7.2.5.2 Colculation of hazardous waste quantity factor value for radianuclides. Explains how to calculate the hezardous waste quantity factor value for radiomachides and describes use of the minimum value, which is either 19 or 100 (as described in section 2.4.2.2 above).

Section 7.2.5.3 Colculation of hazardous waste quantity factor value for sites containing mixed radioactive and other hazardous substances. Explains how to calculate the factor value for these sites.

Section 7.3 Targets. Explains how to evaluate targets at sites containing radioactive substances and sites containing radioactive and other bezardous substances.

Section 7.3.1 Level of contamination ot a sampling location. Explains how to determine the appropriate level of contamination.

Section 7.3.2 Selection of benchmarks and comparisons with observed release/observed contamination. This section lists the beachmarks and explains how they are used in determining the level of contamination.

V. Remined Applying

A. Executive Order No. 12291

Under Executive Order No. 12291, the Agency must judge whether a regulation is "major" and thus subject to the requirement of a Regulatory Impact Analysis. The rule published today is not major because the rule will not result in an effect on the economy of \$100 million or more, will not result in increased costs or prices, will not have significant adverse effects on competition, employment, investment, productivity, and innovation, and will

not significantly disrupt domestic and export markets.

To estimate the costs associated with the final rule, a final economic analysis entitled "Economic Impact Analysis of the Revised Hazard Ranking System" was prepared as an addendum to the December 1987 economic impact analysis (EIA) to incorporate new data. As in the January 1968 EIA, the total annual cost of implementing the final rule is estimated as a function of the number of Screening SIs (SSI) and Listing SIs (LSI) that will be conducted annually and the unit cost of each. In the January 1968 EIA, estimates of total costs were developed assuming 1,130 SSIs and 100 LSIs would be conducted annually. The Agency now estimates that 1,100 SIs will be conducted annually (EPA is no longer using the terms SSI and LSI). The total annual cost is estimated to be \$78.8 million, the sum of the cost of conducting 1,000 SIs at a unit cost of \$55,000, 70 SIs for NPL sites (without monitoring wells) at a unit cost of \$100,000, and 30 SIs for NPL sites (with monitoring wells) at a unit cost of \$160,000.

To estimate the incremental cost of implementing the final revised version of the HRS, the unit cost of conducting all preremedial listing activities using the current HRS from the January 1988 EIA is updated. That cost was estimated to be \$58,200 in the January 1988 EIA, and was developed assuming the PA had already been conducted. The 1968 estimate is a function of 480 hours of Field Investigation Team (FIT) technical time valued at \$40 per hour and 30 samples being evaluated at a unit cost of \$1,300 per sample. To compare the costs of the current HRS to those developed above for the final revised version of the HRS, the FIT technical time is valued at \$50 per hour and each sample evaluation is estimated to cost \$1,000. The revised total cost of conducting all listing activities beyond the PA for the current HRS, therefore, is estimated to be \$54,000. In addition, the average level of effort for a PA under the current HRS is estimated to be 60 hours, and the unit cost of the PA, assuming a \$50 FIT hourly rate, is estimated to be \$3,000.

Based on these revisions, the annual cost of using the current HRS is estimated to be \$65.4 million, the sum of the cost of conducting 2,000 PAs at a unit cost of \$3,000 (\$6 million) and the cost of conducting 1,100 Sis at a unit cost of \$54,000 (\$59.4 million). Compared to the current HRS, the annual incremental cost of using the final revised version of the HRS is estimated to be \$13.4 million. On the basis of this evaluation, implementing the final revised version of the HRS would not constitute a major rule, because the annual incremental cost of the final rule is less than \$100 million. No negative economic effects are anticipated from this rule.

B. Regulatory Flexibility Determination

Appendix A of the December 1987 EIA includes an assessment of the ability of responsible parties to pay the costs of HRS scoring under the current HRS and the three alternative scoring mechanisms considered at that time. That analysis evaluated the impact of HRS costs under each ranking methodology on the financial viability of 15 sample companies. Under that analysis, only the smallest sample firm (one with an average net income of \$53,700) was expected to have difficulty in paying the costs of conducting a complete SI under each of the alternative ranking scenarios. The new unit cost of a complete SI developed during the Phase I field test and used in this economic analysis falls within the range of costs already evaluated in appendix A of the December 1987 EIA. Civen the previous analysis, EPA concludes that most sample firms are healthy enough financially to be able to afford the expenditures associated with HRS site inspections. Responsible Parties (RPs) that are financially similar to the smallest firm (Firm 15 in appendix A of the December 1987 RIA), however, do not have the assets or the income to enable them to assume payments similar to the estimates derived for the SI done under the current HRS or the final revised version of the HRS.

The Regulatory Flexibility Act of 1980 requires that Federal agencies explicitly consider the effects of proposed and existing regulations on small entities and examine alternative regulations that would reduce significant adverse impacts on small entities. The small entities that could be affected by the revisions to the HRS are small businesses and small municipalities that are responsible for hazardous wastes at a site. Based on the updated analysis presented here, EPA concludes that using the final rule is unlikely to result in a significant impact on a substantial number of small entities. As discussed in the December 1987 EIA, this conclusion is drawn because small firms are no more or less likely to be responsible parties than are large firms. In addition, when they are RPs, small firms usually are one of several companies responsible for a site and probably would not bear the full burden of liability for HRS expenditures and other cleanup costs.

C. Paperwork Reduction Act

The information collection requirements contained in this rule have been approved by the Office of Management and Budget (OMB) under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 et seq., and has assigned OMB control number 2050-0095.

Public reporting burden for this collection of information is estimated to be 620 hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Chief, Information Policy Branch, PM-U.S. Environmental Protection Agency, 401 M St., SW., Washington, DC 20460; and the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DČ 20503, marked "Attention: Desk Officer for EPA."

D. Federalism Implications

E.O. 12612 requires agencies to assess whether a regulation will have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPA has determined that this regulation does not have federalism implications and that, therefore, a Federalism Assessment is not required.

List of Subjects in 40 CFR Part 399

Air pollution controls, Chemicals, Hazardous materials, Intergovernmental relations, Natural resources, Oil pollution, Reporting and recordkeeping, Superfund, Waste treatment and disposal, Water pollution control, Water supply.

Dated: November 9, 1990.

William K. Reilly,

Administrator

40 CFR part 300 is amended as follows:

PART 300-[AMENDED]

1. The authority citation for part 300 continues to read as follows:

Authority: 42 U.S.C. 9605; 33 U.S.C. 1321(c)(2); E.O. No. 117535, 36 FR 21243; E.O No. 12560, 52 FR 2923.

2. Part 300, appendix A is revised to read as follows:

Federal Register / Vol. 55, No. 241, / Friday, December 14, 1990 / Rules and Regulations 51583

4.1.8.2.1 Toxicity/persistence/

4.1.3.2.1.4 Celculation of toxicity/

4.1.3.2.2 Hazardous waste quantity.

4.1.3.3.1 Food chain individual.

4.1.3.3.2.1 Level I concentrations.

threat-waste characteristics factor

4.1.3.3 Human food chain threat-targets.

4.1.3.3.2.3 Potential human food chain

Level II concentrations.

4.1.3.3.2.4 Calculation of population factor

4.1.3.3.3 Calculation of human food chain

threat-targets factor category value.

threat score for a watershed.

4.1.4.2 Environmental threat-waste

4.1.4.2.1.1 Ecosystem toxicity.

4.1.4 Environmental threat.

characteristics.

bioaccumulation.

4.1.4.2.1.2 Persistence

4.1.3.4 Calculation of human food chain

4.1.4.1 Environmental threat-likelihood of

4.1.4.2.1 Ecosystem toxicity/persistence/

4.1.4.2.1.3 Ecosystem bioaccumulation

4.1.4.2.1.4 Calculation of ecosystem -

4.1.4.2.2 Hezerdous waste quantity.

4.1.4.2.3 Calculation of environmental

threat-waste characteristics factor

4.1.4.3 Environmental threat-targets.

4.1.4.3.1 Sensitive environments.

4.1.4.3.1.1 Level I concentrations.

4.1.4.3.1.2 Level II concentrations.

4.1.4.3.1.3 Potential contamination.

4.1.4.4 Calculation of environmental threat score for a watershed.

migration component score for a

4.2 Ground water to surface water migration

4.2.1.2 Definition of hazardous substance

migration path for ground water to

4.2.1.9 Observed release of a specific

4.2.1.4 Target distance limit. 4.2.1.5 Evaluation of ground water to

surface water migration component.

4.2.2.1 Drinking water threat-likelihoo, of

surface water migration component.

hazardous substance to surface water in-

4.1.5 Calculation of overland/flood

4.1.6 Calculation of overland/flood

migration component score.

4.2.1 General Considerations. 4.2.1.1 Eligible surface waters.

4.1.4.3.1.4 Calculation of environmental threat-targets factor category value.

toxicity/persistence/bioaccumulation

persistence/bioaccumulation factor

4.1.3.2.3 Calculation of human food chain

Bioaccumulation potential.

bioaccumulation

4.1.3.2.1.1 Toxicity.

category value.

4.1.5.3.2 Population.

contamination.

4.1.3.2.1.3

value.

4.1.3.3.2.2

value.

release.

potential.

factor value.

category value.

watershed.

component.

water segment.

release.

2.2 Drinking water threat.

4.2.2.1.1 Observed release.

4.2.2.1.2 Potential to release.

REFERENCE 1

4.1.3.2.1.2 Persistence.

Appendix A to Part 300---The Hazard **Ranking System**

Table of Conte

- List of Figures
- List of Tables
- 1.0. Introduction. **1.1 Definitions**
- 2.0
- **Evaluations** Common to Multiple Pathways. 2.1 Overview
- 2.1.1 Calculation of HRS site score. 2.1.2 Calculation of pathway score.
- 2.1.3 Common evaluations.
- 2.2 Characterize sources.
- 2.2.1 Identify sources. 2.2.2 Identify hazardous substances associated with a source. 2.2.3 Identify hazardous substances
- available to a pathway. Likelihood of release.
- 2.4 Waste characteristics.
- 2.4.1 Selection of substance potentially
 - posing greatest hazard. 2.4.1.1 Toxicity factor.
- 2.4.1.2 Hazardous substance selection.
- 2.4.2 Hazardous waste quantity.
 - 2.4.2.1 Source hazardous waste quantity.
 - 2.4.2.1.1 Hexardous constituent quantity. 2.4.2.1.2 Hazardous wastestream quantity.
 - 242.1.3 Volume.
- 242.14 Area. 24.2.15 Calculation of source hazardous
- waste quantity value. 2.4.2.2 Calculation of hazardous waste
- quantity factor value. Waste characteristics factor category
- 243 value.
- 24.3.1 Factor category value. 24.3.2 Factor category value, considering bioaccumulation potential.
- 2.5 Targets.
- 2.5.1 Determination of level of actual
- contamination at a sampling location.
- 2.5.2 Comparison to benchmarks.
- 3.0 Ground Water Migration Pathway.
- 3.0.1 General considerations. 3.0.1.1 General considerations. 3.0.1.2 Aquifer boundaries. 3.0.1.2.1 Aquifer interconnections. 3.0.1.2.2 Aquifer discontinuities.

- 3.0.1.3 Karst amifer.
- 3.1 Likelihood of release.
- 3.1.1 Observed release.
- 3.1.2 Potential to release.
- 3.1.2.1 Containment.
- 3.1.2.2 Net precipitation. 3.1.2.3 Depth to aquifer.
- 3124 Travel time.
- 3.1.2.5 Calculation of potential to release factor value.
- 3.1.3 Calculation of likelihood of release factor category value.
- 8.2 Waste characteristics.
- 3.2.1 Toxicity/mobility.
- 8.2.1.1 Toxicity.
- 3.2.1.2 Mobility.
- 3.2.1.3 Calculation of toxicity/mobility factor value.
- 3.2.2 Hazardous waste quantity. 3.2.3 Calculation of waste characteristics factor category value.
- 3.3 Targets.
- 3.3.1 Nearest well
- 3.3.2 Population.
- 3.3.2.1 Lave' of contamination.

- 3.3.2.2 Level I concentrations.
- 8.3.2.3 Level If concentrations.
- 3.3.2.4 Potential contamination.
- 3.3.2.5 Calculation of population factor value.
- 3.3.3 Resource
- 3.3.4 Wellbead Protection Area. 3.3.5 Calculation of targets factor category value.
- 3.4 Ground water migration score for an aquifer.
- Calculation of ground water migration 3.5 pathway score. Surface Water Migration Pathway.
- 4.0
- 4.0.1 Migration components.
- 4.0.2 Surface water categories.
- 4.1 Overland/flood migration component.
- 4.1.1 General considerations. 4.1.1.1 Definition of hazardous substance migration path for overland/flood
 - migration component.
- 4.1.1.2 Target distance limit. 4.1.1.3 Evaluation of overland/flood
- migration component.
- 4.1.2 Drinking water threat. 4.1.2.1 Drinking water threat-likelihood of
- release. 4.1.2.1.1 Observed release.
- 4.1.2.1.2 Potential to release.
- 4.1.2.1.2.1 Potential to release by overland flow.
- 1.2.1.2.1.1 Containment.
- 4.1.2.1.2.1.2 Runoff.
- 4.1.2.1.2.1.3 Distance to surface water. 4.1.2.1.2.1.4 Calculation of factor value for
- potential to release by overland flow
- 1.2.1.2.2 Potential to release by flood.
- 4.1.2.1.2.2.1 Containment (flood)
- 4.1.2.1.2.2.2 Flood frequency.
- 4.1.2.1.2.2.3 Calculation of factor value for potential to release by flood.
- 1.2.1.2.3 Calculation of potential to release factor value.
- 1.1.2.1.3 Calculation of drinking water threat-likelihood of release factor category value.
- 4.1.2.2 Drinking water threat-waste characteristic

4.1.2.2.1.3 Calculation of toxicity/

4.1.2.2.2 Hazardous waste quantity. 4.1.2.2.3 Calculation of drinking water

threat-waste characteristics factor

category value. 4.1.2.3 Drinking water threat-targets.

4.1.2.3.2.1 Level of contamination.

4.1.2.3.2.2 Level I concentrations.

4.1.2.3.4 Calculation of drinking water

threat-targets factor category value. 4.1.2.4 Calculation of the drinking water

4.1.3.2 Human food chain threat-waste

Resources.

threat score for a watershed.

Human food chain threat.

likelihood of release.

characteristics.

4.1.3.1 Human food chain threat-

Level II concentrations.

Potential contamination.

Calculation of population factor

- 4.1.2.2.1 Toxicity/persistence.
- 4.1.2.2.1.1 Toxicity. 4.1.2.2.1.2 Persistence

persistence factor value.

4.1.2.3.1 Nearest intake. 4.1.2.3.2 Population.

4.1.2.3.2.3

4.1.2.3.2.4

4.1.2.3.2.5

value.

4.1.2.8.8

4.1.3

4.2.2.1.3 Coloulation of drinking water first-likelihood of release factor and the second 4.2.2. Drinking water threat-waste characteristics. æ 42221 Twicky/mobility/parsistence. 422211 Twicky. 422212 Hold Ы. ۰. 42222 Harredous waste quantity. 42223 Calculation of delating water figent-waste characteristics factor cotagory value. 4223 Disking weter facest-targets. 42231 Normat Intel 42232 Population est intelle. 422221 Lavel I concentrations. 422322 Lovei II consentrations. 422323 Potential contemposition. 422324 - Calculation of population factor volue. 42233 Barn 42233 Incruces. 42234 Colculation of disking water firmet targets factor company vol-4.2.2.4 Calculation of debiling wet ý weter terest score for a vestashed. 423 H Human food chain throat-and of palaces. 4231 B March 1 4232 He n food chain throat-waste delice. 42321 Tenicity/mobility/persistance/ 423211 Tunicity. 423232 Make 423212 Milliony. 423213 Projetance. 423214 Millionenalism patientis 423215 Columbus of twickly/ **لمان** My/persistence/vicence dia a . 423.22 Hanneleys wests quantity. 423.23 Calculation of human field claim finest-wests characteristics factor unser-sense characteristics factor category value. 4223 Haman fixed chain threat-targets. 42231 Pool chain individual. 42332 Pepulation. 423321 Level I concentrations. 423322 Level II concentrations. 423223 Potential human food chain **Combool** 423324 Colculation of population inchar velue. 42333 Calculation of human food chain Areat-targets factor category value. 4.2.3.4 Calculation of James Sood chain Areat score for a watershed. 4.2.4 Bartenmental threat. 4241 Invicemental treat-likelihood of 4242 Bul name in the second states ristica. Scorpolass loxicity/mobility/ aca/bioaccumulation 42421 300 persistence/bisseccumdation. 424211 Beneyatam texticity. 424212 Mobility. 424213 Paulation 424214 Bongeten biseccumulation

- 42422 Histories veste quartiy.

4.2.4.2.3 Calculation of environm threat-waste characteristics factor gary value. cat

- 4243 - B rivenmental threat-targets.
- 4243.1 Sensitive environment
- 4243.1.1 Level I concentrations.
- 4243.1.2 Level II concentrations.
- 424313 Potential contamination.
- 424314 Calculation of environmental threat-targets factor category value. 42.44 Calculation of environmental
- threat score for a watershed.
- 42.5 Calculation of ground water to surface water migration component score for a undershed.
- 42.8 Calculation of ground water to surface weier migration gamponent score. 4.3 Calculation of surface water migration
- 4.3 Calculation of entrace water pethway score.
 8.0 Soil Exposure Pothway.
 8.1 General considerations.
 8.1 Resident population threat.
 8.1.1 Likelihood of exposure.
 8.1.2 Weste characteristics.

- 5.1.2.1 Toxicity. 5.1.2.2 Hexardous waste quantity.
- \$123 Calculation of waste characteristics factor category value.

- characteristics sector category v \$13 Targets. \$1.3.1 Resident individual. \$1.3.2 Resident population. \$1.3.2.1 Level I concentrations. \$1.3.2.2 Level II concentrations. \$1.3.2.3 Colonistion of resident

- population factor value. 18183 Wothers. 18184 Resources.
- 8.1.3.5 Terrestrial sensitive anvironments. 8.1.3.6 Calculation of resident population
- targets factor category value. 8.1.4 Colculation of resident population

- dieset scom. 5.2 Noerby population threat. 5.2.1 Likelihood of exponent. 5.2.1.1 Attractiveness/accessibility.

 - 5.2.1.2 Area of continuination. 5.2.1.3 Likelihood of exposure factor
- colugary value. 5.2.2 Waste characteristics.

 - 5.2.2.1 Toxicity. 5.2.2.2 Himserious waste quantity. 5.2.2.3 Calculation of waste
 - characteristics factor category value.
- 5.2.3 Targets. 5.2.3.1 Nearby individual. 5.2.3.2 Papulation within 1 mile. 5.2.3.3 Calculation of nearby population
- targets factor calegory value. 8.2.4 Calculation of nearby population threat score.
- 5.3 Calculation of soil exposure pathway SCOTT.
- 6.0 Air Migration Pathway. 6.1 Likelihood of missoe.

- 6.1.1 Observed release. 6.1.2 Potential to release.
- 6.1.2.1 Ges potential to release.

- 612.1 Ges poundat to reserve. 6.12.12 Ges containment. 6.12.13 Ges surgration potential. 6.12.14 Colouistion of ges potential to rale.
- 6.1.2.2 Particulate potential to release.
- 61.2.2.1 Particulate containment. 6.1.2.2.2 Particulate source type.
- 61223 Particulate migretion potential.

- lation of particulate 41224 Cale tial to release ve
- potential to release value. 8.1.2.8 Colculation of potential to release
- factor value for the site. 8.1.3 Calculation of Malhood of release factor category value. 6.2 Waste characteristics.
- 6.2.1 Texicity/mobility. 6.2.1.1 Texicity. 6.2.1.2 Mobility.

- 6.2.1.3 Calculation of texicity/mobility factor value.
- 6.2.2 Hazardous waste quantity.
- 6.2.3 Calculation of waste characteristics factor category value.
- 6.3 Targets. 6.3.1 Nessest individual. 6.3.2 Pepulation.
- - 6321 Level of contamination.

 - 4322 Level I concentrations. 4323 Level II concentrations. 4324 Potential contemination. 4325 Colonistics of population factor
 - velue.
- 6.1.3 Resources. 6.3.4 Southire environments.
 - 63A1 Actual contradication
 - 43.4.2 Potential contamination.
 - 6343 Culculation of sensitive
 - nte factor value.
- 6.3.5 Calculation of targets factor category
- 6.4 Calculation of air migration pathway
- 7.8 Sins Containing Radioactive
- 7.1 Likelihood of release/likelihood of **COLO** H.

7.2.4 Selection of substance potentially

2.5 Electrodous where grantity. 7.2.5.1 Source hereedous weste grantity

veste quantity value for milicanciides. 7.2.5.2 Calculation of honordous waste

7252 Classification of January Wester quantity factor value for radiomechides 7253 Calculation of honordous waste

7.3.1 Level of contamination at a sumpling

3-1 Overview of giound water migration

pathway. 3-2 Not procipitation factor values. 4-1 Overview of surface water overland/

flood migration component.

•

7.3.2 Comparison to benchmarks.

quantity factor value for sites contain

mixed redisective and other hezerdows

7.1.5.1.1 Radissucilide constituent quantity

auclide wastastet

in of source h

melides

peeing groatest heaned. 7.2.5 Heavedow waste quantity.

-ides.

- 7.1.3 Observed salaase/observed
- 7.1.2 Potential to rela
- 7.2 Waste characteristics

fer måle

(Tier A).

72512 Inde

mbatances.

7.3 Targets.

location.

List of Figures Figure mather

.

quantity (Tier II). 7.2.5.1.3 Calculation

7.2.1 Human toxicity. 7.2.2 Benegation toxicity. 7.2.3 Paraistance.

- 4-2 Overview of ground water to surface water migration component.
- Sample determination of ground water 4.9 to surface water angle.
- 5-1 Overview of soil exposure pathway. 6-1
- Overview of air migration pathway. Particulate migration potential factor 8-2
- 6-3 Particulate mobility factor values.
- List of Tables
- Table number
- 2-1 Sample pathway scoresheet. 2-2 Sample source characterization
- worksheet. 2.3
- Observed release criteria for chemicat analysis. 2.4
- Toxicity factor evaluation. 2-5 Hazardous waste quantity evaluation metions.
- 2-6 Hazardous waste quantity factor values.
- 2-7 Waste characteristics factor category values.
- Ground water migration pathway 8-1 scoresheet.
- Containment factor values for ground water migration pathway. Monthly latitude adjusting values.
- 3
- Net precipitation factor values. 3-4
- Depth to aquifer factor values.
- 3-6 Hydraulic conductivity of geologic incials.
- 9.7 Travel time factor valu
- Ground water mobility factor values. 8-8
- Toxicity/mobility factor values. مـع
- 3-10 Health-based benchmarks for hazardous substances in drinking water.
- 3-11 Nearest well factor values. 3-12 Distance-weighted population values for potential contamination factor for
- ground water migration pathway. 4–1 Surface water overland/flood migration
- component scoresheet. Containment factor values for surface 4-2
- water migration pathway. 4-3
- 4
- Drainage area values. Soil group designations. Rainfall/runoff values. 4-5
- 4-8 Runoff factor values.
- Distance to surface water factor values. Containment (flood) factor values.
- 4-10
- Flood frequency factor values. Persistence factor values—half-life. Persistence factor values—log Kor 4-11
- Toxicity/persistence factor values. 4-12
- Surface water dilution weights. Dilution-weighted population values for potential contamination factor for 4-13 4-14 surface water migration pathway.
- 4-15 Bioaccumulation potential factor values
- 4-16 Toxicity/persistence/bioaccumulation factor values.
- 4-17 Health-based benchmarks for hazardous substances in human food chain.
- 4-18 Human food chain population values. 4-19 Ecosystem toxicity factor values.
- 4-20 Ecosystem toxicity/persistence factor values.
- 4-21 Ecosystem toxicity/persistence/ bioaccumulation factor values.
 4-22 Ecological-based benchmarks for
- hazardous substances in surface water.
- Sensitive environments rating values. 4-2.

- 4-24 Wetlands rating values for surface water migration pathway. 4-25 Ground water to surface water
- migration component scoresheet. 4-28 Toxicity/mobility/persistence factor
- velues.
- 4-27 Dilution weight adjustments. 4-28 Toxicity/mobility/persistence/
- bioaccumulation factor value 4-29 Ecosystem toxicity/mobility/ persistence factor values
- 4-30 Ecosystem toxicity/mobility/ persistence/bioaccumulation factor values
- 5-1 Soil exposure pathway scoreahest. 5-2 Hazardous waste quantity evaluation
- equations for soil exposure pathway. Health-based benchmarks for
- hazardous substances in soils.
- Pactor values for workers.
- Terrestrial sensitive environments rating values.
- 5-6 Attractiveness/accessibility values.
- Area of contamination factor values.
- 5-8 Nearby population likelihood of exposure factor values.
- Nearby individual factor values. .0 5-10 D Distance-weighted population values for nearby population threat.
- 6-1
- Air migration pathway scoresheet. Gas potential to release evaluation. 6-2
- Gas containment factor values. 6-8
- 6-4
- Source type factor values. Values for vapor pressure and Henry's 6-6 constant.
- Gas migration potential values for a 6-6 hazardous substance.
- 6-7 Gas migration potential values for the 8000000
- 6-8 Particulate potential to release evaluation.
- 6-9 Particulate containment factor values
- 6-10 Particulate migration potential values.
- 6-11 Gas mobility factor values.
- Particulate mobility factor values. 6-12
- 6-13 Toxicity/mobility factor values 6-14 Health-based benchmarks for
- hazardous substances in air. 8-15 Air migration pathway distance weights.
- 6-16 Nearest individual factor values.
- 6-17 Distance-weighted population values for potential contamination factor for air pathway. **6_1**8[°] Wetlands rating values for air
- migration pathway
- 7-1 HRS factors evaluated differently for radionuclides.
- 7-2 Toxicity factor values for radionuclides. 1.0 Introduction

The Hazard Ranking System (HRS) is the principal mechanism the U.S. Environmental Protection Agency (EPA) uses to place sites on the National Priorities List (NPL). The HRS serves as a screening device to evaluate the potential for releases of uncontrolled. hazardous substances to cause human health or environmental damage. The HRS provides a measure of relative rather than absolute risk. It is designed so that it can be consistently applied to a wide variety of sites.

1.1 Definitions

Acute toxicity: Measure of toxicological responses that result from a single exposure to a substance or from multiple exposures within a short period of time (typically several days or less). Specific measures of acute toxicity used within the HRS include lethal dosess (LDss) and lethal concentrations (LCas), typically measured within a 24-hour to 96-hour period.

Ambient Aquatic Life Advisory Concentrations (AALACs): EPA's advisory concentration limit for acute or chronic toxicity to aquatic organisms as established under section 304(a)(1) of the Clean Water Act, as amended.

Ambient Water Quality Criteria (AWQC): EPA's maximum scute or chronic toxicity concentrations for protection of aquatic life and its uses as established under section 304(a)(1) of the Clean Water Act, as amended.

Bioconcentration factor (BCF): Measure of the tendency for a substance to accumulate in the tissue of an aquatic organism. BCF is determined by the extent of partitioning of a substance, at equilibrium, between the tissue of an aquatic organism and water. As the ratio of concentration of a substance in the organism divided by the concentration in water, higher BCF values reflect a tendency for substances to accumulate in the tissue of aquatic organisms. [unitless]. Biodegradation: Chemical reaction of a-

substance induced by enzymatic activity of microorganisms.

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1990, as amended (Pub. L. 96-510, as amended).

Chronic toxicity: Measure of toxicological responses that result from repeated exposure to a substance over an extended period of time (typically 3 months or longer). Such responses may persist beyond the exposure or may not appear until much later in time than the exposure. HRS measures of chronic toxicity include Reference Dose (RfD) values.

Contract Laboratory Program (CLP): Analytical program developed for CERCLA waste site samples to fill the need for legally defensible analytical results supported by a high level of quality assurance and documentation.

Contract-Required Detection Limit (CRDL). Term equivalent to contract-required quantitation limit, but used primarily for inorganic substances

Contract-Required Quantitation Limit (CRQL): Substance-specific level that a CLP laboratory must be able to routinely and reliably detect in specific sample matrices. It is not the lowest detectable level achievable. but rather the level that a CLP laboratory should reasonably quantify. The CRQL may or may not be equal to the quantitation limit of a given substance in a given sample. For HRS purposes, the term CRQL refers to both the contract-required quantitation limit and the contract-required detection limit.

Curie (Ci): Measure used to quantify the

amount of radioactivity. One curie equals 37

billion nuclear transformations per second,

Decay product: Isotope formed by the

chemical properties that are different from

radioactive decay of some other isotope. This

newly formed isotope possesses physical and

and one picocurie (pCi) equals 10⁻¹⁵ Ci.

these of its passed insteps, and may also be

Detection Limit (RL): Lowest smooth that can be distinguished from the partnel medium "seles" of an analytical instrument or

nethed. For 1915 purposes, the detection limit used in the methed detection limit finit used is the method detection limit (ACL) or, for seal-time field instruments, the detection limit of the instrument or used in te fail.

he see. Distinct weight: Personator in the 1953 relates water adjustes pathway that relates the point value conigned to targets as he flow or depth of the solorent surface retur body increases. [entitees]. Distance weight: Personator in the 1955 of algoriton, ground water migration, and coll mignetics, potent water migration, and coll mignetics of the teachers in the point of the solorent of teachers in the point Dent

reporters pollorarys that resistors we report a signal to targets as their dis accessor from the site. (million). Distribution coefficient (R.): Man and a sublicity of a subst-

m af concentration completely (Aq. Massari to actual a partitioning of a substance starsen geologic meterials (by exception ediment, reck) and water (also colled artifice coefficient). The distribution artificien coefficiently. The distribution puttion of coefficient is used in the 1915 in evaluat the sublity of a substance for the groun use for the ground

Here of a transmission on the ground algorithm performs, just/gl. (20-percent officative describ Instantio sociated with a 10-percent increases i so over control groups. For HES in. the suspense considered to conce 20., (10 perc and the second second Mass and California groups and to cance press, the response considered to cance Ingenese testimat per kilogens body gist per day (mg/kg-day)), per day (mg/kg-day), per day

ded, cencer tion of a point nded, concentration of a pricensus or Inform substance in human food or Inf food at or above which FDA will take estimal fixed at or othere which PDA will be legal action to summe adultation produce from the mether. Only FDAALs establish for this and deallish apply in the HBLS. Half-life Laugth of time sequence for an initial concentration of a substance to be and protocol

alved as a result of less through decay. The ndidas fire dacay p adation, hydrolysia HES on streeten, hydrolysis, photoly ritre decay, and valatilisatio ritres anteiners (Threete nie.

HER CERCIA has educations, pollutante, and contaminant defaued in CERCLA sections 200(14) and -10(10), except where otherwise specifically d in the 1925.

Hence is on rate. Hence wastesteen: Meterial containing CERCLA benerices substances (so defined in CERCLA section 101/16) that was dependent, stand, depend, or placed is or that otherwise relevant to, a source. HES "focur": Pelmary rating elements because the time and to.

nel to the HES.

HES "Jactor congrey": Set of HES lactors (but in Multiwood of release (or exposure), mate characteristics, targets). HES "migration pathways": HES ground mater, surface water, and or migration

pelloreque. HES "pedirony": But of HES Sector categories excluted to produce a score to measure relative side pread by a size in one of four environmental pedarope (that is, ground weaks, satisfies water, sell, and sir). HES "alle score": Composite of the four

HES polynosy access. Heavy's low constant: Measure of the velocity of a substance in a dilute solution of

voter at equilibrium. It is the zotio of the voper pressure coarted by a substance in the gas phase ever a dilute aqueous solution of that substance to its concentration in the relation at a given temperature. For HRS perpense, use the value reported at or near 25° C. (atmosphere-cubic meters per mole He Yanda.

Hydrolyair Chemical reaction of a ibutance with water.

Karat Turnin with characteristics of relief and draining arising from a high degree of pack schubility in astural waters. The majority of lazat occurs in limestones, but at may also form in dolomite, gypoun, and a deposits. Penturus associated with karst 1---esh depesits. Penturas severessier termine typically include irregular tepagraphy, sinkholes, vertical shafts, abrupt tepagraphy, sinkholes, vertical shafts, abrupt es, caverns, abundant oprings, and/or presering streams. Karst squiffers are cisted with knest terrain.

LC. (lethel concentration, 20 percent): encontration of a substance in air (typically is per cubic meter (jig/m?) or [typically micrograms per liter (ng/l]] that hills 30 percent of a group of exposed expanients. The LCm is used in the HRS in

It is not the transmission of a second secon HES is as nicent per kilogram body weight (me Maximum Contaminant Level (MCL

Under section 2412 of the Sale Drinking Weise Act, as amended, the maxim sible concentration of a substance in ter that is delivered to any user of a public

ir supply. Incident Conteman ant Level Goai DACLG: Under section 1412 of the Safe ng Weter Act, as amended, a increable concentration for a se Delakt in delaking water that is protective of adverse leanen health effects and allows an adequate ergin of valiety. Mathed Detection Limit (MDL): Lowest

encontration of analyte that a method can detect reliably in either a sample or black. Mined radioactive and other hazardous

distances: Meterial containing both radioactive bezerdous substances and manuficactive bezardous substances. ardiens of whether these types of etences are physically separated, abined chemically, or simply mixed ~ -

National Ambient Air Quality Standards (NAAQS): Primary standards for air quality established under sections 108 and 100 of the ann Air Act, as amanded.

National Emission Standards for neclous Air Pollutants (NESHAPs): adards established for substances liste a 112 of the Clean Air Act, as ular metic ded. Only those NESHAPs promulant is asbient concentration units apply in the HRS.

Octanol-water partition coefficient (Kap for PD: Measure of the extent of partitioning of a ice between water and octanol at allibrium. The Key is determined by the ratio between the concentration in octanol divided by the concentration in water at equilibrium. (unitiess).

Organic curbon partition coefficient (Ker): lessure of the extent of partitioning of a Man

substance, at equilibrium, bet rees dige entropy in grainers materials and water. The higher the Kap the store likely a substance is higher UP has the serve array to black to geologic motorials than to : in water, just/gi. Matalystic Chamical machine of a sic meterials than to remain

substance caused by direct absorption of solar energy (direct photolysis) or caused by other substances that absorb solar energy (indirect photolysis). Redistion: Particles (alpha, bota, acutrono)

or photons (x- and gamme-rays) emitted by redisandial

Rediractive decay: Process of spontaneous nucleor transformation, whereby an isotope of ane element is transformed into an isotope of another element, releasing encode energy in the form of indiction.

Andianctive half-life: Time sequired for ano-half the stone is a given quantity of a specific redisanchies to undergo radioactive decay.

Andianctive substance: Solid, liquid, or gas containing atoms of a single radiomechide or moltiple radiomechides.

Redisactivity: Property of these lectopes of means that exhibit solicective decay and endi redictio

Andienuclich,/aufinientape: lootope of an element exhibiting redirectivity. For HES purposes, "redirencide" and "redioisotope" are used spacesymensity. Reference date (RfD): listimate of a daily

Raj ne level of a sub esperate level of a substantian an a summer tance to a huma boath affects are not anticipated. [milligen beaks execution are not an another the second participation of the second participation of the second secon

odens substances sure a facility pers din. der the Resource Conservation a my Act or the Tunic Substa Barren a al Act or by the Nucleur Regulatory

niger (R): Measure of extern was to tenining rediction. Or Restigner pro-experience to including mediation. One romag-equals that amount of a-tary or gaining a rediction required to produce ions carrying a change of 1 electrostatic unit (out) in 1 cubic continuent of dry air under standard conditions. One microscontgen (pE) equals

Sample quantitation limit (SQL): Quantity of a substance that can be maximally atilised given the limits of detection for the shels of analysis and sum characteristics the may effect que (for example, dilution, concentration Screening concentration) (1) tion).

Scree g concentration: Modio-specific -di nerk a excentration for a heat nce that is used in the HHS for comparison with the concentration of that hazardeen substance in a sample from that mode. The screening concentration for a specific heardeen substance corresponds to unce dass for inhelation exposures or its min for easi exponents as appropriate, and, if the substance is a human carcinogen with a weight of evidence chantification of A. B. or C. to that concentration that corresponds to its 10-4 individual Metime excess cancer risk for inhelation exponents or for oral exponents. As appropriate.

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Site: Area(s) where a hazardous substance has been deposited, stored, disposed, or placed, or has otherwise come to be located. Such areas may include multiple sources and. may include the area between sources.

Stope factor (also referred to as cancer potency factor): Estimate of the probability of response (for example, cancer) per unit intake of a substance over a lifetime. The slope factor is typically used to estimate upper-bound probability of an individual developing cancer as a result of exposure to a particular level of a human carcinogen with a weight-of-evidence classification of A, B, or C. [(mg/kg-day)⁻¹ for non-radioactive substances and (pCi)-1 for radioactive substances].

Source: Any area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance. Sources do not include those volumes of air, ground water, surface water, or surface water sediments that have become contaminated by migration, except: in the case of either a ground water plum with no identified source or contaminated surface water sediments with no identified source, the plume or contaminated sediments may be considered a source.

Target distance limit: Maximum distance over which targets for the site are evaluated. The target distance limit varies by HRS pathway.

Uranium Mill Tailings Radiation Control Act (UMTRCA) Standards: Standards for radionuclides established under sections 102. 104, and 106 of the Uranium Mill Tailings Radiation Control Act, as amended.

Vapor pressure: Pressure exerted by the vapor of a substance when it is in equilibrium with its solid or liquid form at a given temperature. For HRS purposes, use the value reported at or near 25° C. [atmosphere or torr]

Volatilization: Physical transfer process through which a substance undergo change of state from a solid or liquid to a gas.

Water solubility: Maximum concentration of a substance in pure water at a given temperature. For HRS purposes, use the value reported at or near 25° C. [milligrams per liter (mg/l)].

Weight-of-evidence: EPA classification system for characterizing the evidence supporting the designation of a substance as a human carcinogen. EPA weight-of-evidence groupings include:

Group A: Human carcinogen--sufficient evidence of carcinogenicity in humans. Group B1: Probable human carcinogenlimited evidence of carcinogenicity in humans.

Group B2: Probable human carcinogensufficient evidence of carcinogenicity in animala

Group C: Possible human carcinogen-limited evidence of carcinogenicity in animal

Group D: Not classifiable as to human carcinogenicity--applicable when there is no animal evidence, or when human or animal evidence is inadequate. Group E: Evidence of noncarcinogenicity for humans.

2.0 Evaluations Common to Multiple Pathways

2.1 Overview. The HRS site score (S) is the result of an evaluation of four pathways:

- Ground Water Migration (S_{pr}). Surface Water Migration (Spe).
- Soil Exposure (S.).
- Air Migration (S.). .

The ground water and air migration pathways use single threat evaluations, while the surface water migration and soil exposure pathways use multiple threat evaluations. Three threats are evaluated for the surface water migration pathway: drinking water, human food chain, and environmental. These threats are evaluated for two separate migration components--overland/flood migration and ground water to surface water migration. Two threats are evaluated for the soil exposure pathway: resident population and nearby population.

The HRS is structured to provide a parallel evaluation for each of these pathways and threats. This section focuses on these parallel evaluations, starting with the calculation of the HRS site score and the individual pathway scores.

2.1.1 Calculation of HRS site score. Scores are first calculated for the individual pathways as specified in sections 2 through 7 and then are combined for the site using the following root-mean-square equation to determine the overall HRS site score, which ranges from 0 to 100;

$$S = \sqrt{\frac{S_{gw}^2 + S_{gw}^2 + S_g^2 + S_a^2}{4}}$$

2.1.2 Calculation of pathway score. Table 2-1, which is based on the air migration pathway, illustrates the basic parameters used to calculate a pathway score. As Table 2-1 shows, each pathway (or threat) score is the product of three "factor categories": likelihood of release, waste characteristics, and targets. (The soil exposure pathway uses likelihood of exposure rather than likelihood of release.) Each of the three factor categories contains a set of factors that are assigned numerical values and combined as specified in sections 2 through 7. The factor values are rounded to the nearest integer, except where otherwise noted.

2.1.3 Common evaluations. Evaluations common to all four HRS pathways include: Characterizing sources.

-Identifying sources (and, for the soil exposure pathway, areas of observed contamination [see section 5.0.1]]. -Identifying hazardous substances

associated with each source (or area of observed contamination).

-Identifying hazardous substances available to a pathway.

TABLE 2-1.-SAMPLE PATHWAY SCORESHEET

Factor category	Maxi- mum value	Value so- signed
Likelihood of Release		
1. Observed Release	550	Į
2. Potential to Relate	500	
lines 1 and 2)	550	l
Waste Characteristics		
4. Toxicity/Mobility	(a)	ł
5. Hazardous Waste Quantity	.(a) .100	1
Tarrata	100].
1 al Yara		l I
7. Neerest Individual		ł
78. Level 1	50	1
7b, Level II	45	ł
7c. Polential Contemination	20	
7d. Nearest Individual (higher of		
lines 78, 70, or 7c)	50	1
8. Population		
82. Level !	(0)	ł
8b. Level II.	(b)	ł
8c. Potential Contamination	(0)	1
8d. Total Population (lines		1
8a+8b+8c)	(6)	1
9. Resources	5	{
10. Sensitive Environments	(0)	
10a. Actual Contamination	(b)	1
10b. Potential Contamination	(b)	
10c. Sensitive Environments		
(ines 10a+10b)	(0)	1
44 Towners (Town 7d + 8d + 0 + 40a)	1 4	1

. Ingres union ra+00+04+00()...((0)) ... Pathway Score is the product of Likelihood of Release. Waste Characteristics, and Targets, di-vided by 82,500. Pathway scores are limited to a 12. Pr maximum of 100 points.

Maximum value applies to waste characteristics catagory. The product of lines 4 and 5 is used in Table 2-7 to derive the value for the waste charac-teristics factor category.
 There is no limit to the human population or sensitive environments factor values. However, the pathway some based solely on sensitive environ-ments is limited to a maximum of 60 points.

Scoring likelihood of release (or

likelihood of exposure) factor category.

- -Scoring observed release (or observed contamination).
- Scoring potential to release when there is no observed release.

 Scoring waste characteristics factor category.

-Evaluating toxicity.

- -Combining toxicity with mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential, as appropriate to the pathway (or threat).
- Evaluating hazardous waste quantity. Combining hazardous waste quantity with the other waste characteristics factors.
- -Determining waste characteristics factor category value.

Scoring targets factor category.

-Determining level of contamination for targets.

These evaluations are essentially identical for the three migration pathways (ground water, surface water, and air). However, the

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as differ in certain segrects for the

eventualized differ in contain suspects for the and expresses pathway. Section 7 specifies methications that apply to each pathway when evoluting size containing suffice-size substances. Section 2 focuses on evolutions common at the pathway and theat levels. Note that for the growth vector and exclose vector microtion activates, superside course on for the ground water and outlines water migration pathways, supervise eccases are colculated for each applier (see sections 3.8) and each watershing fore pathway scores for a site. Although the evaluations is section 2 do not very when different equifiers or verturabels are accord at a site, the specific fact r values (for example, observed misson,

hexardous waste quantity, texicity/mobility) that needs from these evaluations can vary by equifer and by watershed at the site. This can occur through differences both in the specific services and targets eligible to be evaluated for each equifer and watershed and in whether observed releases can be established for each equifer and watershed. Such differences in accrime at the evaluation Such differences is scoring at the equifer and watershed level are addressed in sections 3 and 4, not section 2.

2.2 Characterize sources. Source characterization includes identification of the -inc

· Sources (and areas of observed contamination) at the site.

TABLE 2-2 -- SAMPLE SOURCE CHARACTERIZATION WORKSHEET

• Hennels شيو ور a associated with these sources (or stone of observed contenination).

· Patheneys potentially threatened by user hannedous substances. •

Table 3-2 presents a sample workshopt for source characterization.

2.2.1 Adoutify sources. For the three migration pathways, identify the sources at the alte that contain honordous substances. Identify the migration pathway(s) to which each source applies. Per the soil exposure , pathway, identify mass of observed contamination at the site (see section 5.0.1).

A. Source dimensions and humanisus wants quantity.

.

Source

Hausedows washedreen quartily: __

Valence ____

Anne

Area of electronic contemination:

8. Hannelma substances associated with the source.

	junitari el elateri						
Maandous edulance		e in the second s	0	Sulace v	nder (SM)	9	- N
	-	Periodate	(GW)	Custand/ flood		Peaklent	Heaty
	<u> </u>	l					
·		· • • • • • • • •	·				L

Identify honorchast substances and with a sense. For each of the 222 14 in pathways, consider these between documented in a ce (for example, by exampling, babaia diaste, and or written statements) to ite) to be at source when evaluating clased with th through in some instances, a 196 substance can be de id p -عد أنمك being present at a site (for example, by below, manifeste, and or written statemen bet the specific cources(s) containing that become outstance courset be decourses handows exterimer cannot be decomparise For the three arignation pedensyre, in these instances when the specific source(s) cannot be decompared for a homedean exterimer, cantider the homedean exterimer to be sent in each source at the site, encept sent for which definitive information effectes that the basterious exhibiting was at or could not be provide. For an area of observed contamination in

For our area of observed contamination is the sell exposure performing, consider only these hanneless substances that most the collects for observed contamination for the res (see section S.S.1) to be associa date bate that a danty.

that area when overheating the pathway. 223 Minutify humanism substances available to a pathway. In evaluating each

•

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nigration puthway, consider the following nanodous substances svailable to migrate at the sources at the site to the pathway: 600 · Ground weter migration.

- -Hausrdous substances that most the criteria for an observed release (see section 2.3? to ground water.
- -All hazardous subitances associated with a source with a ground water containment factor value grouter than • fort section 3.1.2.1).

· Surface water migration-overland/flood and.

- -Hezardous substances that most the criteria for an observed release to surface water in the watershed being dested. -
- -All hezardous substances associated with a source with a surface water amont factor value granter than 8 for the wetershed (see sections 4121211 and 4121221)
- · Surface water migration-ground water to sufface water component.
 - -Hazardous substances that most the criterie for an observed release to ground water.

All boundous substances association with a source with a ground vester the ground factor value ground the sub--412 teted. 0 (see sections 42212 and 3121).

Air migration.

- -Henseless substances that meet the culturis for an observed release to the atmosphere.
- All genores hereadons substances essociated with a source with a gas containment factor value greater than 0 (see section 61211).
- All particulate hemselous substances associated with a sporce with a particulate contain ment factor value greater then 0 (see section 6.1.2.2.1).

• For each migrafies pathway, in those instances when the specific source(s) containing the housedness substance connot visi, consider that hexardows be docus substance to be available to migrate to the pathway when it can be associated (see section 2.2.2) with at least one source having a containment factor value groater than 0 for

I officient interview generations of the polyney. In evaluating the self exposure pathway, consider the following hasardous substances available to the pathway:

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• Soil exposure-resident population threat.

- -All hazardous substances that meet the criteria for observed contamination at the site (see section 5.0.1).
- Soil exposuis—nearby population threat.
 All hazardous substances that meet the criteria for observed contamination at areas with an attractiveness/ accessibility factor value greater than 0 (see section 5.2.1.1).

2.3 Likelihood of release. Likelihood of release is a measure of the likelihood that a waste has been or will be released to the environment. The likelihood of release factor category is assigned the maximum value of 550 for a migration pathway whenever the criteria for an observed release are met for that pathway. If the criteria for an observed release are met, do not evaluate potential to release for that pathway. When the criteria for an observed release are not met, evaluate potential to release for that pathway, with a maximum value of 500. The evaluation of potential to release varies by migration pathway (see sections 3, 4 and 6).

Establish an observed release either by direct observation of the release of a hazardous substance into the media being evaluated (for example, surface water) or by chemical analysis of samples appropriate to the pathway being evaluated (see sections 3, 4, and 6). The minimum standard to establish an observed release by chemical analysis is analytical evidence of a hazardous substance in the media significantly above the background level. Further, some portion of the release must be attributable to the site. Use the criteria in Table 2-3 as the standard for determining analytical significance. (The criteria in Table 2-5 are also used in establishing observed contamination for the soil exposure pathway, see section 5.0.1.) Separate criteria apply to radionuclides (see section 7.1.1).

TABLE 2-3.---OBSERVED RELEASE CRITERIA FOR CHEMICAL ANALYSIS

Semple Measurement < Sample Quantitation Limit*

No observed release is established. Sample Measurement. > SAMPLE QUANTITATION LIMPT *

An observed release is established as follows:

- If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds the sample quantitation limit.^a
- If the background concentration equals or exceeds the detection limit, an observed release is established when the sample measurement is 3 times or more above the background concentration.

• If the sample quantitation limit (SQL) cannot be established, determined if there is an observed release as follows: --It the sample analysis was performed under the EPA Contract Laboratory Program, use the EPA contract-required quantitation limit (CRQL) in place of the SQL.

-If the sample analysis is not performed under the EPA Contract Laboratory Program, use the detection limit (DL) in piece of the SQL.

2.4 Waste characteristics. The waste characteristics factor category includes the following factors: hazardous waste quantity, toxicity, and as appropriate to the pathway or threat being evaluated, mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential.

2.4.1 Selection of substance potentially posing greatest hazard. For all pathways (and threats), select the bazardous substance potentially posing the greatest hazard for the pathway (or threat) and use that substance in evaluating the waste characteristics category of the pathway (or threat). For the three migration pathways (and threats), base the selection of this hazardous substance on the toxicity factor value for the substance, combined with its mobility, parsistence, and/ or bioaccumulation (or ecosystem bioaccumulation) potential factor values, as applicable to the migration pathway (or threat). For the soil exposure pathway, base the selection on the toxicity factor alone.

Evaluation of the toxicity factor is specified in section 2.4.1.1. Use and evaluation of the mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential factors vary by pathway (or threat) and are specified under the appropriate pathway (or threat) section. Section 2.4.1.2 identifies the specific factors that are combined with toxicity in evaluating each pathway (or threat).

each pathway (or threat). 2.4.1.1 Toxicity factor. Evaluate toxicity for those hazardous substances at the site that are available to the pathway being scored. For all pathways and threats, except the surface water environmental threat, evaluate human toxicity as specified below. For the surface water environmental threat, evaluate ecosystem toxicity as specified in section 4.1.4.2.1.1.

Establish human toxicity factor values based on quantitative doss-response parameters for the following three types of toxicity:

• Cancer--Use slope factors (also referred to as cancer potency factors) combined with weight-of-evidence ratings for carcinogenicity. If a slope factor is not available for a substance, use its ED₁₀ value to estimate a slope factor as follows:

Slope factor
$$=\frac{1}{6 (ED_{i*})}$$

 Noncancer toxicological responses of chronic exposure- -use reference dose (RfD) values. Noncancer toxicological responses of acute exposure--use acute toxicity parameters, such as the LD₁₀.

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Assign human toxicity factor values to a hazardous substance using Table 2-4, as follows:

• If RfD and slope factor values are both available for the hazardous substance. assign the substance a value from Table 2-4 for each. Select the higher of the two values assigned and use it as the overall toxicity factor value for the hazardous substance.

 If either an RfD or slope factor value is available, but not both, assign the hazardous substance an overall toxicity factor value from Table 2-4 based solely on the available value RfD or slope factor).

 If neither an RfD nor slope factor value is available, assign the hazardous substance an overall toxicity factor value from Table 2-4 based solely on acuts toxicity. That is, consider acute toxicity in Table 2-4 only when both RfD and slope factor values are not available.

 If neither an RfD, nor slope factor, nor acute toxicity value is available. assign the hazardous substance an overall toxicity factor value of 0 and use other hazardous substances for which information is available in evaluating the pathway.

TABLE 2-4.--TOXICITY FACTOR EVALUATION

Chronic Toxicity (Human)

Reference dose (RfD) (mg/kg-day)	Assigned Value
R1D < 0.0005	10,000 1,000 100
0.05 ≤ RID < 0.5 0.5 ≤ RID RID not evallable	10 1 0

Carcinogenicity (Human)

Weight-of-evidence*/slope factor (mg/ tig-day)=1			Assigned	
	B	C	VELUG	
0.5 ≤ S ^{P3}	5 ≤ 8F	50 <u>≤</u> SF	10.000	
0.05 ≤ SF < 0.5	0.5 ≤ SF < 5	5 <u>≤</u> SF < 50	1,000	
SF < 0.05	0.05 ≤ SF < 0.5	0.5 ≤ SF < 5	100	
	SF < 0.05	SF.< 0.5	10	
Slope factor not available.	Slope - factor not available.	Siope factor not available.	0	

•A, B, and C reter to weight-of-evidence categories. Assign substances with a weight-of-evidence category of D (inadequate evidence of carcinogenicity) or E (evidence of tack of carcinogenicity) a value of 0 for carcinogenicity. •SF = Slope factor.

TABLE 2-4 .-- TOXICITY FACTOR EVALUATION -- CONCLUDED

Ande Testally (Numeri)

Civil Liles (mg/hg)	Darmel LDas (mg/hg)	Dust or mist LCs (mg-i)	Bas or vepor LC _{as} (ppor)	Assigned value
UD a < 6	لکی < 2	LCm < 0.2 0.2 5 LCm < 2 2 5 LCm < 20 20 5 LCm < 20 20 5 LCm - 20 LCm noi suminine	LCm < 20	1,000 100 10 10 1 0

If a tanicity factor value of 0 is anyigned to all homorieus existences available to a particular pathway (that is, handleisest tanicity data are available for evaluating all tenicity de Res autom al, use a default vaine of 160 as when texicity factor voluments and here الم بهة مط . . strong. For beautions substa ices having nerge, For hadrandeen autoriances investig de tendelty date for moltiple exposure es for example, inheletion and effen), consider all exposure routes and the highest antigned value, regardless of some route, as the tenicity factor value. It ISS purposes, antign both astronomy

For HES purposes, anigo be ad lead (and he compounds) a addity factor value of \$1,000. le) a hereen

proste cellucio apply for solgaing factor to far burnes tacicity and ecceystem by far tadianacidas (see societa 7.2.1 2-1725

al 7.2.2). 24.1.2 Hannedous substance estaction. ar each humedous substance evaluated for mignetian performs for flowel, combine the mean tenicity factor value for encourten micity factor value) for the instantons distance with a mobility, persistence, and/ r bioaccombinism for computern forecommission for computern forecommission personal factor value as For each la 8 2

- Grand water adjustice. -Dutamilat a cambined limnen testicity/ mobility factor value for the herards substance (nor section 3.2.1). .
- · Surface weter migration overland/Sood n compensat.
 - nine a combined human tenicity/ - **N** ce factor value for the
 - makes whether we want to be taking or furner (see section 4.1.2.2.1) mine a combined houses twictly/ interes/bisectoredation factor int a cumbin Iman/Nonco ins for the hexadous subst
 - a food chain threat (see (عدل combined occupation subtrace/bioeccumulation uine a ceu
 - tenicity/partistence/unersideus factor value for the basendous substance for the conformation throat (me motion 41421).

urface water migration-ground water to to water migration component. Such

- -Determine a combined house terricity / exhibity/persistence factor volve for the househous substance for the drinking voter fluxet (see section 42221):
- ie a cambined humon texticity/ Determin mobility/participants/bioaccumaista isstance for the burner food chain Great (see section 4.2.2.2.1).

.

-Determine a combined accesystem toxicity/mobility/persistence/ bioaccumulation factor value for the herenvious substance for the environmental threat (see section 424211

- · Air might Sell.
- -Determine a combined homen toxicity/ mobility factor value for the bararde substance (see section 6.2.1).

Determine each combined fector value for a hexardous substance by multiplying the dividual factor values appropriate to the schway (or lives). For each migration athway (or lives) being evaluated, select the her ous substance with the high et. hined factor value and use that substa 102 in evaluating the waste characteristics factor

Augury of the pathway (or threat). Pur the soil expansive pathway, sele ed the u mba nce with the highest hum nicity factor value from among the nces that most the criteria for observed minution for the threat evaluated and that substance in evaluating the wester cluristics factor category.

2A2 Hanardous weste que ntity. Evaluate rions waste quantity factor by first n han gaing auch source (or area of observed tion) a source bezardous waste stity value as specified below. Sum these values to obtain the hexardous weste quantity factor value for the pethway being 4

In evaluating the hazardous weste quantity factor for the first sugration pathways, allocate hazardous substances and hazardous wastertranss to specific sources in the manner specified in section 2.2.2. except: consider-hexardous substances and us weekstreens that cannot be effective version and called by the second of the second o m in the unallocated source for a pation pelloway if there is definitive nation indicating that the substance or stream could only have been placed in metion indica rose with a containment factor value of 0 for that migration pathway.

ting the hexardous was de q factor for the soil exposure petivery. allocat to each area of obs rved contamin ntice epily these hexardous substances that meet the criteria for observed contamination for that area of observed contamination and only those hezardous wastestreams that contain assuctions substances that meet the criteria for observed contamination for that area of

ned co m. Do not con other hexarding substances or hexard mus at the site is eval ينيل م

factor for the soil expressive pathway. 2.4.2.1 Source housedour weste gu abitr. For each of the flow migration poll antign a source hazardous weste q عد ما utit v تي e to each source (including the located asurce) having a could factor volue grater than 0 for the pathway being evaluated. Consider the unellocated source to have a containment factor value voter then 0 for each migration pethway. For the soil exposure pethway, artiga a

notes hastactous wants quantity value to ach some of observed contamination, as splicable to the threat being evaluated. For all pathways, evaluate source

For an planneys, evaluate source herardous waste quantity using the following four measures in the following hierarchy: • Hazardous countileest quantity. • Hazardous westerleese quantity.

- Velupe
- · Anna.
- For the unallocated source, use only the first two measures.

Separate criteria apply for assigning a sense homodous where quantity value for radiamedidas (see section 7.2.5). sity value for

2A213 Honordous constituent quantity. Evaluate hexardous constituent quantity for the summer for area of observed instica) based solely on the mass of CERCLA bezondone substa ances (as defined in CERCLA section 101(14), as ame ded) allocated to the source for area of observed n), encept

 Per a luzzerdous vente listed purseent to section 3000 of the Solid Waste Disposel Act, as anomied by the Resource Conservation ne listed pur and Recovery Act of 1976 (BCRA), 42 U.S.C. 1981 et see, determine he mans for the eval a of this measure as fails -

- -If the honordous waste is listed solely for Flavord Code T (turde waste), include only the mass of countilies in the hostidoes weste that are **CERCIA** hereedown miketences and not the mass of the outine hazardone
- -E the hexandous wouts is listed for any other Hexand Code (including T plus any other Hexand Code), include the tas of the entire hexardous waste.

 For a IICRA hemodous waste that exhibits the characteristics identified maler section 3664 of RCRA, as amended. determine its mess for the evolution of this measure as follows:

.

-If the hazardous waste exhibits only the characteristic of toxicity (or only the characteristic of EP toxicity), include only the mass of constituents in the hazardous waste that are CERCLA hazardous substances and not the mass of the entire hazardous waste.

,

-If the hazardous waste exhibits any other characteristic identified under section 3001 (including any other characteristic plus the characteristic of toxicity (or the characteristic of EP toxicity]), include the mass of the entire hazardous waste.

Based on this mass, designated as C, assign a value for hazardous constituent quantity as follow

 For the migration pathways, assign the source a value for hazardous constituent quantity using the Tier A equation of Table

• For the soil exposure pathway, assign the area of observed contamination a value using the Tier A equation of Table 5-2 (section 5.1.2.2).

If the hazardous constituent quantity for the source (or area of observed contamination) is adequately determined (that is, the total mass of all CERCLA bazardous substances in the source and releases from the source (or in the area of observed contamination] is known or is estimated with reasonable confidence), do not evaluate the other three measures discussed below. Instead assign these other three measures a value of 0 for the source (or area of observed contamination) and proceed to section 2.4.2.1.5.

If the hazardous constituent quantity is not adequately determined, assign the source (or area of observed contamination) a value for hazardous constituent quantity based on the available data and proceed to section 24212

TABLE 2-5.--HAZARDOUS WASTE QUANTITY EVALUATION EQUATIONS

Tier	Meesure	Units	Equation for sesigning value *
A	Hazardous	ib	с
B*	quantity (C) Hezardous wastestream	в	W/5,000
C,	(clume (V) Landiil Suriace	yda yda	V/2,500 V/2.5
	Surface impoundment	yd*	V/2.5
	(buried/backfilled) Drums * Tanks and containers other	gallon yd ^a	V/500 V/2.5
	than drums Contaminated soil Pile Other	yda yda yda	V/2,500 V/2.5 V/2.5
D	Area (A) Landfill Surface impoundment	ft# ft#	A/3,400 A/13

TABLE 2-5 .-- HAZARDOUS WASTE QUAN-TITY EVALUATION EQUATIONS-Concluded

Tier	Measure	Units	Equation for assigning value *
	Surface impoundment (buried/ beckfillert)	ħª	A/13
	Land treatment Pile 4 Contaminated soil	ft# ft# ft#	A/270 A/13 A/34,000

^a Do not round to nearest integer. ^b Convert volume to mess when necessary: 1 ton=2,000 pounds=1 cubic yard=4 dnums=200 "If actual volume of drums is unavailable, assume

1 drum=50 galeons. ⁴Use land auriace area under pile, not surface area of pile.

24.2.1.2 Hazardous wastestream quantity. Evaluate hazardous wastestream quantity for the source (or area of observed contamination) based on the mass of additional CERCLA pollutants and contaminants (as defined in CERCLA section 101[33], as amended) that are allocated to the source (or area of observed contamination). For a wastestream that consists solely of a hazardous waste listed pursuant to section 3001 of RCRA, as amended or that consists solely of a RCRA hazardous waste that exhibits the characteristics identified under section 3001 of RCRA, as amended, include the mass of that entire hazardous waste in the evaluation of this measure.

Based on this mass, designated as W, assign a value for hazardous wastestream quantity as follows:

• For the migration pathways, assign the source a value for hazardous wastestream quantity using the Tier B equation of Table

· For the soil exposure pathway, assign the area of observed contamination a value using the Tier B equation of Table 5-2 (section 5.1.2.2).

Do not evaluate the volume and area measures described below if the source is the unailocated source or if the following condition applies:

 The hazardous wastestream quantity for the source (or area of observed

contamination) is adequately determined that is, total mass of all hazardous wastestreams and CERCLA pollutants and contaminants for the source and releases from the source (or for the area of observed contamination) is known or is estimated with reasonable confidence.

If the source is the unallocated source or if this condition applies, assign the volume and area measures a value of 0 for the source (or area of observed contamination) and proceed to section 2.4.2.1.5. Otherwise, assign the source (or area of observed contamination) a value for hazardous wastestream quantity based on the available data and proceed to section 2.4.2.1.3.

2.4.2.1.3 Volume. Evaluate the volume measure using the volume of the source (or the volume of the area of observed

contamination). For the soil exposure pathway, restrict the use of the volume measure to those areas of observed contamination specified in section 5.1.2.2. Based on the volume, designated as V.

assign a value to the volume measure as follows

• For the migration pathways, assign the source a value for volume using the appropriate Tier C equation of Table 2-5.

 For the soil exposure pathway, assign the area of observed contamination a value for volume using the appropriate Tier C equation of Table 5-2 (section 5.1.2.2).

If the volume of the source (or volume of the area of observed contamination. if applicable) can be determined, do not evaluate the area measure. Instead, assign the area measure a value of 0 and proceed to section 2.4.2.1.5. If the volume cannot be determined (or is not applicable for the soil exposure pathway), assign the source (or area of observed contamination) a value of 0 for the volume measure and proceed to section 2.4.2.1.4.

2.4.2.1.4 Area. Evaluate the area measure using the area of the source (or the area of the area of observed contamination). Based on this area, designated as A, assign a value to the area measure as follows:

· For the migration pathways, assign the ource a value for area using the appropriate Tier D equation of Table 2-5.

· For the soil exposure pathway, assign the area of observed contamination a value for area using the appropriate Tier D equation of Table 5-2 (section 5.1.2.2).

2.4.2.1.5 Calculation of source hazardous waste quantity value. Select the highest of the values assigned to the source (or area of observed contamination) for the hazardous constituent quantity, hazardous wastestream quantity, volume, and area measures. Assign this value as the source hazardous waste quantity value. Do not round to the nearest integer.

2.4.2.2 Calculation of hazardous waste quantity factor value. Sum the source hazardous wasts quantity values assigned to all sources (including the unallocated source) or areas of observed contamination for the pathway being evaluated and round this sum to the nearest integer, except: if the sum is greater than 0, but less than 1, round it to 1. Based on this value, select a hazardous waste quantity factor value for the pathway from Table 2-6.

TABLE 2-6.-HAZARDOUS WASTE **QUANTITY FACTOR VALUES**

Hazardous waste quantity value	Assigned value
0	0 1* 100 10,000 1,000,000

"If the hazardous waste quantity value is greater than 0, but less than 1, round it to 1 as specified in

For the pathway, if hazardous constitute is not adequately determined, assign the ent outri ty is not adequately determined, assign a value specified in the text; do not assign the value of

Per a migration patheny, if the basedoos medium quantity is adapteday demined (nor section 24.2.1.1) for all evenuenced (nor section 2.4.2.1.1) for all surces (or all partiess of sectors and shores remaining other a support scitca), ange the value from Table 3-4 as the standard waste quantity factor wake for the otherup. If the basedone constituent pathity is not adequately determined for one r more sources for two or more perticuts of sources or releases remaining after a removal reliant on the sector sector after a second

senses or releases remaining after a removal action) and a a factor value as fallows: + If any length for that migratice pathway is subject to Lovel 1 or Lovel II concentrations (not acciden 2.5), and a other the value from Table 2-6 or a value of 300, whichever is granter, as the homeology waste quantity interview.

priotice, as the hotoroous vector quantumy factor value for that polycopy. • If some of the tangets for that polycopy is subject to Lovel I or Lovel II concentrations. ign a factor vider as follows:

- -If there have been no removed action. andpa other the value from Table 3-8 or a value of 50, which over is greater, as the hostedown wante questify factor value for that pathway.
- -If dance has been a removal action: --Determine values from Table 2-4 with and without consideration of
- the support other. ----E the value that would be assigned from Table 2-6 without consideration of the removal action would be 100 or granter, earlies other the value fram Table 2-4 th consideration of the senarral tion or a value of 200, whichever with case it, as the her la gro of the second se by factor value for the
- preferry. --If the voice that would be assigned from Table 3-6 without consideration of the removal action would be lass than 100, assign a voice of 10 as the humandour vorte quantity factor value for the muy.

For the self expression pathways, if the membrus constituent quantity in advanceshig stansional for all areas of observed of fur all other or commune rains, anoign the value from Table banacious works ignatily factor he hancelous constituent quantity is 3-4 on the house e. If the humanisms can angentaly datas and for one or me erons of chearved contamination, assign other the value from Table 2-6 or a value of 20. whichever is growing, as the hearedown waste quantity factor value. 24.3 Weste characteristics factor congrey value. Determining the waste characteristics factor column nat ad

stacturation factor category value as actiled in sociate 24.3.3 for all patient constructions access accessingly values as specified in section 2.4.3.1 for all path-ways and flowers, except the surface value-house food chain threat and the surface value-conferencestal threat. Determine the waste characteristics fector category value for the letter two threats as specified in section Latter br 2412

2.3.1 Pecter category value. Per the pedinny (or these!) being evaluated, multiply the testicity or combined factor value, as oppropriate, from excitor 2.4.1.2 and the lastitudeus utable quantity factor value from Institution water and the second sector value from section 2422, subject to a maximum product of 1×10⁴. Based on this most characteristics product assign a wante characteristics factor

.

category value to the pathway (or threat) from Table 2-7.

TABLE 2-7 .-- WASTE CHARACTERISTICS FACTOR CATEGORY VALUES

Walls characteristics product	Anigrad
G	0 1 2 3 6 10 16 22 56 10 16 22 56 100 160 220
1×10 ⁴¹ to loss than 1×10 ¹²	580 1,000

2.4.3.2 Pactor category value, considering feaccumulation potential. For the surface war-boman feed chois threat and the surface water-anvisonmental threat, mak the tenicity or combined factor value, an łv appropriate. from section 24.1.2 and the hemerdous waste quantity factor value from section 24.2.2, subject to:

 A maximum predect of 1×10¹², and
 A maximum predect exclusive of the give of the economistica (or econystem

bisaccumulation) potential factor of 1×10°. Based on the total waste characteristics duct, and nct, assign a waste characteristics factor pay value to these threats from Table 2-7.

2.5 Targets.

The types of targets evaluated include the

fal · Individual (factor name varies by

part.

athrony and threat). • Human population. • Resources (these very by pathrony and ninet).

 Sensitive environments (included for a athronys encept ground weater migration).
 The factor values that may be assigned to us (included for all -.

is that may be assigned to each type of target have the same n inge is each pathway for which that type of target is evaluated. The factor value for most types of targets depends on whether the target is subject to actual ar potential contaminat far the petheray and whether the actual -antica is Lovel I or Lovel II: conta

 Actual contamination: Target is Access communication is anyon or sensitiated either with a sampling location that mosts the criteria for an observed ses (or observed contamination) for the petimey or with an observed release based nct observation for the pathway (additional criterie apply for establishing actual contemposition for the human food cisio threat is the surface water migration s 3 through 6 specify how to detern gets associated with a sampling in or with an observed missise base be targets any es direct observation. Determine whether th actual contamination is Level I or Level II as follows:

-Level 1:

--Modio-apocific concentrations for the ternet meet the criterie for an

observed selence for observed customination) for the pathway and are at or above madie specific uchmuck values. These benchmerk values (see section 2.5.2) include both screening concentrations and concentrations etilied in segulatory limits (such Maximum Contaminant Level as Manie (MCL) values), or (MCL) values), or for the human food chain throat in

fir the b the surface water migration nativery, concentrations in ties way, concernio s from aquatic human food naions are at or above ek volues. Such tissue cin equ ples may be used in addition so media-specific concentrations only as specified in sections 4.1.3.3 and uis.

-Level E

- contamination) for the pet nway, but are less than made on hazardena adottances aligible to be evaluated for the sampling location has an applicable banchmark, assign Level II to the acteal contemination of the acteal heachmarks. If same of the location, or
- --Per observal releases based on deact observation, assign Level H to targets as specified in sections 3. 4, and 8, or -Fur the leasen feed chain threat in
- the surface water migration pathway, concentrations in tissue samples from squartic human food chain ergeniere, when applicable, are below bunchmark values.
- any believe performance versus. If a tanget is subject to both Level I and Level II concentrations for a perform (or through, ovaluate the tanget using Lovel I concentrations for that -E a t way (er threat). put

Potential contamination: Target is abject to a potential solution (that is, target is associated with actual contamination for

that patheney or theost). Assign a factor value for individual risk as follows (coloct the highest value that applies to the patheney or theost):

points if any individual is exposed to • 55 Level | concentral

· 45 points if any individual is exposed to Level II conce

 Maximum of 20 points 2 any individual is subject to potential contamination. The value assigned is 20 multiplied by the distance or dilution weight appropriate to the mey.

Assign factor values for population and molitive environments as follows:

• Sum Lovel I targets and multiply by 10. [Lovel] is not used for sensitive aviconments in the soil exposure and sir

ration pethoneys.)

.

.

Sun Level II targets.
 Multiply potential targets by distance or dilation weights appropriate to the pathway.
 can, and divide by 10. Distance or dilation weighting accounts for diminishing exposure

.

.

with increasing distance or dilution within the different pathways.

 Sum the values for the three levels. In addition, resource value points are assigned within all pathways for welfarerelated impacts (for example, impacts to agricultural land), but do not depend on whether there is actual or potential contamination.

2.5.1 Determination of level of actual contamination at a sampling location. Determine whether Level I concentrations or Level II concentrations apply at a sampling location (and thus to the associated targets) as follows:

• Select the benchmarks applicable to the pathway (or threat) being evaluated.

• Compare the concentrations of hazardous substances in the sample (or comparable samples) to their benchmark concentrations for the pathway (or threat), as specified in section 2.5.2.

• Determine which level applies based on this comparison.

• If none of the hazardous substances eligible to be evaluated for the sampling location has an applicable benchmark, assign Level II to the actual contamination at that sampling location for the pathway (or threat).

In making the comparison, consider only those samples, and only those hazardous substances in the sample, that meet the criteria for an observed release (or observed contamination) for the pathway, except: tissue samples from aquatic human food chain organisms may also be used as specified in sections 4.1.3.3 and 4.2.3.3 of the surface water-human food chain threat. If any hazardous substance is present in more than one comparable sample for the sampling location, use the highest concentration of that hazardous substance from any of the comparable samples in making the comparisons.

Treat sets of samples that are not comparable separately and make a separate comparison for each such set.

2.5.2 Comparison to benchmarks. Use the following media-specific benchmarks for making the comparisons for the indicated pathway (or threat): • Maximum Contaminant Level Goals

 Maximum Contaminant Level Goals (MCLGs)—ground water migration pathway and drinking water threat in surface water migration pathway. Use only MCLG values greater than 0.

• Maximum Contaminant Levels (MCLs)-ground water migration pathway and drinking water threat in surface water m_ation pathway.

• Food and Drug Administration Action Level (FDAAL) for fish or shellfish—human food chain threat in surface water migration pathway.

• EPA Ambient Water Quality Criteria (AWQC) for protection of aquatic life environmental threat in surface water migration pathway.

 EPA Ambient Aquatic Life Advisory Concentrations (AALAC)—environmental threat in surface water migration pathway.
 National Ambient Air Quality Standards

(NAAQS)—air migration pathway. • National Emission Standards for

Hazardous Air Pollutants (NESHAPs)—eir migration pathway. Use only those NESHAPs promulgated in ambient concentration units. S-051999 0058(03)(13-DEC-90-11:23:26) • Screening concentration for cancer corresponding to that concentration that corresponds to the 10⁻⁶ individual cancer risk for inhalation exposures (air migration pathway) or for oral exposures (ground water migration pathway; drinking water and human food chain threats in surface water migration pathway; and soil exposure pathway).

• Screening concentration for noncancer toxicological responses corresponding to the RfD for inhalation exposures (air migration pathway) or for oral exposures (ground water migration pathway; drinking water and human food chain threats in surface water migration pathway; and soil exposure pathway).

Select the benchmark(s) applicable to the pathway (or threat) being evaluated as specified in sections 3 through 6. Compare the concentration of each hazardous substance from the sampling location to its benchmark concentration(s) for that pathway (or threat). Use only those samples and only those hazardous substances in the sample that meet the criteria for an observed release (or observed contamination) for the pathway, except: tissue samples from aquatic human food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of any applicable hazardous substance from any sample equals or excee its benchmark concentration, consider the sampling location to be subject to Level I concentrations for that pathway (or threat). If more than one benchmark applies to the hazardous substance, assign Level I if the concentration of the hazardous substance equals or exceeds the lowest applicable benchmark concentration.

If no hazardous substance individually equals or exceeds its benchmark concentration, but more than one hazardous substance either meets the criteria for an observed release (or observed contamination) for the sample (or comparable samples) or is eligible to be evaluated for a tissue sample (see sections 4.1.3.3 and 4.2.3.3), calculate the indices I and J specified below based on these hazardous substances.

For those hazardous substances that are carcinogens (that is, those having a carcinogen weight-of-evidence classification of A. B. or C), calculate an index I for the sample location as follows:

$$I = \sum_{i=1}^{n} \frac{C_i}{SC_i}$$

where:

- C_i=Concentration of hazardous substance i in sample (or highest concentration of hazardous substance i from among comparable samples).
- SC_i=Screening concentration for cancer corresponding to that concentration that corresponds to its 10⁻⁶ individual cancer risk for applicable exposure (inhalation or oral) for hazardous substance i.
- n=Number of applicable hazardous substances in sample (or comparable samples) that are carcinogens and for which an SC, is available.

For those hazardous substances for which an RfD is available, calculate an index [for the sample location as follows:

$$J = \sum_{j=1}^{m} \frac{C_j}{CR_j}$$

where:

- C_j = Concentration of hazardous substance j in sample (or highest concentration of hazardous substance j from among comparable samples).
- CR₂=Screening concentration for noncancer toxicological responses corresponding to RfD for applicable exposure (inhalation or oral) for hazardous substance j.
- m=Number of applicable hazardous substances in sample (or comparable samples) for which a CR, is available.

If either I or J equals or exceeds 1, consider the sampling location to be subject to Level I concentrations for that pathway (or threat). If both I and J are less than 1, consider the sampling location to be subject to Level II concentrations for that pathway (or threat). If, for the sampling location, there are sets of samples that are not comparable, calculate I and J separately for each such set, and use the highest calculated values of I and J to assign Level I and Level II.

See sections 7.3.1 and 7.3.2 for criteria for determining the level of contamination for radioactive substances.

3.0 Ground Water Migration Pathway

Evaluate the ground water migration pathway based on three factor categories: likelihood of release, waste characteristics, and targets. Figure 3-1 indicates the factor included within each factor category.

Determine the ground water migration pathway score (S_w) in terms of the factor category values as follows:

$$S_{sv} = \frac{(LR) (WC) (T)}{SF}$$

where:

LR=Likelihood of release factor category value.

WC=Waste characteristics factor category value.

T=Targets factor category value.

SF=Scaling factor.

Table 3-1 outlines the specific calculation procedure.

Calculate a separate ground water migration pathway score for each aquifer, using the factor category values for that aquifer for likelihood of release, waste characteristics, and targets. In doing so, include both the targets using water from that aquifer and the targets using water from all overlying aquifers through which the hazardous substances would migrate to reach the aquifer being evaluated. Assign the highest ground water migration pathway score that results for any aquifer as the ground water migration pathway score for the aite.

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FIGURE 3-1 OVERVIEW OF GROUND WATER HIGRATION PATHWAY

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TABLE 3-1.--GROUND WATER MIGRATION PATHWAY SCORESHEET

		·
Factor categories and factors	Medmum value	Value assigned
t Hallhold of Balance to an Amilian		
1. Observed Beisses	.550	_ ·
2 Printed to Reference		
2a Containstant	-10	
2b. Nat. Precipitation	10	
2c. Depth to Aquity	5	
2d. Travel Time	-35	
2e. Potential to Release [lines 2a(2b+2c)]	500	
3. Likelihood of Release (higher of lines 1 and 2e).	550	·
Waste Characteristics:	i	· ·
4. Toxicity/Mobility	(#)	1
5. Hezerdout Weste Quentity	t (m)	
6. Waste Characteristics	100	
Targets:	1	1
7. Nearest WeB	50	
8. Population:		1
8e. Level I Concentrations	(4)	1
8b. Level # Concentrations	(1) (1)	· · · · · ·
8c. Potential Contamination	(4)	I
8d. Population (lines 8a+8b+8c)	1 ()	
9. Resources	5	·
10. Wellheed Protection Area	20	1
11. Tergets (inte 7 + 80 + 9 + 10)	j (ta)]
Ground Water Higration Score for an Aquiller:		1
12. Aquiler Score [(ines 3 x 5 x 11)/82,500]	100	1
Ground, Water Higration Pathway Score:		1 .
13. Pathway Score (Spa), (highest value from the 12 for all adulters evaluated)*	1 700	1

Maximum value applies to waiste characteristics category.
 Maximum value not applicable.
 Do not round to nearest integer.

3.0.1 General considerations

3.0.1.1 Ground water target distance limit. The target distance limit defines the maximum distance from the sources at the site over which targets are evaluated. Use a target distance limit of 4 miles for the ground water migration pathway, except when aquifer discontinuities apply (see section 3.0.1.2.2). Furthermore, consider any well with an observed release from a source at the site (see section 3.1.1) to lie within the target distance limit of the site, regardless of the will observe the source at the site

For sites that consist solely of a contaminated ground water plume with no identifies source, begin measuring the 4-mile target distance limit at the center of the area of observed ground water contamination. Determine the area of observed ground water contamination based on available samples that meet the criteria for an observed release.

3.0.1.2 Aquifer boundaries. Combine multiple aquifers into a single hydrologic unit for scoring purposes if squifer Interconnections can be established for these aquifers. | contrast, restrict aquifer boundaries if aquifer discontinuities can be established.

3.0.1.2.1 Aquifer interconnections. Evaluate whether aquifer interconnections occur within 2 miles of the sources at the site. If they occur within this 2-mile distance, combine the aquifers having interconnections in scoring the site. In addition, if observed ground water contamination attributable to the sources at the site extends beyond 2 miles from the sources, use any locations within the limits of this observed ground water contamination in evaluating aquifer interconnections. If data are not adequate to establish aquifer interconnections, evaluate the aquifers as separate aquifers. 3.0.1.2.2 Aquifer discontinuities. Evaluate whether aquifer discontinuities occur within the 4-mile target distance limit. An aquifer discontinuity occurs for scoring purposes only when a geologic, topographic, or other structure or feature entirely transects an aquifer within the 4-mile target distance limit, thereby creating a continuous boundary to ground water flow within this limit. If two or more aquifers can be combined into a single hydrologic unit for scoring purposes, an aquifer discontinuity occurs only when the structure or feature entirely transects the boundaries of this single hydrologic unit.

When an aquifer discontinuity is established within the 4-mile target distance limit, exclude that portion of the aquifer beyond the discontinuity in evaluating the ground water migration pathway. However, if bazardous substances have migrated across an apparent discontinuity within the 4-mile target distance limit, do not consider this to be a discontinuity in scoring the site. 3.0.1.3 Karst aquifer. Give a karst aquifer

3.0.1.3 Karst aquifer. Give a karst aquifer that underlies any portion of the sources at the site special consideration in the evaluation of two potential to release factors (depth to aquifer in section 3.1.2.3 and travel time in section 3.1.2.4), one waste characteristics factor (mobility in section 3.2.1.2), and two targets factors (nearest well in section 3.3.1 and potential contamination in section 3.3.2.4).

3.1 Likelihood of release. For an equifer, evaluate the likelihood of release factor category in terms of an observed release factor or a potential to release factor.

3.1.1 Observed release. Establish an ubserved release to an aquifer by demonstrating that the site has released a hazardous substance to the aquifer. Base this demonstration on either: Direct observation—a material that contains one or more hazardous substances has been deposited into or has been observed entering the aquifer.
 Chemical analysis—an analysis of

 Chemical enalysis—an analysis of ground water samples from the equifer indicates that the concentration of hazardous substance(s) has increased significantly above the background concentration for the site (see section 2.3). Some portion of the significant increase must be attributable to the site to establish the observed release, except: when the source itself consists of a ground water plume with no identified source, no separate attribution is required.

If an observed release can be established for the aquifer, assign the squifer an observed release factor value of 550, enter this value in Table 3-1, and proceed to section 3.1.3. If an observed release cannot be established for the aquifer, assign an observed release factor value of 0, enter this value in Table 3-1, and proceed to section 3.1.2.

3.1.2 Potential to release. Evaluate potential to release only if an observed release cannot be established for the squifer. Evaluate potential to release based on four factors: containment, net precipitation, depth to aquifer, and travel time. For sources overlying karst terrain, give any karst aquifer that underlies any portion of the sources at the site special consideration in evaluating depth to aquifer and travel time, as specified in sections 3.1.2.3 and 3.1.2.4.

3.1.2.1 Containment. Assign a containment factor value from Table 3-2 to each source at the site. Select the highest containment factor value assigned to those sources with a source hazardoas waste quantity value of 0.5 or more (see section 24.2.1.6 (Do not include this minimum size requirement in ovelasting any other factor of this petimory.) Assign this highest value as the contributent factor value for the applier being ovelasted. Enter this value in Tuble

3-1. If no reacto at the site mosts the minimum site requirement, then select the highest value artigned to the senses at the site and

seeign it as the containment factor value for the aquifur being evaluated. Enter this value in Tuble 3-1. 3.1.2.2 Not precipitation. Assign a set precipitation factor value to the site. Figure 3-2 provides computed net precipitation factor values, based on site location. Where measury, determine the set precipitation factor value as follows:

Beuro	Analyted value
All Generat Generat Generation Incomplete I and Tambaset Combiness, and Tables	
Bilines of handous advance miguites tem source are (i.e., source area includes source and any	10
andersen andersen alegebredj. Na haar	10
The widering of homesham advances alonging term sparse sets, a fact, and	
(a) Norte of the following present: (1) antimured anglestered cover, or (2) functioning and maintained use on	10
evented antism and mainfit management system, or (3) functioning inscripts collection and removal system insurflicture shares lines.	·
(4) Any the of the time tame is (4) present	•
(c) Any two of the items is (c) present	7
(4) All three itages to (4) present plus a functioning ground water manipulag system	5
(4) All fame in (4) present, plus no bulk or non-containanteed liquids nor materials containing tree liquids department in source area.	3
- He addetes of hazardese adsetues adjustes tem source area, deads for with functioning inschole collection	
and estimat system shows and between been, functioning yound water manimum system, and	_
	•
	· · ·
	•
Sente and build or under mitighted interior descine first conden and the sentences in the and the	1
nettell für landente is generated, ligeles er meterielte sontaining free ligeles net deposited in source area, and functioning and explosited areas executed asserts.	
Santas Impeundunt	
Billings of humaning substants should be from surface international	1 · •
	10 10
Free-Reality present with other an other, unaquest other, or other that is not reprintly improved and reprintment.	10
He addetee of hexardese adjustese alignation team surface improvedueset, tree lipids protect, sound ching that	
h regeliefy inspected and registained, advance bestward, and	
(6) Listr with functioning lossingle estimates and removal system below fair, and functioning ground value	5
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to come and one statistical attention on statistic statistic statistic statistics and the second formation of the statistical statistics and statistics and statistical statistics and statistical statistics and statistics	•
The addition of home address advantage has and as increasing a state in the design of a	Sector and a sector state and a set
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Land Trestment	
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No functioning, multiplicat, sup-on stating and suppl functionant testing	10
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. (a) Fundaning and materials are an entering management system	7 .
60 Persitiving and malaginad survey curtes and seal management system, and vegetable cover	5
established over online land traspont area.	

At Long transmission manufacture of the second s

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Source	Assigned value
Containers	
containers beried.	Eveluate using All sources criteria.
sence of negatives substance mersion from complete area (i.e., container area includes containers and as	y 10
The one ensemble income one has under container and	10
deno for no similar structured surrounding container area	10
ng surrounding container area unacound or not regularly inspected and maintained	10
evidence of hiszarcious substance migration from container area, container area surrounded by sound dila	g Contraction of the second
et is regularly inspected and maintained, and	
Uner (or essentially impervious base) under container area	····
) Essentially impervious base under container area with Equids collection and removel system	
Containing of the second of th	D Star D Star D
contain to percent or volume or an containing, and uncounting and manufactor reven control; per	
including grand with make the part to make a various of collection states, at least works increasing	
containers, hezerdous schetanoss in leaking or distariorating containers transformed to containers in act	
condition, and containers saaled except when waste is added or removed.	₹.
Free liquids present, containment system has sufficient capacity to hold total volume of all containers an	d 5
to provide adequate treeboard, single liner under container area with functioning leachate collection ar	d
removal system below liner, and functioning ground water monitoring system.	
) Same as (d) except: double liner under container area with functioning leachate collection and remov	1
system between liners.	4
timers inside or under maintained intect structure that provides protection work precipitation so that resin	
na sa hana ka	
unon nor teachate would be generated from any unseeled or ruptured containers, liquids or material ortaining free liquids and dependent is any container, and functioning and materialized autorit content concerns	
unon nor reachase would be generated from any unsealed or ruptured containers, liquids or material containing free liquids not deposited in any container, and functioning and maintained run-off control present, addance of boxentious substance micration from container area, containers instance and all free liquid	n Feature who All sources criteris (with no bulk
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Federal Register / Vol. 55, No. 241 / Friday, December 14, 1990 / Rules and Regulations

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- يتشييه أدور . Wilson man plantion is not available. -late a أعاته n (f.) as follows: E = 90 R.110 T/12 while potential ------- (inches) for
- T-Mone mentily in
- inperature (°C) fer mach i.

a=475×10""P-771×10""P+ 178×10"1[+0.48230 when the latitude adjusting value for an off from Table 3-8. For latitudes lower a B" North or 21" South. determine the addy latitude adjusting value by mpointion. ct the initials adjustics value for each

Calculate monthly not precipitation by subtracting monthly evapotranspiration (or

TABLE 3-S .- MONTHLY LATITUDE ADJUSTING VALUES

dal ever piration) from al evapolounspiration) exceeds all, ansign that month a Ration for a m procip

not proclateries value of 0. • Calculate the annual not proclaterion by summing the monthly not proclaterion. 100

Based on the annual net percipitation, assign a not precipitation factor value from Table 3-4.

Inter the value assigned from Pigare 3-2 or from Table 3-4, as appropriate, in Table 3-1.

Luthete*	Month											
(Augurent)	Jan.	Fail.	March	April	May	Detail	July	August	Bupt	Out.	Nov.	Dec.
*****	5555		1.82 1.82 1.86 1.88	1.15 1.13 1.11 1.00 1.00	1.33 1.30 1.34 1.21 1.18	1.36 1.30 1.25 1.21 1.17	1.37 1.31 1.27 1.23 1.39	1.25 1.21 1.16 1.16 1.14	1.88 1.84 1.85 1.89	6.92 6.94 6.95 6.97 6.99	0.75 0.73 0.83 0.89	0.70 0.75 0.81 0.85 0.96
	85 19 19 19	6.50 6.51 6.57 6.57	1.88 1.88 1.84 1.85 1.85	1.85 1.91 0.97 0.97	1,13 1,00 1,04 1,00 0,96	1.11 1.06 1.01 0.95 0.91	1.14 1.00 1.04 1.00 0.95	1.11 1.07 1.04 1.02 0.09	5656 5	1.00 1.01 1.05 1.05	8.53 0.50 1.01 1.05 1.00	0.94 0.90 1.04 1.09 1.15

• De eint name te namme integer. • Per unfertet tellentes igner dien SV Harts er SV Spelle, determine die tellente adjunteg value by interpolution.

TABLE 3-4 -- NET PRECIPITATION FACTOR VALUER

Hat produktion (incluse)	Antipend
Construction 8 to 8 Construction 8 to 18 Construction 16 to 18 Construction 16 to 28 Construction 29	• • •

Depth to apaple. Interest of a by determining the depth from merror paint of humanitum relation of the methy being 1123 n aq در ا - 1 e to the lap of the de: to to the sup of two appears ones and, constituting all inputs in that it. Moreover the dappe to an experience summer here the surface to the top of the r subset the distance here the surface **4**0 d m point of home با میں م mat br increased and the section of the sec

upth, conten a value from Table 3-5 to the syste to equifier factor. Determine the dapth to equifier only at cations within 2 miles of the sources at the in, except: If observed gaund water

in utilibutable to sources at the 0 te extends more than 2 miles beyond these perces, use sty location within the limits of sensors, use any location within the limits of this observed ground water contamination when evaluating the depth to aquifer factor for any aquifer that dees not have an observed release. If the necessary geologic information is available at makiple locations, calculate the depth to aquifer at each location. Use the location having the smallest depth to assign the factor value. Enter this value in Table 3-1.

TABLE	3-6DEPTH TO AQUIFER FACTOR
	VALUER

- -

Dapits to equilar * (keal)	Antiped
Long these or equal to 25	5
Gregter than 250	

"Use depth of all layers between the temperature solutions and applier. Am. "I a bitmans of 0 less to any hant applier that underlass any portion of the marties at the sha

3.1.2.4 Travel time. Evaluate the travel time factor based on the geologic motoriels in the interval between the lowest known point of homeolous substances of the site and the

top of the aquilier being evaluated. Assign a value to the topval time factor as follows: • If the depth to aquilier (see section 3.1.2.3) is 10 fact or less, aroign a value of 35. • If, for the interval being evaluated, all layers that underlie a pertian of the sources at the pite are lesser, assign a value of 35. · Others

- Balact the lowest hydraulic conductivity ingracial four within the above interval. Consider only layers at losst 3 feet thick. However, do not consider layers or particus of layers within the first 20
- r persons as apply to the applier. Annuale hydraulic conductivities for dividual layers from Table 5-6 or in the state from in-oils or laboratory tests. Use representative, measured, hydraulic civity values whenev 6 - Halle
- ere than one loyer has the same reat hydronic conductivity, include such layers and sun their icknesses. Assign a thickness of 0 of to a least layer that undefies any pertian of the sources at the site. Longs a value from Table 3-7 to the
- towel time factor, based on the factores and hydrouic conductivity of the lowest hydrouic conductivity hyun(s).
TABLE 3-6 .-- HYDRAULIC CONDUCTIVITY OF GEOLOGIC MATERIALS

· .	
Type of meterial	Assigned hydraulic conductivity* (cm/sec)
Clay; low permeability #1 (compact unitactured #0; shale; unitactured metamorphic and igneous rocks	30-5
Sands; sandy-sits; sediments that are predominently sand; highly permeable & (coarse-grained, unconsolidated or compact and highly fractured); pres; moderately permeable financiones and dolomites (no karet); moderately permeable sandstone; moderately permeable fractured ignoous and metamorphic rocks	10-4
Gravet, clean sund, highly permeable fractured igneous and metericophic rocks; permeable basali; kaust Emeatones and dolonities	10-1

* Do not round to exercise integer.

TABLE 3-7 .--- TRAVEL TIME FACTOR VALUES *

	•	· · ·	Thic	Thickness of Iowest Bydraulic conductivity layer(a) [®] (lest)					
	Hydraulic conductivity (cm/sec)		Great Shan 3 5	ar Great to that 10	tter Greater 5 to then 100 10 500	Greater than 500			
Greater then or equal to 10 ⁻⁹			35 36	3	5 35 5 15	25 15			
Loss then 10"?				5	i	i			

" If depth to equilier is 19 feet or less or if, for the interval being evaluated, all layers that underfie a portion of the sources at the elite are karet, useign a value of 35.

* Consider only layers at least 3 feet thick. Do not consider layers or portions of layers within the first 10 feet of the depth to the equilier.

Determine travel time only at locations within 2 miles of the sources at the site, except if observed ground water contamination attributable to sources at the

contamination stiributable to sources at the site extends more than 2 miles beyond these sources, use any location within the limits of this observed ground water contamination when evaluating the travel time factor for any aquifer that does not have an observed release. If the necessary subsurface geologic information is available at multiple locations, evaluate the travel time factor at each location. Use the location having the highest travel time factor value to assign the factor value for the aquifer. Enter this value in Table 3-1.

3.1.2.5 Colculation of potential to release factor value. Sum the factor values for net precipitation, depth to aquifer, and travel time, and multiply this sum by the factor value for containment. Assign this product as the potential to release factor value for the aquifer. Enter this value in Table 3-1.

3.1.3 Calculation of likelihood of release factor category value. If an observed release is established for an equifer, usign the observed release factor value of 550 as the likelihood of release factor category value for that equifer. Otherwise, assign the potential to release factor value for that equifer as the likelihood of release value. Enter the value assigned in Table 3-1.

3.2 Woste characteristics. Evaluate the waste characteristics factor category for an aquifer based on two factors: toxicity/ mobility and hazardous waste quantity. Evaluate only those hazardous substances evaluable to migrate from the sources at the site to ground water. Such hazardous substances include:

• Hazardous substances that meet the criteria for an observed release to ground water.

• All hazardous substances associated with a source that haz a ground water containment factor value greater than 0 (see sections 2.2.2, 2.2.3, and 3.1.2.1).

3.2.1 Toxicity/mobility. For each hazardous substance, assign a toxicity factor value, a mobility factor value, and a combined toxicity/mobility factor value as specified in the following sections. Select the toxicity/mobility factor value for the aquifer being evaluated as specified in section 3.2.1.3. 3.2.1.1 Taxicity. Assign a taxicity factor value to each hexardous substance as specified in Section 2.4.1.1.

3.2.1.2 Mobility. Assign a mobility factor value to each hazardous substance for the aquifer being evaluated as follows:

• For any hazardous substance that meets the criteria for an observed release by chemical analysis to one or more squifers underlying the sources at the site, regardless of the aquifer being evaluated, assign a mobility factor value of 1.

• For any hexerdous substance that does not meet the criterie for an observed release by chemical analysis to at least one of the aquifers, assign that hexardous substance a mobility factor value from Table 3-8 for the aquifer being evaluated, based on its water solubility and distribution coefficient (K₄).

 If the hazardous substance cannot be assigned a mobility factor value because data on its water solubility or distribution coefficient are not available, use other hazardous substances for which information is available in evaluating the pathway.

TABLE S-8.---GROUND WATER MOBILITY FACTOR VALUES*

	Distribution coefficient (KJ) (mi/g)					
Water solubility (mg/l)	Kanst ^e	<u>≤10</u>	>10 to 1,000	>1,000		
Present as liquid *	1 0.2 0.002 2x10 ⁻⁵	1 C.2 0.002 2x10 ⁻⁵	0.01 0.01 0.002 2x10 ⁻¹ 2x10 ⁻¹	0.0001 0.0001 2x10 ⁻³ 2x10 ⁻⁷ 2x10 ⁻⁹		

*Do not round to meanest integer

"Use if the hezardous substance is present or deposited as a liquid.

"Use if the entire interval from the source to the equiler being evaluated is karst.

If none of the homodous substances eligible to be evaluated can be essigned a making factor value, use a default value of 0.000 or the mobility factor value for all these

- -Per any hannedous substance that is a motel (or motelloid) and that does not most the criteria for an observed values by chemical analysis, establish a water colubility for the hannedous existence as follows:
 - ---Determine the erroral same of vester solubilities for complements of this hematican solutions: (consider all nce (consider all nde fur which ade r which adequate ly information is -

 - separat and the lowest water exhibitive in this range. ---Use this grantetic mean as the water schelitty in assigning the basenings schelaring a mobility factor value from Table 3-4. --Per any other basenings schelares father meaning or basenings the schelares
 - t may over presidents second to ther expanic or integrals) that doe at most the otherin for an observed

release by chemical analysis, use the weater solubility of that hexardows nce to se im a mobility factor value from Table 3-8 to the hazardons

For the equiler being evaluated, determine the distribution coefficient to be used in Table 3-8 for the hexardous substance as (ala

. For any hazardous substance that does not most the criterie for an observed release by chemical analysis, if the estire interval iron a source at the site to the aquifer being evaluated is karst, use the distribu coefficient category "Karst" in Table 3-8 in antigning the mobility factor value for that hexardons substance for that aquifit: • Otherwise:

- -For any hozardous substance that is a metal (or metalloid) and that does not meet the criteria for an observed release by chemical analysis, use the distantion of a coefficient for the metal or (metalloid) to assign a mobility factor value from Table 3-6 for that heserdous substance.
- For any other inequalic heardow substance that does not meet the criterie for an observed release by chemical analysis, use the distribution coefficient for thet incog besterdous substance, if evaluable, to assign a mobility factor value from Table 3-6. If the distribution coefficient deble, use a default value of is not ave an 10" as the distribution "Jame th coefficient, except: for ashestos une a default value of "greater than 1.000" as the distribution coefficient.
- TABLE 3-0.- TOXICITY/MOBILITY FACTOR VALUES *

- -Per any hasard ce that is 10.00 equate and that does not more a criteria for an observed release by chemical analysis, establish a distribution coefficient for that hemedous substance on follows: is and that does not most the - by Belimate the Kamage for the homodous substance using stance using the following equation: K-=(K_)(f)

 - K_-Sell-weter pertition coefficient for organic carbon for the hexactors substance. L-Serbest centent (fraction of
 - clays plus organic carbon) in the subsurface.
- the subsurface. --Use f, values of 0.00 and 0.77 in the above equation to establish the upper and lower values of the K₄ range for the hazardous substance. --Calculate the geometric mean of the upper and lower K₄ range values. Use this geometric mean as the distribution coefficient in seeigning the hazardous faun Table 3-0.

the hexanious substance a mobility factor value from Table 3-0. 3.2.1.3 Calculation of society/mobility factor value. Assign each hexardows substance a tunicity/mobility factor value from Table 3-0, based on the values assigned to the hexardows substance for the toxicity and mobility factors. Use the hexardows substance with the highest tunicity/mobility factor value for the audior tunicity/mobility factor when for the subfire thing avalanted to assign the value to the toxicity/mobility factor fuel assilts. There this value in in factor for that equilir. Bater th Table 3-1. is velue in

Market Street and an	Toxicity laster value								
	10,000	1,000	100	10	1	0			
1.0 0.2 0.01 0.0000 0.000000	10,000 2,000 100 20 1 0 0,000	1,000 500 10 2 8,1 8,2 2,10-1	160 20 1 6.2 0.01 6.002 2010-1	10 2 0.1 0.00 2:07* 2:10**	1 0.2 0.01 0.002 1x10 ⁻¹ 2x10 ⁻¹	0 0 0 0 0			

*Do not round to nearest integer.

3.2.2 Housedour seast quantity: Assign a boundour vests quantity factor value for the ground water potential (or against) as specified in section 2.4.2. Buter this value in Table 3-1.

Table 3-1. 323 Calculation of wests characteristics factor company value. Moltply the tweicity/ mobility and humanium varies quantity factor values, ashject to a monimum product of 1×10⁹. Based on this product, easign a value from Table 3-7 (acction 2.4.3.1) to the waste characteristics factor company. Inter this makes to table 3-4 volge in Table 3-1.

8.3 Targets. Brahaste the targets factor category for an equifier based on four factors:

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seasest well, population, resources, and Walkand Proto. 102 Ares. Brabaste these four factors based on targets within the target stance limit specified in section \$.0.1.1 and the aquilar boundaries specified in section \$8.1.2. Determine the targets to be included in evaluating these factors for an equifer as specified in section 3.8.

3.3.1 Meanest well in evaluating the searest well factor, include both the drinking star wells drawing from the aquifur being evaluated and these drawing from overlying equifers as specified in section 3.8. Include standby wells in evaluating this factor only If

.

they are used, for drinking water supply at least ance every year. If there is an observed seleces by direct

hourvation for a delaking water well within the target distance limit, and p Level I ations to that well. However, if one or more samples most the criteria for an observed release for that well, determine o H that wall is subject to Lovel I or Lovel II concentrations as specified in sections 2.5.1 and 2.5.2. Use the health-based batchmarks from Table 3-30 in determining the level of

Assign a value for the nearest well factor as follows:

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....

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·. ..

• If one or more drinking water wells is subject to Level I concentrations, assign a value of 50.

 If not, but if one or more drinking water wells is subject to Level II concentrations, assign a value of 45.

 If none of the drinking water wells is subject to Level I or Level II concentrations, assign a value as follows:

- -If one of the target aquifers is a karst aquifer that underlies any portion of the sources at the site and any well draws drinking water from this karst equifer within the target distance limit, assign a value of 20.
- -If not, determine the shortest distance to any drinking water wall, as measured from any source at the site with a ground water containment factor value greater than 0. Select a value from Table 3-11 based on this distance. Assign it as the value for the

nearest well factor. Enter the value assigned to the nearest well

factor in Table 3-1.

- TABLE 3-10.—HEALTH-BASED BENCH-MARKS FOR HAZARDOUS SUBSTANCES IN DRINKING WATER
- Concentration corresponding to Maximum Conterminent Level (MCL).
- Concentration corresponding to a nonzero Madmum Conteminant Level Goal (MCLG).
 Screening concentration for cancer corresponding
- Screening concentration for center corresponding to that concentration that corresponds to the 10⁻⁶ individual cancer risk for one exposures.
 Screening concentration for noncencer toxicologi-
- Screening concentration for noncencer todoological responses conveponding to the Reference Date (RID) for oral explosition.

TABLE 3-11.-NEAREST WELL FACTOR VALUES

Distance from source (rulies)	Assigns
Level I concentrations*	50 45
0 to % Greater than % to % Greater than % to 1	20 18
Greater than 1 to 2 Greater than 2 to 3	5
Greeter then 4	2 0

Distance does not apply.

3.3.2 Population. In evaluating the population factor, include thost remons served by drinking water wells within the target distance limit specified in section 3.9.1.1. For the aquifer being evaluated, count those persons served by wells in that aquifer and those persons served by wells in that aquifer overlying aquifers as specified in section 3.0. Include residents, students, and workers who

regularly use the water. Exclude transient populations such as customers and travelers passing through the area. Evaluate the population based on the location of the water supply wells, not on the location of residences, work places, etc. When a standby well is maintained on a regular basis so that water can be withdrawn, include it in evaluating the population factor. In estimating residential population, when

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located.

In determining the population served by a well, if the water from the wall is blended with other water (for example, water from other ground water wells or surface water intakes), apportion the total population regularly served by the blended system to the well based on the well's relative contribution to the total blended system. In estimating the well's relative contribution, assume each well and intake contribution gaughty end epoprition the population accordingly, except if the relative contribution of any one well or intake exceeds 40 percent based on average annual pumpage or capacity, estimate the relative contribution of the wells and intakes considering the following date, if available:

• Average annual pumpage from the ground water wells and surface water intakes in the blended system.

• Capacities of the wells and intakes in the blended system.

For systems with standby ground water wells or standby surface water intakes, apportion the total population regularly served by the blended system as described above, except:

• Exclude standby surface water intakes in apportioning the population.

• When using pumpage data for a standby ground water well, use average pumpage for the period during which the standby well is used rather than average annual pumpage. • For that portion of the total population

that could be sportioned to a standby ground water well, assign that portion of the population either to that standby well or to the other ground water well(s) and surface water intake(s) that serve that population; do not assign that portion of the population; do not assign that portion of the population; do not assign that portion of the other well(s) and intake(s) in the blended system. Use the apportioning that results in the highest population factor value. (Ether include all standby well(s) or exclude some or all of the standby well(s) as appropriate to obtain this highest value.) Note that the specific standby well(s) included or excluded and, thus, the specific apportioning may vary in evaluating different aquifers and in evaluating the surface water pathway.

3.3.2.1 Level of contamination. Evaluate the population served by water from a point of withdrawal based on the level of contamination for that point of withdrawel. Use the applicable factor: Level I concentrations, Level II concentrations, or potential contamination.

If no samples meet the criteria for an peerved release for a point of withdrawal and there is no observed release by direct observation for that point of withdrawal, evaluate that point of withdrawal using the potential contamination factor in section 3.3.2.4. If there is an observed release by direct observation, use Level II concentrations for that point of withdrawal. However, if one or more samples meet the criteria for an observed release for the point of withdrawal, determine which factor (Level I or Level II concentrations) applies to that point of withdrawal as specified in sections 2.5.1 and 2.5.2. Use the health-based benchmarks from Table 3-10 in determining the level of contamination. Evaluate the point of withdrawal using the Level I concentrations factor in section 3.3.2.2 or the Level II concentrations factor in section 8.3.2.8, as appropriate.

For the potential contamination factor, use population ranges in evaluating the factor as specified in section 3.3.2.4. For the Level I and Level II concentrations factors, use the population estimate, not population ranges, in evaluating both factors.

3.3.2.2 Level / concentrations. Sum the number of people served by drinking water from points of withdrawis subject to Level I concentrations. Multiply this sum by 10. Assign this product as the value for this factor. Enter this value in Table 3-1.

3.3.2.3 Level II concentrations. Sum the number of people served by drinking water from points of withdrawal subject to Level II concentrations. Do not include these people already counted under the Level I. concentrations factor. Assign this sum as the value for this factor. Enter this value in Table 3-1.

3.3.2.4 Potential contamination. Determine the number of people served by drinking water from points of withdrawal subject to potential contamination. Do not include those people already counted under the Level I and Level II concentrations factors.

Assign distance-weighted population values from Table 3-12 to this population as follows:

• Use the "Karst" portion of Table 3-12 to assign values only for that portion of the population served by points of withdrawal that draw drinking water from a karst aquifer that underlies any portion of the sources at the site.

-For this portion of the population, determine the number of people included within each "Karst" distance category in Table 3-12.

		Number of people within the distance category									• "		
Cultures (subger) (subjet)	•	1 8 1	11.83	3 c X	f e f		1,501 10 2,600	A BOIL IN NO.000	19,094 10 39,000				1,900,001 3,000,000
Other These Agent*: O to S		4 2 1 47 45 43	17 11 5 3 2 1	10 38 17 10 7 4		a's z 6 2 8	1,890 1,813 523 294 212 131	6,214 3,335 1,480 350 670 417	16,505 16,122 5,224 2,990 2,122 1,306	82,137 32,385 11,484 4,385 4,778 4,171	101,245 101,213 10,214 20,304 21,222 13,009	SEL200 SEL203 101,005 30,005 67,777 41,700	1,832,455 1,812,122 522,385 283,842 212,219 138,596
Namit* 0 to N		4 2 2 2 2 2	17 11 8 8 8			500 2015 2017 2017 2017	1,815 1,815 1,913 617 617 617 817 817	5,214 3,225 2,407 2,407 2,407 2,407	16,325 14,122 6,163 6,163 6,163 8,163	90,537 52,535 24,685 24,685 24,685 24,685	101,315 101,213 81,835 81,835 81,825 81,823	521,330 381,345 281,345 281,345 281,445 281,445	1,832,455 1,912,122 814,227 814,227 814,227 814,227 814,227

TABLE 3-12 -- DISTANCE WINDING POPULATION VILLIES FOR POPULATION CONTAMINATION FACTOR FOR GROUPS WATER MIGRATION PATHEMAY *

"Read the number of people present while a decases adaptery to essent hanger. Do not court the assigned data-co-weighted peopletion volve to essent

o for all applied, county have applied and applied any parties of the success at the size. It only for family applied and applied any parties of the success at the size.

Antipa a distance excipited population who for each distance estapory based on the number of people indusion within the distance estapory.

 Her the "Other Their Kans" per Table 3-12 for the remainder of the population curved by points of within originst to potential contemination. im of tint.

-Per this parties of the papelation determine the semilar of people included within each "Other The Kanet" distance estapory in Table -Judge, **.** and defense estepary in Table 3-12. May a defense verifiked population the for each distance estepary based in the sumber of piople included defin the distance estepary. en the number

alculate the value for the potential Association factor (PC) as follows:

1 1 (W+K) PC= - 3 30 i=1

.

Clatence weighted population form "Other Than East" perfor of Table 3-12

den İsan

mber el deservi. n ante des.

HPC to have them 1. do not spand it to the moment integer; d'PC to 1 or mans, sound to the nearest integer. Bater this value in Table 2-1.

3323 Calculation of population factor also. Buts the factor values for Lovel 1 ales. Sun the factor values for Lovar i secontrollons, Loval B concentrations, and stantial contanianties. Do not even d this up to the second integer. Assign this sum or is population factor value for the equilier. Inter this value in Table 3-1. 3.3.3 Amounces. To evaluate the

3.3.3 Anoremust to state out. Based on Sactor, asked the bighast value pacified balow that applies for the aquifer sing evaluated. Assign this value as the

seconces factor value for the squifit. Enter this value in Table 3-1.

having a sessence value of 5 if water new from any target well for the squifer ing evaluated or everying equifers (as h being oreclassed or overlying aquiture (or specified in section 3.0) in used for our or more of the following purposes: • Impetion (S-occe minimum;) of

ncial food crups or commercial forage. -

Watering of commercial livestock.
 Ingendiant in commercial feed
separation.

especiales. • Deppig for commercial equaculture. • Deppig for a major or designated water constinue area, analyting detaking water use.

Andge a material value of 5 if no delaking water wells are within the target distance limit, but the water in the inpulier being na in any overlying equilies (as ind in exclict 3.0) is weble for driving r purposes. sign a secondary value of 0 2 none of the

share upplies. 2.3.4 Welland Protection Area. Drobad the Welland Protection Area factor based on Welland Protection Areas designated uses restaction Areas designated up to section \$428 of the Sale Delabit assuming to section 5420 of the Safe Debidag Water Act, as exampled. Consider only these Wallhard Protection Areas applicable to the aquilier be'ry dvaluated ar overlying applics for specified in section 3.0%. Solect the highest value below that applies. Areign R as the value for the Wellhard Protection Area factor for the applier being evaluated. Enter this value to Table 3-5. Areign a sole of the factors of the -

Annya a value of 30 if eith er of the fallowing exteris applies for the squffer being evaluated or everying equifers:

· A source with a ground water minimum factor value groater th en I lie **a**. -her partially or fully, within or above the signated Wellhead Protection Ases. -

 Observed ground water contamination altributable to the sources at the site lies. either partially or felly, within the designated Wellhead Protection Area.

If another criteries applies, gavins a value of S. I. within the target distance limit, there is a designated Welligent Protection Asso is a designated Wellbard Protocom some andiable to the again: being evaluated or

verlying equiliers. Assign a value of 0 if zone of the above pplice.

explice. 32.5 Calculation of targets factor cotypery value. Sum the factor values for memory wall, population, resources, and Wellmad Protection Asso. Do not sound this sum to the memory adaptive the soun as the targets factor category value for the acquite. Bater this value in Table 3-1. 4.4 Commit water minuting score for an

separtize. Bater this value in Table 3-1. 3.4 Ground water migration access for on equific. For the equifier boing evaluated, multiply the factor estagary values for Hallwood of subsee, waste characteristics, and tangets, and sound the product to the second integer. Then divide by 82,000, Assign the second singler. Them divide by 82,000, Assign the second singler, them divide by 82,000, Assign the second singler. Them divide the a matching patheout scale for the second value migration patheout scale for the second value migration occurs in Table 3-1.

3.5 Calculation of ground water migrates relievely access. Calculate a ground water situation access for each against underlying. 2.5 Colombian of ground water migration policy scare. Colombia a ground water migration scare for each aquiler underlying the senices at the site, as appendix score for an signific so the ground water migration score for an signific so the ground water migration score for an signific so the ground water migration score for an signific to the ground water migration score for an signific so the ground water migration score for an signific so the ground water migration score for the second water migration polymery.
 4.0 Surface Water Migration Polymy.
 4.1 Adjustion components. Budants the second value time polymery based on two migration surgestants:
 Oradual/fixed migration to surface water migration (see section 4.1).
 Cound water to surface water migration (see section 4.1).

(see section 4.2). τ.

Brokenie sech component based on the secon three threats disking water threat, human food chair threat, and savitamental threat. Scane one or both components, considering their solutive importance. If only one component is speed, areign its score as the surface water migration pathway accre. If

both components are scored, select the higher of the two scores and assign it as the surface water migration pathway score.

4.0.2 Sutface water categories. For HRS purposes, classify surface water into four categories: rivers, lakes, oceans, and coastal tidal waters.

Rivers include:

· Personnially flowing waters from point of origin to the ocean or to coastal tidal waters, whichever comes first, and wetlands contiguous to these flowing waters. • Aboveground portions of disappearing

river

 Man-made ditches only insofar as they perennially flow into other surface water.

· Intermittently flowing waters and contiguous intermittently flowing ditches only in arid or semiarid areas with less than 20 inches of mean annual precipitation.

Lakes include:

 Natural and man-made lakes (including impoundments) that lie along rivers, but excluding the Great Lakes

· Isolated, but perennial, lakes, ponds, and wetlands.

- • Static water channels or oxbow lakes contiguous to rivers.

 Small rivers, without diking, that merge into surrounding perennially inundated wetlands.

 Wetlands contiguous to water bodies defined here as lakes.

Ocean and ocean-like water bodies include:

 Ocean areas seaward from the baseline of the Territorial Sea. (This baseline represents the generalized coastline of the United States. It is parallel to the seaward limit of the Territorial Sea and other maritim limits such as the inner boundary of Federal. fisheries jurisdiction and the limit of States jurisdiction under the Submerged Lands Act, as amended.)

The Great Lakes.

Wetlands contiguous to the Great Lakes.

Coastal tidal waters include:

 Embayments, harbors, sounds, estuaries, back bays, lagoons, wetlands, etc. seaward from mouths of rivers and landward from the baseline of the Territorial Sea.

4.1 Overland/flood migration component. Use the overland/flood migration component to evaluate surface water threats that result from overland migration of hazardous substances from a source at the site to surface water. Evaluate three types of threats for this component: drinking water threat, human food chain threat, and environmental threat.

General considerations. 4.1.1

4.1.1.1 Definition of hazardous substance migration path for overland/flood migration component. The hezerdous substance migration path includes both the overland segment and the in-water segment that hazardous substances would take as they migrate away from sources at the site:

Begin the overland segment at a sou and proceed downgradient to the probable point of entry to surface water.

 Begin the in-water segment at this probable point of entry.

-For rivers, continue the in-water segment in the direction of flow (including any tidal flows) for the distance established by the target

- distance limit (see section 4.1.1.2). -For lakes, oceans, coastal tidal waters, or Great Lakes, do not consider flow direction. Instead apply the target
- distance limit as an arc. -If the in-water segment includes both rivers and lakes (or oceans, coastal tidal waters, or Great Lakes), apply the target distance limit to their combined in-water segments.

For sites that consist of contaminated sediments with no identified source, the hazardous substance migration path consists solely of the in-water segment specified in lection 4.1.1.2

Consider a site to be in two or more watersheds for this component if two or more hazardous substance migration paths from the sources at the site do not reach a comm point within the target distance limit. If the site is in more than one watershed, define a separate hazardous substance migration path for each watershed. Evaluate the overland/ flood migration component for each watershed separately as specified in section 41.1.2

4.1.1.2 Target distance limit. The target distance limit defines the maximum distance over which targets are considered in evaluating the site. Determine a separate target distance limit for each watershed as follown

· If there is no observed release to surface water in the watershed or if there is an observed release only by direct observation (see section 4.1.2.1.1), begin measuring the target distance limit for the watershed at the probable point of entry to surface water and extend it for 15 miles along the surface water from that point.

If there is an observed release from the site to the surface water in the watershed. that is based on sampling, begin measuring the target distance limit for the watershed at the probable point of entry; extend the target distance limit either for 15 miles along the surface water or to the most distant sample point that meets the criteria for an observed release to that waterahed, whichever is greater.

In evaluating the site, include only surface water targets (for example, intakes, fisheries, sensitive environments) that are within or contiguous to the hazardous substance migration path and located, partially or wholly, at or between the probable point of entry and the target distance limit applicable to the watershed:

• If flow within the hazardous substance migration path is reversed by tides, evaluate upstream targets only if there is documentation that the tidal run could carry substances from the site as far as those upstressa targets.

· Determine whether targets within or contiguous to the hazardous substance migration path are subject to actual or potential contamination as follows

-If a target is located, partially or wholly, either at or between the probable point of entry and any sampling point that meets the criteria for an observed release to the watershed or at a point that meets the criteria for an observed release by direct observation, evaluate

that target as subject to actual contamination, except as otherwise specified for fisheries in section 4.1.3.3 and for wetlands in section 4.1.4.3.1.1. If the actual contamination is based on direct observation, assign Level II to the actual contamination. However, if the actual contamination is based on ples, determine whether the actual contamination is at Level I or Level II concentrations as specified in sections 4.1.2.8, 4.1.8.5, and 4.1.4.3.1

-If a target is located, partially or wholly, within the target distance limit for the watershed, but not at or between the probable point of entry and any sampling point that meets the criteria for an observed release to the watershed, nor at a point that meets the criteria for an observed release by direct observation, evaluate it as subject to potential contamination.

For sites consisting solely of contaminated sediments with no identified source,

determine the target distance limit as follows: • If there is a clearly defined direction of flow for the surface water body (or bodies) containing the contaminated sediments, begin measuring the target distance limit at the point of observed sediment contamination that is farthest upstream (that is, at the location of the farthest available upstrea sediment sample that meets the criteria for an observed release); extend the target distance limit either for 15 miles along the surface water or to the most distant downstream sample point that meets the criteria for an observed release to that

 watershed, whichever is greater.
 If there is no clearly defined direction of flow, begin measuring the target distance limit at the center of the area of observed ediment contamination. Extend the target distance limit as an arc either for 15 miles along the surface water or to the most distant sample point that meets the criteria for an aved release to that watershed, whichever is greater. Determine the area of observed sediment contamination based on available samples that meet the criteria for an observed release

Note that the hazardous substance migration path for these contaminated sediment sites consists solely of the in-water segment defined by the target distance limit; there is no overland segment.

For these contaminated sediment sites, include only those targets (for example, intakes, fisheries, sensitive environments) manes, insumes, sensure environments) that are within or contiguous to the hazardous substance migration path and located, wholly or partially, within the target distance limit for the site. Determine whether these targets are subject to actual or potential contamination as follows:

• If a target is located, partially or wholly, within the area of observed sediment contamination, evaluate it as subject to actual contamination, except as otherwise specified for fisheries in section 4.1.3.3 and wetlands in section 4.1.4.3.1.1.

-If a drinking water target is subject to actual contamination, evaluate it using Level II concentrations.

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procedure. If the site is in only one watarshed, assign a overhand/facel migration across for that retexched as the overhand/facel migration responsent stars for the site.

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Flood Frequency







FIGURE 4-1 ... IRVIEW OF SURFACE WATER OVERLAND/FLOOD HIGRATION COMPONENT

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BILLING CODE 5000-50-C

Pectar categories and lactors	Manhanat Vilian	Value assigned
Bibiling Weinr Threat		-
Uhefbaset of Release:	_	
1. Character Relations by Constant Pro-		·
S. Contemport	10	
	5	·
2. Claimse to Surface Weter	25	
3. Hendel & Balance & Context For (Res 21(2+2.3)	500	
S. Contributed Cheed	10	
Sb. Fixed Program	50	· ·
Sc. Pyterial to Patrone by Plant (less 3x/3k)	500	· ·
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7. Humania Carlos Carlos		
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TABLE 4-1,--SUMPICE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCONEMEET

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If the site is in more than one watershed: • Calculate a separate overland/flood migration component score for each watershed, using likelihood of release, waste characteristics, and targets applicable to sach watershed.

 Select the highest overland/flood migration component score from the watersheds evaluated and saign it as the overland/flood migration component score for the site.

4.1.2 Drinking water throat. Evaluate the drinking water throat for each watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.1.2.1 Drinking water threat-likelihood of release. Evaluate the likelihood of release factor category for each watershed in terms of an observed release factor or a potential torelease factor.

4.1.2.1.1 Observed release. Establish an observed release to surface water for a watershed by demonstrating that the site has released a harardous substance to the surface water in the watershed. Base this demonstration on either.

· Direct observation:

- -A material that contains one or more bazardous substances has been seen entering surface water through migration or is known to have entered surface water through direct deposition, or
- -A source area has been flooded at a time that harardous substances were present; and one or more harardous substances were in contact with the flood waters, or
- -When evidence supports the inference of a release of a material that contains one or more hazardoes substances by the site to surface water, demonstrated adverse effects associated with that release may also be used to establish an observed release.

Chemical analysis:

-Analysis of surface water, benthic, or sediment samples indicates that the concentration of hazardous substance(s) has increased significantly above the background concentration for the site for that type of sample (see section 2.3).

- -Limit comparisons to similar types of samples and background concentrations---for example, compare surface water samples to surface water background
- concentrations.
- For benthic samples, limit comparisons to essentially sessile organisms.
- -Some portion of the significant increase must be attributable to the site to establish the observed release, except: when the site itself consists of contaminated sediments with no
- identified source, no separate attribution is required.

If an observed release can be established for a watershed, assign an observed release factor value of 550 to that watershed, enter this value in Table 4-1, and proceed to section 4.1.2.1.3. If no observed release can be established for the watershed, assign an observed release factor value of 0 to that watershed, enter this value in Table 4-1, and proceed to section 4.1.2.1.2.

4.1.2.1.2 Potential to release. Evaluate potential to release only if an observed release cannot be established for the watershed. Evaluate potential to release based on two components: potential to release by overland flow (see section 4.1.2.1.2.1) and potential to release by flood (see section 4.1.2.1.2.2). Sum the values for these two components to obtain the potential to release factor value for the watershed, subject to a maximum value of 500.

4.1.2.1.2.1 Potential to release by overland flow. Evaluate potential to release by overland flow for the watershed based on three factors: containment, runoff, and distance to surface water.

Assign potential to release by overland flow a value of 0 for the watershed if: • No overland segment of the hazardous

 No overland segment of the hazardous substance migration path can be defined for the watershed, or

• The overland segment of the hazardous substance migration path for the watershed exceeds 2 miles before surface water is encountered. If either condition applies, enter a value of 0 in Table 4-1 and proceed to section 4.1.2.1.2.2 to evaluate potential to release by flood. If neither applies, proceed to section 4.1.2.1.2.1.1 to evaluate potential to release by overland flow.

4.1.2.1.2.1.1 Containment. Determine the containment factor value for the watershed as follows:

• If one or more sources is located in surface water in the watershed (for example, intact sealed drums in surface water), assign the containment factor a value of 10 for the watershed. Enter this value in Table 4-1.

• If none of the sources is located in surface water in the watershed, assign a containment factor value from Table 4-2 to each source at the site that can potentially release hazardous substances to the hazardous substance migration path for this watershed. Assign the containment factor value for the watershed as follows:

- -Select the highest containment factor value assigned to those sources that meet the minimum size requirement described below. Assign this highest value as the containment factor value for the waterabed. Enter this value in Table 4-1.
- -If, for this waterabed, no source at the site meets the minimum size requirement, then select the highest containment factor value sesigned to the sources at the site eligible to be evaluated for this waterabed and assign it as the containment factor value for the waterabed. Enter this value in Table 4-2.

A source meets the minimum size requirement if its source hazardous waste quantity value (see section 2.4.2.1.5) is 0.5 or more. Do not include the minimum size requirement in evaluating any other factor of this surface water migration component,

except potential to release by flood as specified in section 4.1.2.1.2.2.3.

4.1.2.1.2.1.2 Runoff. Evaluate runoff based on three components: rainfall, drainage area, and soil group.

TABLE 4-2.--CONTAINMENT FACTOR VALUES FOR SURFACE WATER MIGRATION PATHWAY

80uroe	Assigned value
An automatic sectory contact impoundments, Line Presenter, Conditionary, and Lances	10 .
No evidence of hazardous substance-migration from source area erat	
(a) Neither of the following present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system.	10
(b) Any one of the two items in (a) present	9
(c) Any two of the following present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system, or (3) liner with functioning leachate collection and removal system immediately above liner.	7
(d) All items to (c) present	5
(e) All heres in (c) present, plus no bulk or non-containentzed liquids nor materials containing free liquids deposited in source area. No evidence of hazardous substance migration from source area, double liner with functioning teachate collection and vemoval system above and between finers, and:	3
(I) Only one of the following deficiencies present in containment; (1) bulk or noncontainentzed liquids or materials, containing free liquids deposited in source area; or (2) no or nonfunctioning or nonmaintained num-on control system and nunoff management system, or (3) no or nonfunctioning or nonmaintained engineerad cover.	3
(g) None of the deficiencies in (f) present	0
Source area inside or under maintained intact structure that provides protection from pracipitation so that makter runoff nor leachate is	1. 1 ^m - 1

THELE 4-E -- CONTAINMENT FACTOR VALUES FOR SURFACE WATER MIGRATION PATIENTY-CONCIDENT

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substates is lastly or distanting contained business to containers in good container, and containers pasted except when	
(c) From Rights present, containment system tess sufficient capacity to total total volume of all containers and to provide advante	5
factored, and state for your contains area with functioning inspirate collector and entered system below flux."	•
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(a) Tank and analisy applycant provided with accurdary containment (s.g. five under test area, weak system, daughe-well) with test.	. 7
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for at least 20 years. If such site-specific data map. Us not round the rainfall values are not available, estimate the 2-year, 26-hour measurt integer, sainfall for the site from a rainfall-frequency

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Drainage area. Determine the drainage area for the sources at the site. Include in this drainage area both the sources areas and the area upgradient of the sources, but exclude any portion of this drainage area for which runoff is diverted from entering the sources by storm sewers or run-on control and/or runoff management systems. Assign a drainage area value for the watershed from Table 4-3.

Soil group. Based on the predominant soil group within the drainage area described above, assign a soil group designation for the watershed from Table 4-4 as follows:

Select the predominant soil group as that type which comprises the largest total area within the applicable drainage area.
If a predominant soil group cannot be

 If a predominant soil group cannot be delineated, select that soil group in the drainage area that yields the highest value for the runoff factor.

Calculation of runoff factor value. Assign a combined rainfall/runoff values for the waterabed from Table 4-5, based on the 2year, 24-hour rainfall and the soil group designation. Determine the runoff factor value for the waterabed from Table 4-6, based on the rainfall/runoff and drainage area values. Enter the runoff factor value in Table 4-1.

TABLE 4-3.-DRAINAGE AREA VALUES

Drainage area (acres)	Assigned value
Less then 50	1 2 3 4

TABLE 4-4.-SOIL GROUP DESIGNATIONS

Surface soli description	Soll grou designation
Coarse-textured solls with high infli- tration rates (for example, sands, hourse eards)	•
Medium-textured solis with moderate initiation rates (for example, sandt loarse, instac)	B
Moderately fine-textured sole with low infiltration rates (for example, ally infiltration rates (for example,	C
Fine-textured soils with very low initi- tration rates (for example, clays, sendy clays, elly clay loans, clays, loans, elly clay (or impermettie surfactis (for example, pevement).	D

TABLE 4-5.--RAINFALL/RUNOFF VALUES

2-Yeer, 24-hour rainfail	Soil group designation							
(inches)	À	B	C	D				
Less then 1.0	0001223	0122334	2239445	384458				

TABLE 4-8 FUNOFF FACTOR VALL	JE S
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Drainage	Rainfall/runoff value									
Value	D	1	2	3	4	5	0			
1 2 3 4	0 0 0 0	0 0 0 1	0 1 1 2	1 1 3 7	1 2 7 17	1 3 11 25	1 4 15 25			

4.1.2.1.2.1.3 Distance to surface water. Evaluate the distance, along the overland segment, from any source with a surface water containment factor value greater than 0 to either the mean high water level for tidal waters or the mean water level for other surface waters. Based on this distance, assign a value from Table 4–7 to the distance to surface water factor for the watershed. Enter this value in Table 4–1.

4.1.2.1.2.1.4 Calculation of factor value for potential to release by overland flow. Sum the factor values for runoff and distance to surface water for the watershed and multiply this sum by the factor value for containment. Assign the resulting product as the factor value for potential to release by overland flow for the watershed. Enter this value in Table 4-1.

4.1.2.1.2.2 Potential to release by flood. Evaluate potential to release by flood for each watershed as the product of two factors: containment (flood) and flood frequency. Evaluate potential to release by flood separately for each source that is within the watershed. Purthermore, for each source, evaluate potential to release by flood separately for each category of floodplain in which the source lies. (See section 4.1.2.1.2.2.2 for the applicable floodplain categories.) Calculate the value for the potential to release by flood factor as specified in 4.1.2.1.2.2.3.

4.1.2.1.2.2.1 Containment (flood). For each source within the waterahed, separately evaluate the containment (flood) factor for each category of floodplain in which the source is partially or wholly located. Assign a containment (flood) factor value from Table 4-8 to each floodplain category applicable to that source. Assign a containment (flood) factor value of 0 to each floodplain category in which the source does not lie.

4.1.2.1.2.2.2 Flood frequency. For each source within the watershed, separately evaluats the flood frequency factor for each category of floodplain in which the source is partially or wholly located. Assign a flood frequency factor value from Table 4-8 to each floodplain category in which the source is located.

4.1.2.1.2.2.3 Calculation of factor value for potential to release by flood. For each source within the watershed and for each category of floodplain in which the source is partially or wholly located, calculate a separate potential to release by flood factor value. Calculate this value as the product of the containment (flood) value and the flood frequency value applicable to the source for the floodplain category. Select the highest value calculated for those sources that meet the minimum size requirement specified in section 4.1.2.1.2.1.1 and assign it as the value for the potential to release by flood factor for the watershed. However, if, for this watershed, no source at the site meets the minimum size requirement, select the highest value calculated for the sources at the site eligible to be evaluated for this watershed and assign it as the value for this factor.

TABLE 4-7.--DISTANCE TO SURFACE WATER FACTOR VALUES

Distance	Assigned value
Lose then 100 feet	25 20 16 9 6 3

TABLE 4-8.--CONTAINMENT (FLOOD) FACTOR VALUES

Containment ortieria	Assigned Value
Documentation that containment at the source is designed, construct- ed, operated, and maintained to prevent a washout of hazardous substances by the flood being eval-	0
Other	10

TABLE 4-9.—FLOOD FREQUENCY FACTOR VALUES

Floodplain category	Assigned Value
Source floods annually	50 50 25 7

Enter this highest potential to release by flood factor value for the waterahed in Table 4-1, as well as the values for containment (flood) and flood frequency that yield this highest value.

4.1.2.1.2.3 Calculation of potential to release factor value. Sum the factor values assigned to the watershed for potential to release by overland flow and potential to release by flood. Assign this sum as the potential to release factor value for the watershed, subject to a maximum value of 500. Enter this value in Table 4-1.

4.1.2.1.3 Calculation of drinking water threat-likelihood of release factor category value. If an observed release is established for the watershed, assign the observed release factor value of 550 as the likelihood of release factor category value for that watershed. Otherwise, assign the potential to release factor value for that watershed as the likelihood of release factor category value for that watershed. Enter the value assigned in Table 4-1.

4.1.2.2 Drinking water threat-waste characteristics. Evaluate the waste characteristics factor category for each

ntended based as two factors: testicity/ tes and h basedone weste quanti personanti una successive adutte Destante estruture la segunte form de s et de sta to ménes mater in de mate via de confisiel florai becartere sob on the s ious automore via in organization and a sector of the sect

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· All happeleus substances accepted complement factor when geneter then 8 for the protoched fore sections 222, 223. 4121211 md 4121223).

heativities substance, and p a topicity factor value, a participant factor value, and a combined topicity/passistance factor value as specified in sociations 4.1.2.2.1.3 through 4.1.2.2.1.3. Solect the toxicity/persistance factor value for the toxicity/persistance star value at 412211

ordien 4.1.2.2.1.3. 4.1.2.2.1.1 Texricity: Assign a tenticity actor value to each innervious substance as perfiled in section 24.1.1. 4.1.2.2.1.2 Assistance. Assign a societance factor value to each insurations shotness. In assigning this value, evolution statistance based primerily on the half-life of to insurations aborates in autients weber and accountable on the accounting of the notions and believes in automatics water reducting on the exception of the notarily on the exception of the no substance to sectiments. The half-effects water is defined for 1905 the beau ł s ilio in sudi s at the time required to reduce the -tial conce propriets as the life required to reduce the initial concentration in surface water by one-half as a senit of the combined decay processes of biodegendation, hydrolynis, photolynis, and whetHastion. Surption to

ated for the 1965 based on to is evel garithm of the p-octanol-water pertition the la coefficient (log K_) of the hazardous ----

Estimate the half-life (1, 1) of a hazardous hotance as follows: اليو

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h-Hydrahysis half-life. b-Wedegradsticn half-life. p-Photolysis half-life. v-Velati8zation half-life.

If one or more of these last com half-lives cannot be estimated for the hannel no substante from available data. delete that component helf-life from the above equation. If none of these four spenent half lives can be estimated for the median ashetance from evallable data. use the default procedure indicated below. Estimate a holf-life for the housedows and and nce for lakes or for rivers, oceans, constal tidal waters, and Great Lakes, as 80

If a half-life can be estimated for a terdono substance: Anaiga that becards 1

• A te substance a passistence factor value from the appropriate perties of Table 4-30 (that is lakes: or rivers, ms, constal tidal waters, and Great econa. Lahasi.

TABLE 4-10.-PERBISTERICE FACTOR VALUES-HALF-LIFE

· Select the appropriate parties of Table 4-10 as fallener.

- -U there is one or more detailing wets intaking along the hannedrost substa-migration path for the watershed, subset the namest delaking water intake an account of from the pathol sist of entry. If the in-water argument strange the probable point of entry of this subsciel intake includes both and this sale this was associate means means account labor and other works belies, use the labor perties of Table 4-30 only if more than half the distance to this selected intake lies to inhole). herwise, one the rivers, econor, astal tight waters, and Great Lakes Other perties of Table 4-10. Per ands with no ind sold identified services, use the point where measurement bajos (see section 4.1.1.2) rether than the probable point
- ef entry. -If there are no disking water intakes I best dre 20 octaning minut annan bet flere ern jetelles er pointe of ere fir any of the neuence types loted in section 41.2.3.3, select the meanert soch escans 6.1.2.3.3, select the measured a latake or point of use. Select the portion of Table 4-30 based on this intuke or maket of one in the
- perfuse of Table 4-30 based on this induce or point of one in the morener specified for drinking water intoles. -If there are no drinking water intoles and no specified resource intoles and points of use, but there is another type of resource intole in section 4.1.2.3.3 of resource listed is section 4.1.2.3.3 (is example, the voter is woble for disking voter purposes even though not used), select the partice of Table 4-10 based on the nonrest point of this resource in the moment specified for drinking water intakes.

Bellaro valor category	Substance half the (days)	Assigned vitre	
Planes, ecourt, exacted tidd votion, and Grout Labors	Less Res or opini to 0.2	0.0007 0.07 0.4 1	
	Loss then or equal to 0.02	6.0007 6.67 6.4 1	

*Do not round to respect integer.

If a half-life cannot be estimated for a andem sebetante frem available data, me the following default procedure to easign a persistence factor value to that hazardous

· For these beautious substances that are stale (ar partallaide), easign a purcletence other value of 1 as a definit for all surface 101 ctat value of t

· Per other hausedous enhoteness forth For other transmiss substances (joth experies and transmis), assign a persistence former value of 0.4 as a default for rivers, consum, constal tidal vesters, and Grout Labos, and a persistence factor value of 0.67 as a default for labos. Subject the appropriate value in the same summer specified for using Table 4 as Table 4-20.

Use the peculatance factor value assigns base " on helf-life or the default procedure unless the henerdous substance can be assigned a higher factor value from Table 4-11, based on its log K... If a higher value can be assigned from Table 4-11, assign this higher value as the passistence factor value for the hazardons substance.

TABLE 4-11.--PERBISTENCE FACTOR VALLES-LOG K....

Log K	
Com theo 15	0.0007
15 to loss theo 4.9	9.07
49 to 45	9.4

TABLE 4-11 .- PERMISTENCE FACTOR VALUES-LOG K_--Concluded

	-	Log K.,	 Annopued Vision *
-	ater the	.45	,

·Use for taken, doon, contra, n, countril titul

412213 Colculation of Innicity/ paraistence factor valos. Assign each hazardous substance a taxicity/paraistence factor value from Table 4-12, based on the values assigned to the honordous substance for the toxicity and pensistence factors. Use

the hazardous substance with the highest toxicity/persistance factor value for the waterahed to assign the toxicity/persistance factor value for the drinking water throat for the watershed. Enter this value in Table 4-1. 41222 Hazardous waste quantity. Assign a hazardous waste quantity factor

value for the waterahed as specified in

section 2.4.2. Enter this value in Table 4-1. 41223 Calculation of drinking water threat-waste characteristics factor category value. Multiply the toxicity/persistence an hazardous waste quantity factor values for the watershed, subject to a maximum product of 1 x 10⁴. Bused on this product, assign a value from Table 2-7 (section 2.4.3.1) to the drinking water threat-waste characteristics factor category for the watershed. Enter this value in Table 4-1.

TABLE 4-12 .-- TOXICITY/PERSISTENCE FACTOR VALUES*

	Toxicity factor value						
	.10,000	1,000	100	10	1	0	
1.0	10,000 4,000 700 7	1,009 400 70 0.7	100 40 7 0.07	10 4 0.7 0.007	1 0.4 0.07 0.0007	0 0 0 0	

*Do not round to meanest integer.

4.1.2.3 Drinking water threat-targets. Evaluate the targets factor category for each waterabed based on three factors: scarest

values of the second of the second se target surface water intakes are subject to actual or potential contamination as specified in section 4.1.1.2. Use either an observe ue based on direct observation at the rel intake or the exposure concentrations from samples (or comparable samples) takes at or beyond the intake to make this determination (see section 41.2.1.1). The expe concentrations for a sample (that is, surface water, benthic, or sediment sample) consist of the concentrations of these hexardous substances present that are significantly above background levels and attributable at least is part to the site (that is, those meet the citize is subject to active the second sec

en an inteke is subject to actual minetion, evaluate it using Level I-

concentrations or Level II concentrations. If the actual contamination is based on an observed release by direct observation, use Level II concentrations for that intake. However, if the actual contamination is based on an observed release from samples. determine which level applies for the intake by comparing the exposure concentrations from samples (or comparable samples) to health-based benchmarks as specified in sections 2.5.1 and 2.5.2. Use the health-base enchmerks from Table 8-10 (section 3.3.1) in determining the level of contamination from samples. For contaminated sediments with no identified source, evaluate the actual contamination using Level II concentrations [see section 4.1.1.2].

4.1.2.3.1 Nearest intake. Evaluate the nearest intake factor based on the drinking water intakes along the overland/flood hezardous sobstance migration path for the waterabed. Include standby inteless in evaluating this factor only if they are used if evaluating this factor only if they are used for supply at least once a year.

Assign the nearest intake factor a value as follows and enter the value in Table 4-1:

 If one or more of these drinking water intakes is subject to Lovel I concentrations as specified in section 4.1.2.3, assign a factor value of 50.

· If not, but if one or more of the drinking water intakes is subject to Lovel II concentrations, assign a factor value of 45. • If none of these drinking water intakes is

subject to Level I or Level II concentrations. mine the nearest of these drinking water intakes, as measured from the probable point of entry (or from the point where measurement begins for contaminated sediments with no identified source). Assign a dilution weight from Table 4-13 to this intake, based on the type of surface water body in which it is located. Multiply this dilution weight by 20, round the product to the nearest integer, and assign it as the factor value.

Assign the dilution weight from Table 4-13 as follows:

TABLE 4-13.--SURFACE WATER DILUTION WEIGHTS

Type of austace water body *					
Descriptor	Flow characteristics	weight *			
Minimal stream Minimal stream Moderate stream Moderate to large stream Large stream to fiver Large stream to fiver Large stream Coastal tidal waters 4 Straffow cosen zone' or Great Lake Moderate depth ocean zone ' or Great Lake Straffow cosen zone ' or Great Lake Straffow cosen zone ' or Great Lake	Less than 10 cts 4 To te 100 cts 4 Greater than 1000 to 1,000 cts Greater than 1,000 to 100,000 cts Greater than 10,000 to 100,000 cts Greater than 10,000 cts Greater than 10,000 cts Flow not applicable, depth not applicable. Flow not applicable, depth greater than 20 feet Flow not applicable, depth greater than 200 feet To cts or greater 10 cts or greater	1 0.01 0.001 0.0001 0.0001 0.0001 0.00001 0.00005 0.5			

Treat each take as a separate type of water body and easign a diution weight as specified in text.

Treat each lake as a separam type or news owny and any inclusion of the second to many and the second.
 To sol cound to nearest integer.
 To solve the second.
 To solve the second limit of the Territorial Sea and the limit of States jurisdiction under the Submerged Lands Act, as amended.

· For a river (that is, surface water body types specified in Table 4-13 as minimal stream through very large river), assign a dilution weight based on the average annual flow in the river at the intake. If available,

use the average annual discharge as defined in the U.S. Geological Survey Water **Resources Data Annual Report. Otherwise,** estimate the average annual flow.

· For a lake, assign a dilution weight as follows:

-For a lake that has surface water flow entering the lake, assign a dilution weight based on the sum of the

۰.

arage annual flows for the owners due holine extering the lake up to a point of the intake. in p

- er penn er une angen. 17 a lake that has ge suzface wet leve entering, but that does have unface water flow leaving, assign
- flow entropy, but that does have entropy water flow lasving, andge a dilation weight based on the sam of the average entropy flows for the surface water bodies beaving the labe. For a closed labe (that in, a labe without mathem water flow anisoing or lasving anign a dilation weight based on the average entropy provide these flow into the labe. If aveilable, using the delater weight for the corresponding river flow rate in Table 4-53. If not available, andge a distant distion weight of 1. ig they for

Per the occurs and the Great Labor.
 rigs a disting weight based on dupt.
 Per constal tidal wears, assign a dilution of 0.0000; do not cansidar dapth or

Per a quist-flowing close that has average sensed flow of 20 orbits fast per second (cfs) or greater and that contains the probable point of eatry to orderse voter, apply a sense of mixing in assigning the dilation weight:

- et the same of mixing at the prob-dat of entry and actual it for 3 a na the probable point of entry. mapt if the author water ad it far 3 mile herectadolles change to tarba tible this 3-pile distance, ex nos, extend the nee of subley only to the point of which the change estawn. mign a disting veryight of 0.5 to on state that has which this some of
- minime. -Depend this same of picture, series a distance verifie the same on for any other three (that is, assign the distance verifiet based on a series account for -Dead a quint-flowing three with an everyon examplifier of lase than 10 the series on our other than the al Seet.
- ge annual floor of loss than 10 me as any other slour (that in, n it a dilation weight of 1). n 19 de essign it a di

an enter where water flows here a n Gase cases where weier flows form a suffere weter heaty with a lower assigned listen weight flow. Table 4-23) to a surfact weight (that is, weter flows from a surfact regist (that is, weter flows from a surface mater body with more dilution to one with see dilution), use the lower assigned dilution regist as the dilution weight for the latter Zen unter body.

4.1.2.3.3 Papalation in evaluating the population factor, include only persons served by detaking water drawn from inte that are along the overland/flood hazardou substance substance path for the watershed and that are within the target distance limit stified in section 4.1.1.2. Include residents students, and workers who regularly use the weter. Exclude transient populations such as customers and travelers passing through the ares. When a standby intake is maintained on a regular besis so that water can be withdrawn, include it in evaluating the elation factor.

in estimate is based on the number of ices, multiply each residence by the wage sumber of persons per residence for a county in which the residence is located. 4a

la estiin estimating the population served by an ake, if the water from the intake is blends with other water (for example, water from for intakes or ground water the total population wells), appartion the total population wells), appartion the total population a surface we regularly served by the blanded syst intake based on the intake's relative ution to the total blended syste m. 1e sting the intake's relative contribution. ch well or intake contribute e už ally and apportion the population andingly, except if the relative accordingly, except: if the relative contribution of any one intake or well exceeds 40 percent based on average as page or capacity, estimate the relative ribution of the wells and intakes constriksidering the following data, if available: **CM**

Average annual pumpage from the round weige wells and surface water intakes

- --- unsued system. • Capacities of the wells and intakes in the blanded system.

For systems with standby surface value intuines or standby ground water wells, appurties the total population regularly served by the blended system as described above, et

above, except: • Exclude standby ground water wells in apparticing the population. • When using pumpage data for a standby excluse water intake, one average pumpage for the parted during which the standby intake is used softer than average assured

For that parties of the total population that could be appartiened to a standby surface water inteles, assign that portion of

the population officer to that standby intake or to the other surface water intake(s) and ground water well(s) that serve that population; do not assign that portion of the population both to the standby intake and to the other intake(s) and well(s) in the blatched system. Use the apportioning that results in the highest population factor value. (Either include all standby intake(s) as appropriate to obtain this highest value.) Note that the specific standby intake(s) as appropriate to obtain this highest value.) Note that the specific standby intake(s) included or excluded and, thus, the specific apportioning may very in evaluating different watersheds and in evaluating the ground water pathway. 412321 Lovel of contamination. Bruhasts the population factor based on three factors: Lovel II concentrations, Level II concentrations.

accuse Loven a concentrations, Lovel II conceptriffers, and potential contamination. Determine which factor applies for an intake as specified in section 4.1.2.3. Evaluate intake as a specified in section 4.1.2.3. s subject to Level I concentration as manas respect to Lavel 1 concettration es specified in section 4.1.2.3.2.2, intakes subject to Lavel II concentration as specified in section 4.1.2.3.2.3, and intakes subject to ination as specified in Antial contam atim 412324

Per the potential cont untion factor, per For the personne communication matching population ranges in evaluating the factor as specified in section 4.1.2.1.2.4. For the Level I and Level II concustorians factors, us the tion estimate, not population ranges, in insting both factors.

412322 Level | concentrations. Som the sumber of people served by drinking weter from intuities subject to Level I concentrations. Multiply this run by 10. Anoign this product as the value for this factor. Bater this value in Table 4-1.

412323 Level I cancer inee S the sumber of people served by deinking water from Intaine subject to Lovel II concentrations. Do not include people about country while the Level I concentrations factor. Assign this own as the value for this factor. Rater this value in Table A-3

4.1.2.3.2.4 Potential contamination. For each applicable type of surface water body in Table 4-14, first determine the number of Table 4-16, list enverse us summer a people served by detaking water from intakes subject to potential contamination in that type of people already counted under the Level I and Level II concentrations factors. Includes CORE and the In-

ENGLA

	· .		•		Number of	People	2 - 1 - 1 - 1 1 - 1 - 1 - 1		
Type of Surface Water Body ^b	O	1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000
Minimal stream (< 10 cfs)	0	4	17	53	164	522	1,633	5,214	16,325
Small to moderate stream (10 to 100 cfs)	0	0.4	2	5	16	52	163	521	1,633
Moderate to large stream (> 100 to 1,000 cfs)	0	0.04	0.2	0.5	2	5	16	52	163
Large stream to riv r (> 1,000 to 10,000 cfs)	 0.	0.004	0.02	0,05. ·	0.2	0.5	2	5	16
Large river (> 10,000 to 100,000 cfs)	0	Ő '	0.002	0.005	0.02	0.05	0.2	0.5	2
Very large river (> 100,000 cfs)	0	° Ó	0	0.001	0.002	0.005	0.02	0.05	0.2
Shallow ocean zone or Great Lake (depth < 20 feet)	0	0	. 0.002	0.005	0.02	0.05	0.2	0.5	2
Moderate ocean zone or Great Lake (depth 20 to 200 feet)	0	0	0	0.001	0.002	0.005	0.02	0.05	0.2
Deep ocean zone or Great Lakes (depth > 200 feet)	·0 .	0	. 0	0	0.001	0.003	0.008	0.03	0.08
3-mile mixing zone in quiet flowing river (2 10 cfs)	.0	2	9	26	82	261	817	2,607	8,163

TABLE 4-14 DILUTION-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FACTOR FOR SURFACE WATER MIGRATION PATHWA

· · · · · · · · · · · · · · · · · · ·				<u> </u>	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1					
	Number of Feòple									
Type of Surface Water Body ^b	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,001 to 3,000,000	3,000,001 to 10,000,000					
Minimel stream (< 10 cfs)	52,137	163,246	521,360	1,632,455	5,213,590					
Small to moderate stream (10 to 100 cfs)	5,214	16,325	52,136	163,245	521,359					
Moderate to large stream (> 100 to 1,000 c(#)	521	1,633	5,214	16,325	52,136					
Large stream to river (> 1,000 to 10,000 cfs)	52	163	521	1,632	5,214					
Large river (> 10,000 to 100,000 cfs)	5	16	52	163	521					
Very large river (> 100,000 cfs)	0.5	2	5	. 16	52					
Shallow ocean zone or Great Lake (depth < 20 feet)	5	16	52	163	521					
Moderate ocean zone or Great Lake (depth 20 to 200 feet)	0.5	. 2	5	16	52					
Deep zone or Great Lake (depth > 200 feet)	0.3	. 1	3	8	26					
3-mile mixing zone in quiet flowing river (2 10 ofs)	26,068	81,623	260,680	816,227	2,606,795					

TABLE 4-14 (Concluded).

^dRound the number of people to nearest integer. Do not round the assigned dilutionveighted population value to nearest integer.

^bTreat each lake as a separate type of water body and assign it a dilution-weighted population value using the surface water body type with the same dilution weight from Table 4-13 as the lake. If drinking water is withdrawn from coastal tidal water or the ocean, assign a dilution-weighted population value to it using the surface water body type with the same dilution weight from Table 4-13 as the coastal tidal water or the ocean zone.

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For each type of surface water body, assign a dilution-weighted population value from Table 4-14, based on the number of people included for that type of surface water body. (Note that the dilution-weighted population values in Table 4-14 incorporate the dilution weights from Table 4-13. Do not multiply the values from Table 4-14 by these dilution weights.)

Calculate the value for the potential contamination factor (PC) for the watershed as follows:

$$PC = \frac{1}{10} \sum_{i=1}^{n} W_i$$

where:

W₁=Dilution-weighted population from Table 4-14 for surface water body type i. n=Number of different surface water body

types in the watershed.

If PC is less than 1, do not round it to the nearest integer; if PC is 1 or more, round to the nearest integer. Enter this value for the potential contamination factor in Table 4-1

4.1.2.3.2.5 Calculation of population factor value. Sum the factor values for Level I concentrations, Level II concentrations, and potential contamination. Do not round this sum to the nearest integer. Assign this sum as the population factor value for the watershed. Enter this value in Table 4-1.

4.1.2.3.3 Resources. To evaluate the resources factor for the watershed, select the highest value below that applies to the watershed. Assign this value as the resources factor value for the watershed. Enter this value in Table 4-1.

Assign a value of 5 if, within the in-water segment of the hazardous substance migration path for the watershed, the surface water is used for one or more of the following ourpo

 Irrigation (5 acre minimum) of commercial food crops or commercial forage crops

Watering of commercial livestock. Ingredient in commercial food

preparation.

• Major or designated water recreation area, excluding drinking water use. Assign a value of 5 if, within the in-water

egment of the hazardous substance migration path for the watershed, the surface water is not used for drinking water, but either of the following applies: • Any portion of the surface water is

designated by a State for drinking water use under section 305(a) of the Clean Water Act. as amended.

 Any portion of the surface water is usable for drinking water purposes.

Assign a value of 0 if none of the above applies.

4.1.2.3.4 Calculation of drinking water threat-targets factor category value. Sum the nearest intake, population, and resources factor values for the watershed. Do not round this sum to the nearest integer. Assign this sum as the drinking water threat-targets factor category value for the watershed. Enter this value in Table 4-1.

4.1.2.4 Calculation of the drinking water threat score for a watershed. Multiply the

drinking water threat factor category values for likelihood of release, waste characteristics, and targets for the watershed, and round the product to the nearest integer. Then divide by 82,500. Assign the resulting value, subject to a maximum of 100, as the drinking water threat score for the watershed. Enter this value in Table 4-1.

4.1.3 Human food chain threat. Evaluate the human food chain threat for each watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.1.3.1 Human food chain threat-likelihood of release. Assign the same likelihood of release factor category value for the human food chain threat for the watershed as would be assigned in section 1.1.2.1.3 for the drinking water threat. Enter this value in Table 4-1. 4.1.3.2 Human food chain threat-waste

characteristics. Evaluate the waste characteristics factor category for each watershed based on two factors: toxicity/ persistence/bloaccumulation and hazardous

waste quantity. 4.1.3.2.1 Toxicity/persistence/ biooccumulation. Evaluate all those bazardous substances eligible to be evaluated for toxicity/persistence in the drinking water threat for the watershed (see section 4.1.2.2). 4.1.3.2.1.1 Toxicity. Assign a toxicity

factor value to each hazardous substance as specified in section 2.4.1.1. 4.1.3.2.1.2 Persistence. Assign a

persistence factor value to each hazardous substance as specified for the drinking water threat (see section 4.1.2.2.1.2), except: use the predominant water category (that is, lakes; or rivers, oceans, coastal tidal waters, or Great Lakes) between the probable point of entry and the nearest fishery (not the nearest drinking water or resources intake) along the hazardous substance migration path for the watershed to determine which portion of Table 4-10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.2.1.2. For contaminated sediments with no identified source, use the point where measurement begins rather than the probable point of entry.

4.1.3.2.1.3 Bioaccumulation potential. Use the following data hierarchy to assign a bioaccumulation potential factor value to each hazardous substance:

 Bioconcentration factor (BCF) data. Logarithm of the n-octanol-water

partition coefficient (log Kee) data. · Water solubility data.

Assign a bioaccumulation potential factor value to each hazardous substance from Table 4-15.

If BCF data are available for any aquatic human food chain organism for the substance being evaluated, assign the bioaccumulation potential factor value to the hazardous substance as follows:

 If BCF data are available for both fresh water and salt water for the hazardous substance, use the BCF data that correspond to the type of water body (that is, fresh water or salt water) in which the fisheries are located to assign the bioaccumulation potential factor value to the hazardous substance.

 If, however, some of the fisheries being evaluated are in fresh water and some are in salt water, or if any are in brackish water. use the BCF data that yield the higher factor value to assign the bioeccumulation potential factor value to the hazardous substance.

 If BCF data are available for either fresh water or salt water, but not for both, use the available BCF data to assign the bioaccumulation potential factor value to the hazardous substance.

If BCF data are not available for the hazardous substance, use log Kar data to assign a bioaccumulation potential factor value to organic substances, but not to inorganic substances. If BCF data are not available, and if either log Kee data are not available, the log K_ is available but exceeds 6.0, or the substance is an inorganic substance, use water solubility data to assign a bioaccumulation potential factor value.

TABLE 4-15 .- BIOACCUMULATION POTENTIAL FACTOR VALUES *

If bioconcentration factor (BCF) data are available for any squatic human food chain organism, assign a value as follows: *

BCF	Assigned value
Greater than or equal to 10,000	50,000 5,000 500
10 to less than 100	50 5 0.5

If BCF data are not available, and log K data are available and do not exceed 6.8, assign a value to an organic hazardous substance as follows (for inorganic hazardous substances, skip this step and proceed to the next):

180 8
00
0
)
ι.

If BCF data are not available, and if either Log Kew data are not available, a log Kew is available but exceeds 6.8, or the substance is an inorganic substance, assign a value as followic

TABLE 4-15.-BIOACCUMULATION POINTING FACTOR VALUES ----Concluded

Webs scheliky (mg/l)	
Les 04 8	
27 10 117 Creatur thus 200 to 1,000 Candar thus 1,000	

I none of the Alls, Taxalget & in an a

· Do out grand to another lat -اده ال

not distinguish between firsh water and water in analysing the bisascentralistics which factor value based on log K__ or resolutily data. wate of these data second De pat d àt a

1 nce a biones lí 20 lo 1 ALLELA Colori

des factor value. detance a toxicity/ run Table 4-12, ped to the ch hanna us subs . • - 6 n de s dely a a far the t ... a. 11 a fi and on the vel stence and bioscenned i ne. Use the horsedens b the highest tenister? internet/Managementation factor value returning to antige the value to this n. Bater this value in Table 4-1.

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TABLE 4-16 TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES[®]

Toxicity/		Bioaccumula	ation Potent	ial Factor	Value		
Factor Value	50,000	5,000	500	50	5	0.5	
10,000	5 x 10 ⁸	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	2
4,000	2 x 10 ⁸	2 x 10 ⁷	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,090	•
1,000	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500	. <u>.</u>
700	3.5 x 10 ⁷	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	
400	2 x 10 ⁷	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000	200	
100	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50	
70	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	35	
40	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000	200	20	· · ·
10	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50	5	
ана 7 ана	3.5 x 10 ⁵	. 3.5 × 10 ⁴	3,500	350	35	3,5	· · ·
	2 x 10 ⁵ .	2 x 10 ⁴	2,000	200	20	2	•
	5 x 10 ⁴	5,000	:	50	5	0.5	
0.7	3.5 x 10 ⁴	3,500	350	35	3.5	0.35	· · · · · · · ·
0.4	2 x 10 ⁴	aad at 2,000 m	200	20	2	0.2	· · · · ·
0.07	3,500	350	35	3.5	0.35	0.035	
0.007	- 350	35	3.5	0.3	5 0.03	6.0035	• •
9.0007	35	3.5	0.3	5 0.0	35 0.00	0.0003	
0	0	0	0	- 0	0	0	
	·	•		• • • •	•		

^aDo not round to nearest integer. · · · . • HILLING CODE 4000-40-C • •• **.** · · · · · · · · · · · · ana Angelaria Angelaria 173 •

illy. May 4.1.3.2.2 Househour waste quantity Ansign the same factor value for house regional and and a second second second be realized in Justice 4.1222 for the driving other direct. Bater this value in Table 4-1. 4.1323 Colonization of Januar food Chair and Second Second Second Second Second

te characteristice tics factor category maintence selected e. For the las unles. For the honordean exhistence exiscined for the watensheld in section 4.3.3.2.1.4. one its tendely/possistence factor value and bioaccusterilation potential factor value as follows to assign a value to the waste characteristic factor category. Pirst, and taily the tendely/possistence factor value and the beautients wate quantity factor value for the watenshed, subject to a maximum predict of 1×10⁶. Then multiply this product by the bioaccustenties potential factor values for dis bioaccustenties potential factor value for ⁶. This second principal factor version consolution potential factor version associate substance, subject to a second product of 1x(10⁻¹². Record on this second product of 1x(10⁻¹². Record on the 1x(10⁻¹². Record on this second product of 1x(10⁻¹². Record on the 1x(10⁻¹². Rec data h initan a yantara u fuct, ar second product, andpo a value from Table 3-7 (action 2421) to the luman fixed chain famat-worth characteristics factor company b characteristics factor cologory embed. Rater this value in Tobic 44

4.1.2.3 Homes food chele threat-target behavio two target factors for each extensive food chele tarbethest and equivies. For both factors, determine defaur the target fisheries are subject to checker the target fisheries are subject to check or potential insues food chele dia mante 2

Constituer a Bobary (or portion of a Bobary) Mais the tanget distance limit of the Annubed to be subject to actual lummas feet the contamination if any of the following in ford chain custo andr:

• Ab resolate adiatante bistog a nalation poinstal factor value of 200 r is present aller in an alignmed semication potential factor verse or are poster to present either in up-observed and by direct electronics to the maked or in a setting water or sediment gle from the vertexical of a lovel that is the criteria for an electronic takene to vertexical from the elec, and of least a free of the fishery is within the boundaries he electronic release (that is, it is located are at the point of direct electronics or at ferences the point of direct of artry and must distant excepting point ortaining observed release. ar gr س خلک er bete 2.2

the most distant sampling point establishing the observed release). • The Balaxy is cleased, and a honordown existence for which the Johery has been choud how how decremented in the observed solvene to the watershed from the observed solvene to the watershed from the observed solvene to the watershed from the observed beautients of the fishery is yothin the beautients of the observed values.

 A beneficio informico la prisont in a processarigite from an econtricity search.
 Searche beneficia ches regenters from t bentlic, human fixed chas regaring \$10000. vestpplad at a layal that maste the other for an observed release to the vestprind from the othe, and at least a pertine of the fixing is within the branchetics of the n frem the ale.

Per a fishery that mosts any of these th dusts, but that is not shally within the symplector of the observal, r lance, const a these warms of the observed. I have a consider to perform of the falsery that is written boundaries of the chorry that is written just to actual here. the boundaries of the observed release to be endjoint to extend homens for d chains contentionfies. Consider the semainder of the fishery within the target distance limit to be subject to potential fixed chain contention n of the

.

In addition, consider all other fisheries that are partially or wholly within the target distance limit for the watershod, including fisheries partially or wholly within the nduries of an observed release for the tarshed that do not meet any of the three cziteria listed above, to be subject to tial human food chain contamination. If only a portion of the fishery is within the target distance limit for the watershed. Include only that partian in evaluating the targets factor category.

When a fishery (or portion of a fishery) is subject to actual food chain contamination. determine the part of the fishery subject to Level I concentrations and the part subject to Level II concentrations. If the actual food als contamination is based on direct arvation. evaluate it using Level II concentrations. However, if the actual food chain contamination is based on samples from the watershed, use these sample ک ایسو ی an the weltershiel, use times surgice from mileble, additional tissue samples from . with human food chein expensions as actified below, to determine the part subject to Level I concentrations and the part subject to Level B concentrations

. Determine the level of ach contamination from samples (including time samples from accentially seconds, benchic argoniene) that most the criteria for actual feed chain contamination by comparing the some concentrations (see section 4.1.2.3) m these samples (or comparable samples) he health-based banchmarks from Table **1 1** 4-17. as described in section 2.5.1 and 2.5.2 Use only the exposure concentrations for these hampdom substances in the sample for the difference of the factories of the second of the contraction of the factories for actual contamination of the factories.
 In addition, detarmine the level of actual

inction from other tissue samples by paring the concentrations of hexardees tances in the tissue samples (or parable tissue samples) to the healt of banchmarks from Table 4-17, as cribed in sections 2.5.1 and 2.5.2. Use only ee additional tissue samples and only these beserdons substances in the tion its that most all the following criteria:

-The tissue comple is from a location. that is within the boundaries of the actual food chain containingtion for the site (that is, either at the point of stween the direct observation or at or be probable point of entry and the most distant sample point meeting the criterie for actual food chain إدعا

- -The tissue sample is from a species of aquatic human food chain organia it spands actualed periods of time his the boundaries of the actual food chain co elemination for the elle and that is not in eccentially sessile. handhic organia
- -The hexardone substance is a substance that is also present in a surface water. benthic, or soliment sample from within the target distance limit for the

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watershol and. for such a semple, mosts the criterie for actual food chain contin

TABLE 4-17 .- HEALTH-BASED BENCH-MARKE FOR HAZARDOUS SUBSTANCES IN HUMAN FOOD CHAIN

Concentration corresponding to Food and Drug Administration Action Level (FDAAL) for lish or shallfish.

 Bereating concentration for concer corresponding to that concentration that corresponding to the concentration that for and experie

• Sere ation for no recting concentration for nonconc ngical serpenses corresponding to to Dese (RID) for and exposures. أوعاس scading to the 8-f-

41.8.8.1 Pool chain individual Evaluate the food chain individual factor based on the fabrics (or partians of fabirates) within the cyst distance limit for the waters using this factor a value as follow ce limit for the wet ad. ٨

• I any fahary (or portion of a fishery) is abject to Lovel I concentrations, societ a a of Sk.

ne is a Sobary for partian of a Solary) it asymbols within the target distance result anywhere within the target distance nil, angle a value of 20. • If there is no abserved release to surface

 If there is no observed release to service the two watershed or there is no observed release of a heisendess enhances being a biseconstation potential factor value of 200 or greater, but there is a faile (or parties of a failury) present anywhere within the target distance limit, assign a value as follows: here

- Using Table 4-23. determine the highest -Using Table 4-23. determine the highest -Battern veright (fast in, lowest amount of dilution) applicable to the fahreise (or particus of fahreise) within the target distance limit. Multiply this dilution weight by 20 and round to the second integer. -Assign this calculated value as the farter value.
- cint wit

 If there are no fisheries for portions of inclus) within the target distance limit of a watershed, assign a value of 0. the west

Histor the value contrained in Table 4-1. 43.2.3.2 Appelation. Brakents the equinities factor for the westershed based on two factors: Lovel I concentrations, Lovel II we means aven a concentrations, favel II secontrations, and potential houses food usin contration. Determine which factor partice for a Roberty (or portion of a fishery) a specified in section 41.3.3. **60** m

4.1.3.3.2.1 Lovel Francestrations. Determine these Scheries for particus of Scheries] within the watershed that are ubject to Lovel I concentration **11.** - .

in food chain population ک جرار e h value for each fishery (or parties of a fishery) as fallen

· Estimate human food chain production for the Sahary based on the estimated served a Tatle

production (in pounds) of homen food chain organisms (for example, lish, shellfish) for that fishery, except: if the fishery is closed and a hazardous substance for which the fishery has been closed has been documented in an observed relative to the fishery from a in an observed release to the fishery from a source at the site, we the estimated annual production for the period prior to closure of the fishery or use the estimated manual production from comparable fisheries that wre of production fa

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Assign the fibbry's value for human food chain population from Table 4-18, based on the estimated human food production for the fibbry.

me managy. Set boundaries between fisheries at those points whire burian fied-chain production changes or where the surface water dilution weight changes.

Sum the human food chain population value for each fishery (and portion of a fishery): Multiply this sum by 10. If the product is less than 1. do not round it to the meaner integer, if 1 or more round to the nearest integer. Assign the resulting value as the Level 1 concentrations factor value. Enter this value in Table 4-1.

4.133.22 Level II conclimations: Determine those Scheries (or partiens of fisheries) within the watershed that are subject to Level II concentrations. Do notinclude any fisheries (or portions of fisheries): already counted under the Level I

concentrations fastor. Assign each fishery (or portion of a fishery) a value for human food chain population from Table 4-18, based on the estimated human ry. Estimate the

Tables 4-12, Desert of the fighty, Estimated human food production for the fighty, Estimate the human food chain production for the fishery as specified in section 4.1.3.2.1. Sum the human food chain population value for each fishery (and portion of a fishery). If this sum is less than 1, do not round it to the nearest integer; if 1 or more round to the nearest integer: Assign the ulting value as the hevel II conce mtrationia factor value. Enter this value in Table 4-1.

POPULATION VALUES

Humes food chein production (pounds par.yeer)	Assigned Numer food shein population value
0 Greater than 0.07 160 Greater than 100 to 1,000 Greater than 1,000 to 10,000 Greater than 10,000 to 100,000	0.03 0.03 0.3 3
Greathr than 100,000 to 1,000,000 Greater than 10 ⁴ to 30 ⁹ Greater than 10 ⁹ to 10 ⁴ Greater than 10 ⁹ Greater than 10 ⁹	\$19 .3,100 \$1,000 \$10,000 3,100,000

* Do not round to nearest integer.

. . . 413323 Fotential human food chain contamination. Determine those fisheries (or portions of fisheries) within the watershe that are subject to potential human food chain contamination. Do not include those fisheries (or portion of fisheries) already counted under the Level I or Level II concentrations factors.

Calculate the value for the potential human food chain contamination factor (PP) for the watershed as follows:

> $PF = \frac{1}{10} \frac{n}{10} P_{10}$ 1.1.1.1. an e state de la seconda de

P.=Human food chain population value for

and the second

where:

. .

fishery i. D_=Dilution weight from Table 4-13 forfishery i.

Number of fisheries subject to potential nen food chein contamination.

in calculating PP: • Estimate the human food chain

dation value (Pi) for a fishery (or portion

of a fishery) as specified in section 4.1.3.3.2.1. • Assign the fishery (or portion of a fishery) a dilution weight as indicated in Table 4-13 (section 4.1.2.3.1), except: do not. assign a dilution weight of 0.5 for a "3-mile mixing zone in quiet flowing river"; instead assign a dilution weight based on the average annual flow.

If PP is less than 1, do not round it to the arest integer; if PP is 1 or more, round to nest integer. Enter the value assigned

in Table 4-1. 4.1.2.3.2.4 Calculation of population factor and the values for the Level I intrations, Level II concentrations, and itial human food shain contamination factors for the watershed. Do not sound this at to the nearbat integer. Assign it as the

41.3.3. Calculation of human food chain threaf targets factor category value. Sum the food chain individual and population factor values for the watershed. Do not round this sum to the nearest integer. Assign it as the human food chain threat-largets factor catagory value for the watershed. Enter this value in Table 5-1. Cab

4.1.3.4 Colculation of human food chain. Threat score for a watershed Multiply the human food chein threat factor Category-yalues for likelihood of selease, svaste characteristics, and targets for the wetershold, and round the product to the nearest integer. Then divide by \$2,500. Assign the resulting value, subject to a maximum of 100; as the human food chain threat score for the watershed. Enter this score in Table 4-1.

4.1.4 Environmental threat. Evaluate the environmental threat for the watershed based on three factor categories: likelihood of release, waste characteristics, and targets. 41A.1 Environmental threat-likelihood of release. Assign the same likelihood of release factor category value for the environmental, threat for the waterabed as would be assigned in section 4.1.2.1.3 for the drinking

water threat. Enter this value in Table 4-1. 4.1.4.2 Environmental threat-waste characteristics. Evaluate the waste characteristics factor category for each watershed based on two factors: ecceyst toxicity/persistence/bioaccumulation and hazardous waste quantity.

4.1.4.2.1 Boosys tem toxicity/persistence/ biooccumulation. Evaluate all those hazardous substances eligible to be

evaluated for texicity/persistence in the drinking water threat for the watershed (see section 41.2.2).

4.1.4.2.1.1 Ecceystem toxicity. Assign an ecceystem toxicity factor value from Table 4-19 to each hexardous substance on the basis of the following data hierarchy: . . EPA chronic Ambient Water Outlity

Criterion (AWQC) for the substance.

• EPA chronic Ambient Aquatic Life Advisory Concentrations (AALAC) for the mbetabce."

KPA acute AWQC for the substance.

+ EPA acute AALAC for the substance. . Lowest LC., value for the substance.

In assigning the ecosystem toxicity factor value to the hezardous substance: • If either an EPA chronic AWQC or ____

AALAC is available for the bazardous substance, use it to assign the ecceystem toxicity factor value. Use the chronic AWQC in preference to the chronic AALAC when both are available. • If neither is available, use the EPA-acute

AWQC or AALAC to easign the ecosystem toxicity factor value. Use the acute AWQC in preference to the acute AALAC.

. If some of the chronic and acute AWQCs and AALACs is available, use the lowest LGes value to assign the ecosystem toxicity · · · · · · factor value. • If an LC ... value is also not available.

assign an eccepystem loxicity factor value of 0 to the hazardous substances and use other hazardous substances for which data are available in evaluating the pathway.

If an ecosystem torderty factor value of 0 is assigned to all barandous substances eligible to be avaluated for the watershed (that is. insofficient data are available for evaluating all the substances), use a default value of 100 as the ecosystem toxicity factor value for all these hazardous substances.

With regard to the AWQC, AALAC, or cted for assigning the ecosystem LC. ielo toxicity factor value to the hazardous aubatance:

. If values for the celected AWQC. AALAC, or LCee are inveitable for both fresh water and marine water for the hazardous mbstance, use the value that corresponds to the type of water body (that is, fresh water or sait water) in which the sensitive environments are located to sitsign the ecosystem toxicity factor value to the hazardous substance.

· E, however, some of the sensitive environments being evaluated are in fresh water and some are in salt water, or if any are in brackish water, use the value [f esh water or marine) that yields the higher factor value to assign the ecosystem indicity factor value to the hazardous substance.

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• If a value for the selected AWOC. AALAC, or LC... is available for either fresh water of marine water, but not for both, use the available one to assign an ecosystem toxicity factor value to the hazardous substance.

So.-Boosverien Temory Factor Values TARE 4-18,

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THELE 4-18. ECOSYSTEM TOUCTY FACTOR VALUES-Concluded

If sufficer as TSA observat: or source AWGC our TSA abvants or assure AALAC is available, analyse a value trans the LCs, as follows:

EPA acute AWOC or AALAC

DD or ANLAC' is a n a value as fallent."

Bildenik MCCorANAC	1
Less 0 m 1 pgf	-
Grater fan 1920 180 pgf	
Geneter Date 1/00 and	3 7

iCan Mit d , and a solar terms 4 • AC 19 3 the 201 1 -

	Angenet
Lass Gen 100 ygfl	1,500 1,500 10 10

10. ي العد الله بينا. 6 اد 1,000 بينا. سناية 10,000 اد 10,000 بينا. سناية 100,000 اد 100,000 بينا. سناية 100,000 اد 100,000 بينا. 1,000 3,000 300 30

n of the SMGCs and MLACs nor the LCs wildels, analys a value of 4. in m

AMOC - Anticiant Water Gradity Colonia.
 AMAC - Andrest Aquat: Life Advisory Concess.

The ANECC value in particulate to the when both and available. See test for use of her and marine values. MAC

414232 P oce as specified in section 412212. t are tho pa ant weiter cale stall bird (that is labor, or u -مري un Ci -16 --44 t af a e de la la t fi e alua fa the mid-min a peth for the u

a of Table 4-10 to 2.9 it w ۳ł ۰. 200 4122121 ر الم ک

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te for all aquitic a die human food ch • Cine (117) a ic en die 1 not just for aq

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414214 -Ē 1 T -21 à fae the) او **ک** 1 ct (-1 a ŝ • د د d a rit in: **n** (this Inches. Buts his subs in Table 4-1.

TABLE 4-28 .-- ECONVERSE TONICITY / PERSISTENCE FACTOR VALUES *

	Econysian taskiy taske wise					
		1,000			1	
	} }*~	.		10 4.7 2.507	1 0,1 0,07 0,007	

· Co est and to

Federal Register / Vol. 55, No. 241 / Friday, December 14, 1990 / Rules and Regulations

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Ecosystem Toxicity/	E	cosystem Bio	accumulation	Potential	Factor Valu	•
Persistence Factor Value	50,000	5,000	500	50	5	0.5
10,000	5 x 10 ⁸	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000
4,000	2 x 10 ⁸	2 x 10 ⁷	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000
1,000	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	-500
700	3.5 x 10 ⁷	3,5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350
400	2 x 10 ⁷	2, x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000	200
100	5 x 10°	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50
70	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	35
40	2 x 10°	2 x 10 ⁵	2 x 10 ⁴	2,000-	200	20
10	5 x 10 ⁵	5 x 10 ⁴	5,000	. 500	50	
7	3.5 x 10 ⁵	3.5 x 104	3,590	350		3.5
4	2 x 10 ²	2 x 10 ⁴	2,000	200	20	. 2
1	5 x 10 ⁴	5,000	500	50	5 	0.5
0.7	3.5 x 10 ⁴	3,500	350	. 35	3.5	0.35
. 0.4	2×10^4	2,000	· 200 ···	20	.2,	.0.2
.0.07	3,500	350	35	3.	5. 0.35	0.015
0.007	350	35	3.5	5 0.:	35 0.035	0.0035
0,0007	35	3.5	0.3	35 0.4	035 01003	5 0.00035
0	0	0	. 0	0	· 0 ·	0

TABLE 4-21 ECOSYSTEM TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES⁴

Bo not round to nearest integer. BILLING CODE 6000-00-C

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4.1.4.2.2 Binnerfour waste questily. algo the came hoter value for basadous and questily for the weigehol as would be signed in section 4.1.2.2.2 for the delaking the threat. Bater this value in Table 4-1. 4.1.4.2.2 Calculation of accievances 41422 8

41423 Calmi te factor coloring abstance selected a 414214, use its a Perde la and in sector 1-1 in de essistance factor value constation potential -----i hadid . une as follows to assign a value to factor a verse characteristic factor estagory. e. mitply the ecception testety/ states factor who and the basedone the wante ch indistance lacter vans and the for the sector of the secto

a maximum product of 2×30th Shood on this second product, assign a volve from Table 2-7 (section 2.63.1) to the environmental three works characteristics factor category for the watershed. Enter this value in Tuble 4-1.

THE 4-32-ECOLODICAL-BROED BENCHMARKS FOR HAZARBOUS SUB-STANCES IN SUIFACE WATER

 Concentration corresponding to EPA. Ambieut Water Quality Criteria (AWQC) for

• Select the appropriate AWQC and AALAC as follows:

-Use choosic value. If available: arwise use acpie value,

-If the southing cariconnect b and is in fach water, are -. der veller, enzept: if av frah sester im is available, une madee velut if allebie. 1 ÷.

-If the sensitive contractant being ated is in sait water, use marine value, escapt if so marine value is available, use facth water value if - available.

-I the small e environment being evaluated is in both fresh water and it water, or is in brackish water, use lower of frosh water or marine values.

- TABLE 4-21.-SEMENTINE ENVIRONMENTS RATING VALUES

- Stratise andronment	Antipant
Called Indults' for Followi designated anderganet of Despined species	180
Hildspillenens to be used by Potenti dedgraded er proposed endergened er Betedened species	75
Hiddel known to boared by State dedgrated endergrated or Developed grades	
Back fund destjonend for while or genes management	25
State designated areas for protection or maintamence of aqualic lis "	5
 Collect Inductors defined in 50 CFR 424.02. * Annue Martine State Country Zones interruptioned plants to respecting projections because of occurated without. * Annue Martine State Country Zones interruptioned plants to respecting projections because of occurated without. * Annue Annuesses and Annuesses and Annuesses and Annuesses and Annuesses and Annuesses. * Annue Annuesses and Annuesses and Annuesses and Annuesses and Annuesses. * Annue Annuesses and Annuesses and Annuesses and Annuesses and Annuesses. * Annue Annuesses and Annuesses and Annuesses and Annuesses. * Annue Annuesses and Annuesses and Annuesses and Annuesses and Annuesses. * Annue Annuesses and Annuesses and Annuesses and Annuesses and Annuesses. * Annue Annuesses and Annuesses and Annuesses and Annuesses and Annuesses. * Annue Annuesses and Annuesses and Annuesses and Annuesses and Annuesses. * Annue Annuesses and Annuesses and Annuesses and Annuesses and Annuesses. * Annue Annuesses and Annuesses. * Annue Annuesses and Annuesses. * Annue Annuesses and Annuesses. * Annue Annuesses and Annuesseses and Annuesses and Annuesses and Annuesses and Annuesseses) protection Int glassics In aquatic or

nt as being used for interes or conservated openning by a given species. Hillmay, field to tenested vehiclents species. For the surface vator regration pathway, field to tenested vehiclents species with aspecie or ninging habits. Simulad under Stoden Stilligt af Clean Water Act, as smar

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TABLE 4-24 --- WETLANDS RATING VALUES FOR SURFACE WATER MIGRATION PATH-WAY

Assigned Value Total-length of watlands * (miles) Less then 0.1. 0 25 0.1 10 1. Nor than 1 to 2 Can -50 75 100 160 250 350 Granter than 2 to 3 Greater than 3 to 4. Greater than 4 to 4. in the A to 12 <u>Cm</u> eler then 12 to 16 Greather than 16 to 20 460 Geneter then 20. 500

*Wetlends as durined in 48 CFR Section 220.3.

4.1.4.3 Environmental thusat-targets. Evaluate the environmental threat-targets factor category for a watershed using one factor: sensitive environmente. 4.1.4.3.1 Sensitive environm

tate. Eveloate nsitive environments along the bazardous substance migration path for the watershed based on three factors: Level 3 concentrations, Level II concentrations, and

potential contaminatio Determine which fector applies to each

sensitive environment as specified is 4.1.2.3, except: use ecological-based cified in section benchmarks (Table 4-22) rather than health-based benchmarks (Table 3-10) in

determining the level of contamination from samples, in determining the level of actual contamination, use a point of direct observation anywhere within the sensitive environment or samples (that is, surface water, benthic, or sediment samples) takes water, weather, or second samples fails anywhere within or beyond the sensitive contromment (or anywhere adjacent to se beyond the sensitive environment if it is contiguous to the migration path):

414312 Level J concentrations. Assign value(s) from Table 4-28 to each sensitive environment subject to Level I. concentrations.

For those sensitive environments that are wetlands, assign an additional value from Table 4-54. In assigning a value from Tab Table 4-24. In essigning a value iron Table -4-24, include only those portiens of wetlands located along the hearshous substance migration path in the area of kevel 1 concentrations. If a wetland is located partially along the area of Level I concentrations and partially along the area of Level II concentrations and/or potential contamination, then solely for purposes of Table 4-24, count the portion(s) along the areas of Level II concentrations or potential contamination under the Level II concentrations factor (section 4.1.4.3.1.2) or potential contamination factor (section

4.1.4.3.1.3), as appropriate. Estimate the total length of wetlands along the hazardous substance migration path (that

is, wetland frontage) in the area of Level I concentrations and assign a value from Table 4-24 based on this total length. Estimate this length as follows:

For an isolated wetland or for a wetland where the probable point of entry to surface . water is in the wetland, use the perimeter of that portion of the wetland subject to Level I concentrations as the length.

• For rivers, use the length of the wetlands contiguous to the in-weter segment of the contiguous to the in-weter segment of the hexardous substance migration path (that is, wetland frontage).

· For lakes, oceans, coastal tidal waters, and Great Lakes, use the length of the wetlands along the shoreline within the target distance limit (that is, wetland frontage along

the shoreline). Calculate the Level I concentrations factor value (SH) for the watershed as follows:

SH=16(WH+ X Sj) j=1

wh

- WH-Value essigned from Table 4-26 to wetlands along the area of Level I concentrations.
- S, = Value(s) assigned from Table 4-23 to sensitive environment i.
- n = Number of sensitive enviro de fonto Table 4-23 subject to Level 1 concentrations.

Enter the value assigned in Table 4-1. 4.1.4.3.1.2 Level II concentrations. Assign value(s) from Table 4-23 to each sensitive enviro ent subject to Level II concentrations. Do not include sa dtive environments already counted for Table 4-23 under the Level I concentrations factor for this watershed.

For those genetive environments that are worlands, assign an additional value from Table 4–24. In assigning a value from Table 4–24, include only those portions of wetlands located along the hazardous substance migration path in the area of Lovel II centrations, as specified in section 414811

Estimate the total length of wetlands along the hazardous substance migration path (that is, wetland frontage) in the area of Level II concentrations and assign a value from Table 4-24 based on this total length: Estimate this length as specified in section 4.1.4.3.1.1. except: for an isolated wetland or for a wetland where the probable point of entry to surface water is in the wetland, use the support to Level II (not Level I) concentrations as the length. Celculate the Level II concentrations value

(SL) for the watershed as follows:

$$SL=WL+\sum_{i=1}^{n} S$$

where:

- WL=Value assigned from Table 4-24 to wetlands along the area of Level II concentrations.
- S,=Value(s) assigned from Table 4-23 to sensitive environment i.
- Number of sensitive environments from Table 4-23 subject to Level II concentrations

Enter the value assigned in Table 4-1. 4.1.4.3.1.3 Potential contamination. Assign value(s) from Tuble 4-23 to each sensitive environment subject to potential

contemination. Do not include assettive wironments already counted for Table 4-23 inder the Level I or Level II concentrations factors.

For each type of surface water body in Table 4-13 (section 4.1.2.8.1), sum the valu assigned from Table 4-23 to the sensitive af a) sents along that type of surface enviz water body, except: do not use the surface water body type "3-mile mixing none in quiet flowing river." If a sensitive environment is along two or more types of surface water bodies (for example, Wildlife Refuge contiguous to both a moderate stream and a bia au large river), assign the sansitive environment only to that surface water body type having the highest dilution weight value from Table 4-13.

For those agneitive environments th at are wetlands, assign an additional value from wetanon, easys an acmount vanis hom Table 4-34. In sectioning a value from Table 4-24, include only those portions of wetlands located along the hazardous substance migration path in the area of potential contamination, as specified in section 4.1.4.3.1.1. Aggregate these wetlands by type of surface water body, succept do not use the surface water body type "3-mile midding no in quiet flowing river." Treat the wetlands aggregated within each type of surface wat in each type of surface water body as separate sensitive anvia solely for purposes of applying Table 4-36 Estimate the total length of the wetlands within each surface water body type as specified in section 41.4.3.1.1, excep isolated wetland or for a wetland where th probable point of entry to surface water is in the wetland, use the perimeter of that portion the wettand, use me permanent or una per of the wetland, subject to potential contamination for the portion of that perimeter that is within the target distant limit) as the length. Assign a separate we from Table 4-24 for each type of surface reade walk

water body in the watershed. Calculate the potential contemination factor value (SP) for the watershed as follower

 $SP = \frac{1}{10} \frac{m}{j=1} ([W_j + S_j]D_j)$

where:

I S,

- =Value(s) assigned from Table 4-23 to sensitive environment i in surface water body type j.
- Number of sensitive environments from Table 4-23 subject to potential contamination.

W; = Value assigned from Table 4-24 for wetlands along the area of potential

- contamination in surface water body
- type j. D,-Dilution weight from Table 4-13 for surface water body type j. -Number of different surface water body

types from Table 4-13 in the watershed.

If SP is less than 1, do not round it to the nearest integer; if SP is 1 or more, round to the nearest integer. Enter this value for the putential contamination factor in Table 4-1. 4.1.4.3.3.4 Gidenlation of anvironments' descritingets further estigancy value. Sum the values for the Lovel 2 consectations, Lovel 2 executively and pojustical contentions factors for the variantical. Do not round this run to the association of pojustical contention for any second polymetric contention for any second target. Antige this sum on the association for the variantical. Batter this value in Table 4-1. 4.1.4.4 Calculation of anvironmental downt across for a variantical. Multiply the contention for the variantical Multiply the contention for the variantical Multiply the contention for the second second values for Halthood of subsets, wates

characteristics, and tagets for the vester and reared the product to the meaner integ Then divide by \$2.000. Assign the reaching value, subject to a maximum of \$4, to the tal threat eres for the water

derivation and the second for the version of the second filter of a second filter of a second filter of a second filter of the secon Anisy China, and conservation waverage Anisym the resulting sears, subject to a minimum value of 200, as the suffice water overland/flood migration component soors for the verticulard. Inter this score in Table 43

4.1.8 Calculation of orealised/flood intention compressor cases. Bellevit the intention calculater orealised/flood intention compressed score fore the highest engene war even for the sugnition component even from the verticele orchasted. Assign this score as the earlyses years overhead/field migraten component score for the sta, subject to a maximum asses of SIR. Bater this score is Table 4-6.

4.2 Ground water to explore swater adjustion component. Use the ground water formines water adjustion component to evaluate authors water firmute that result levelante surface v fee signifies of her و الم nees from a course of the city to extince vester via ground vester. Brokesto these types of the for this component detailing vester threat. Junces feed deals threat, and covinsener funne.

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4.2.1 Countral consciournitions. 4.2.1.1 Eligible surginou western. Coloniate general water to studies water migration component source only for surface waters (see vectors 4.0.2) for which all the following conditions are met:

enditings one mat: • A portion of the surface water is within 1 its of one or more senters at the site boring containment factor value greater than 0 (see ... earlies 42212).

 No equifier discentionity is established investi the sensus and the particle of the ation weter within 1 mile of the source (see action 3.8.1.2.2). However, if hexardous stances have migrated across an apparent matually within this 1 mile distance, do consider a discontinuity present in nat ce scating the site.

* The top of the uppermost aquifer is at or above the bottom of the surface vester.

Do not evolute this component for sites consisting solely of contamineted soliments with no identified source. 4.2.1.3 Definition of heatrdoos substance

ALL'S Department of supervises environments algorithm path for ground woter to surface rater sugration component. The hexardows abstance migration path includes both the outstance magnetice peth includes both the ground water segment that hererfoce water in-weter segment that hererfoces outstances would take as they migrate every from sources at the alter.
 Bastrict the ground water segment to migration via the uppermost equilier between a sense and the series water.

gin the surface water in-water seg at the probable point of entry from the uppermeet equiler to the every from the investig the probable point of entry on that point of the confece water that yields the churtest straight-line distance, within the aquifer boundary (see section 3.0.1.2), from the sources at the site with a containment factor value granter than 0 to the surface

-Per stvars, continue the in-weater express in the direction of flow (including any tidal flows) for the distance established by the target

distance established by the target distance limit (see section 4.2.1.4). -Per inhas, access, coestal tido) webers or Great Lakes, do not consider flow direction. Instead apply the target unce limit as an arc.

-If the in-orstar segment includes both strens and inhes (or eccent, created ing held synthe and since for eccasis, constal tisks waters, or Greet Labor), apply the target-distance limit to their combined in-water sag

Cansider a site to be in two or more Constitute a size to us as some or annound standards for this component if two or no mandeus substance migration paths from a sources of the size do not reach a comm point within the target distance limit. If the site is in more than one wetershed, define a reparate humanism substance migration po supporte hazardous substance migration pa for each watershed. Bralaste the ground ter to seriace water migration compa

for each watershed separately as specified in section 4.2.1.5.

4213 Cheervel release of a specific sentence to surface water in-4.2.1.3 Gloservel release of a specific isomrown solutions to surface mater in-outer agreent. Section 4.2.2.1.1 specifies the collecte for antigoing values to the observed release factor for the gaunal water to surface webs: migration component. With regard to on individual hexarileus exhibitance, consider an observed selesses of that hexarileus substance to be established for the sprince mater in maters around a factor and antiwear is water segment of the ground value to excluse water segments of the ground value to excluse water migration components only when the boundary substance must the to surface water migration component only when the homolous existence mosts the criteria both for an observed valuese both to ground water (see socias 4.2.2.1.1) and for a observed values by chantest analysis to surface water (see socias 4.1.2.1.1). If the homolous substance mosts the criteria 0.1.0 and interface water d d for an

section 43.2.1.1 criteria for an observed release by chamical analysis to surface water but does not also meet the criteria for an observed selence to ground water, do not use any samples of that housedous substance from the surface water in-water segment in oveloating the factors of this component for example, do not use the housedous substance in establishing targets subject to actual contamination, or in determining the level of actual contention for a termst sociien 41.2.1.1 critmin far en observed

contamination or in determining the level of actual contamination for a target). 4.2.1.4 Target distance limit. Determine the target distance limit for each watershad as opecified in section 4.2.1.2, except do not extend the target distance limit to a sample location beyond 35 miles where at least one basedows substance in a cample from that Incentes another the column in section 4.2.1.3 for an observed palease to the surface water

a to conserve persons to us surrice when overlat sugment. Determine the tagets alights to be volunted for each watershal and establish dather these tagets are subject to actual or etesticil contamination as epochical in neuron consentación as energies de incant or riental exelumination as epocifical in clien 4.1.12, compt. do net establish actual minumentos besoid en a semplo location dese et locat eno besendeno colutores in a 12 ple from that location movie the cell often 4813 for an observed subserve

In section 4.2.1.3 for an element observe to the exclose vector in-vector expressed. 4.2.1.8 Brahastine of general states to perfore evelor subjective component. Brahaste the debiling vector theset, human facel chain threat, and exclosenerghil threat for each vectorelast for this component, haved on three factor comprises Mathemat of subsect, vector characteristics, and impute. Figure 4-2 indicates the factors included within each factor compresses the factors of the set factor colugary for each type of threat. BILLING CODE (100-00-0)

Federal Register / Vol. 55, No. 241 / Friday, December 14, 1990 / Rules and Regulations 51627

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Litet freed of Retence (LR)	an a
· · · · · · · · · · · · · · · · · · ·	Beint im thinks a start of the
Observed Release	Nests Characteristics (NC)
Potential to Release	Texticity/Nebility/Persistence
• Het Precipitation	- invente
• Depth to Adurter	Concinegent Concentration Acute Acute
	Nobility Natur Solubility
ارم از این ایک از این این این میشند. این این این این این این این این این این	Distribution Coefficient (K) Persistance
	· Half-life
	Rezervicus Meste Aunstity
	- Mazardous Vastastraumt Gumtrity
	• Volume teacher and the second
	المحمد بين المحمد بين المحمد المح المحمد المحمد
	an a
	these Characteristics (UD)
	Tenerus a transfer a t
	Concicity Concicity Concicity Concicity Concicity Concicity
	Catclingenic Acute Acute
	• Mobility
	Distribution Coefficient (Kal + Potential Human Food
	Juit falls
	Production
	Hazardous Haste Guentity
	• Nazardous Mastestréem Guentity: • Volume
	-Area - Area - A
n an	Having Uaste Characteristics (UC)
	Ecosystem Taxicity/Hability/
	Aeroistance/Sioaccumulation • Lavet T Concentrations
	- Antilent Mater Gustity I + Patential Chievalinetion
	Anbient Aquetic Life
	• Nobility
	· Bistribution Coefficient (Kg
	 Persistance, Nol f-11 fo
	Kou
	Potential Hazardous Haste Quantity
	- Hazardous feistestréen Quentify
	• Wolume
	The second se
	Figure 4-2
	NUMB WATER TO SUBFACE WATER MICRATION CONFORMED

Figure 4-2 Uverview of ground water to gurface water migration component 206

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and a more prov ار میلو به ۲۵ ۲۵ به میلود. به میلود به ۲۵ به میلود میلود میلو ۲۸ میلود به ۲۵ به میلود به میلود به میلود ۲۸ میلود به ۲۵ میلود از میلود ۲۸ میلود به ۲۵ میلود از میلود ۲۸ میلود به ۲۵ میلود از میلود از میلود

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 Ander Steiner (1998)
 Ander Steiner (1998)

Determine the ground voter to eacher voter subjection component, come (A.,) for a votermined in intere of the factor company voters as follows:

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LB,-Elhollhood of subsess factor catagory , value for flored lither in Astabling uniter, human find choin, or suviconmental

therest). WC1-Weste characteristics factor category

Comparison of the second construction of the second construction of the second second construction of the second sec

If the also is in only one wetershell, and yo the ground water be easiliest water adjustion component score het that watershell as the

ground water to author water in component score for the site. . ۰.

I un alle is in more than one weiersh 4 oit sature for

· Calculate a supreste grou ce weter mig nt accuration od, uning Masi date anda u ste characteristics, and to وأطوينا 1.0 to each weighted.

· Select the high et g d senter to ce vedet S state ha inde evaluated and assign it m the waters as the groute al water to surface water amponent score for the site.

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TABLE 4-25	GROUND	WATER TO	SUNFACE WATER	Monation	Semiconent (Sconeehiet
						-

Pectar estagades and lacters	ł	Value assigned
Disible Wer Turet		
Unditional of Balance to Applice: 1. Channel Balance	59	· _ ·
2. Aundel in Advance -	-	
	10	-
h Dyb b Aply	. 5	
21. THE THE		
3. Liberthand of Pichers & Bigher of Bress 4 and 24	-550	· ·
Wate Characteristic -	-	· ·
5. Handas Walls Contin	3	
6. What Clear to file	100	
Tangelitz	-	· · · ·
	-	
Level 1 Communities		
E. Lord J. Convertigition		
81. Papelaist (into in + in + in)		
	5	
11. Disaing White Thread Store (Ches 3 x 6 x 105/02,000, majort to a minimum of 100)	180	·
Nazash Pand Chain Norma	ł	}
Lindband of Relations		
The Constraints		
12. Tuchty Matching / Trinsteines / Terror - Alter	. 🙀	
14. Handhal Walls Califfer		
	1	
11. Read Chain Individual	. 99	
		ŀ
Tile. Land 1 Commentane		
The Potential Human Read Chain Contactington	2.	
10 Dennik Gårer 16 + 178		— —
Ruman Freid Challe Thread Store:	-	
AF HERE LARD CHER LINKE SCHOOL TO IL LE I AFALLES OF SUBJES OF S ADDRESS (LINKE LINKE)	. 100	
Endpanying Versit		
38. Understel of Relating igners weber an ben 3		
Waste Connected and		
21 Cardina Minis Cardin		
21. Wate Cheveletetete	1,000	
Tagets	• • •	•
Sig Land I Connections		
Site Lord & Consentations	. 🙀	
Sie Filming Cartyningin	· . 👥 -	
25. Taylo (nho in) 1 Hi 2 Hi		

TABLE 4-25.--GROUND WATER TO SURFACE WATER MIGRATION COMPONENT SCOREBHEET--Continued

Factor categories and factors	Mindrourn Veiue	value assigned
Environmental Threat Boore: 26. Environmental Threat Score (Elnes 20 x 23 x 251/82,500, subject to a maximum of 60) Ground Water to Surface Water Migration Component Score for a Watershed		
27. Wetershed Score * (lines 11 + 19 + 28, subject to a medimum of 100)	100 100	

ue not application

4.2.2 Drinking water threat. Evaluate the drinking water threat for each watershed based on three factor categories: likelihood of release, waste characteristics, and targets.

4.2.2.1 Drinking water threat-likelihood of release. Evaluate the likelihood of release. factor category for each watershed in terms of an observed release factor or a potential to release factor.

4.2.2.1.1 Observed release. Establish an observed release to the uppermost squifer as specified in section \$1.1. If an observed release can be established for the uppermost aquifer, assign an observed release factor value of 550 to that watershed, enter this value in Table 4-25, and proceed to section 4.2.2.1.3. If no observed release can be established, assign an objerved releas factor value of 0, enter this value in Table 4-25, and proceed to section 422.1.2.

4.2.2.1.2 Potential to release. Byshinte potential to release only if an observed, release cannot be established for the uppermost aquifer. Calculate a potential to rele ase value for the uppermost aquifer as specified in section 3:1:2 and sections 3.1.2.1 through 3.1.2.5. Assign the potential to release value for the uppermisst aquifer as the potential to release factor value for the watershod. Enter this value in Table 4-25. 4.2.2.1.3 Calculation of drinking water threat-likelihood of release factor category value. If an observed release is established for the uppermost aquifer, assign the observed release factor value of 550 as the likelihood of release factor catagory value for the watershed. Otherwise, assign the

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potential to release factor value as the likelihood of release factor category value for the watershed. Enter the value assigned in Table 4-25.

4.2.2.2 Drinking water threat-waste characteristics. Evaluate the waste characteristics factor category for each watershed based on two factors: toxicity/ mobility/persistence and hazardous waste quantity. Evaluate only those bazardous substances available to migrate from the sources at the site to the uppermost aquifer (see section 3.2). Such hazardous substances include

 Hazardons substances that meet the criteria for an observed release to ground waiter. .

· All hazardous substances associated with a source that has a ground water containment lactor value greater than 0 (see sections 2.2.2, 2.2.3, and 3.1.2.1).

42.2.2.1 Texicity/mobility/persistence. For each hazardous substance, assign a toxicity factor value, a mobility factor value, a persistence factor value, and a combined toxicity/mobility/persistence factor value as specified in sections 4.2.2.2.1.1 through 22214

4.2.2.2.1.1 Toxicity. Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1. 4222.1.2 Mobility. Assign a ground water mobility factor value to each hazardous substance as specified in section 3212

42.2.2.1.3 Persistence Assign a surface water persistence factor value to each

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hazardous substance as specified in section 412212

4.2.2.2.1.4 Calculation of toxicity/ mobility/persistence factor value. First, n each hazardous substance a toxicity/ mobility factor value from Table 3-9 (section 3.2.1.3), based on the values assigned to the hazardous substance for the toxicity and mobility factors. Then assign each hexardo substance a toxicity/mobility/persistence factor value from Table 4-28, based on the values assigned for the toxicity/mobility and persistence factors. Use the substance with the highest toxicity/mobility/ persistence factor value for the watershed to assign the value to this factor. Enter this value in Table 4.25.

4.2.2.2.2 Hazardous wasté quantity. Assign the same factor value for hezardo Assign the same incorvence for neuroscilla waste quantity for the watershed as would be assigned for the uppermost equifar in section 3.2.2. Enter this value in Table 4-25. 4.2.2.2.3 Calculation of driving water threat-waste characteristics factor category value. Multiply the toxicity/mobility/ persistence and basardous waste quantity factor values for the watershed, subject to a maximum product of 1×10⁴. Based on this product, assign a value from Table 2-7 (section 2.4.3.1) to the drinking water threatwaste characteristics factor category for the watershed. Enter this value in Table 4-25. 4.2.2.3 Drinking water threat-targets. Evaluate the targets factor catigory for each waterabed based on three factors: nsarest intake, population, and resources. BILLING CODE ONO SO H

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	· · ·	Persistence	Factor Value	
Toxicity/Hobility Pactor Value	1.0	9.4	0.07	0.10097
10.000	.10,000	4,000	700	7
2.000	2,000	800	140	1.4
1.890	1,000	400	70	0.7
200 -	200 /	•	14	0.14
100	390	40	3	0.87
20	29	•	1.4	9.014
10	10	4	9.7	9.007
2	2	●.♥	0.14	0.0914
1	- 1	0.4	0. 0 7	7 x 10 ⁻⁶
0.2	9.2	Ð.08	0.014	1.4 x 10 ⁻⁴
0.1	•.1	0.04	9.007	· 7 x 20 ⁻⁵
0.62	0.42	0.006	0.0014	1.4 x 10 ⁻⁵
9.9	9.01	0.004	7 x 10 ⁻⁶	7 x 20-6
0.002	0.002	\$ x 10 ^{-\$}	1.4 x 19 ⁻⁶	1.4 x 10 ⁻⁶
D.101	10.001	4 x 10 ⁻⁴	7 x 18 ⁻⁵	7 x 10-7
2 x 30 ⁻⁶	2 x 10 ⁻⁴	8 x 10 ⁻⁵	1.4 x 10 ⁻⁵	1.4 x 20 ⁻⁷
1 x 19 ⁻⁴	1 x 10 ⁻⁴	6 x 19 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁸
2 x 10 ⁻⁵	2 x 10 ⁻⁵	\$ x 10 ⁻⁶	1.4×10^{-6}	1.4 x 10 ⁻⁸
2 x 10 ⁻⁶	2 x 10 ⁻⁶	\$ x 10 ⁻⁷	1.4×10^{-7}	1.4 x 10 ⁻⁹
2 x 10 ⁻⁷	2 x 10 ⁻⁷	8 x 19 ⁻⁸	1.4 x 10 ⁻⁸	1.4 x 10-10
2 x 10 ⁻⁸	2 x 10 ⁻⁸	\$ x 10 ⁻⁹	1.4 x 10 ⁻⁹	1.4 x 10 ¹¹
2 x 10 ⁻⁹	2 x 10 ⁻⁹	\$ x 10 ⁻¹⁰	1.4 x 10 ⁻¹⁰	1.4 x 10 ⁻¹¹
o ·			0	0

TABLE 4-25 TORICITY/HOBILITY/PERSISTENCE FACTOR VALUES®

^aDo not round to nearest integer.

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For the nearest intake and population factors, determine whether the target surface water intakes are subject to actual or potential contamination as specified in section 4.1.1.2, subject to the restrictions specified in sections 5.2.1.3 and 4.2.1.4.

When the intake is subject to actual contamination: evaluate it using Level I concentrations or Level II concentrations. Determine which level applies for the intake by comparing the exposure concentrations from a sample (or comparable samples) to health-based benchmarks as specified in section 4.1.2.3, extent use only those samples from the surface water in-water segment and only those hazardous substances in such samples that meet the conditions in sections 4.2.1.3 and 4.2.1.4.

4.2.2.3.1 Nearest intake. Assign a value to the nearest intake factor as specified in section **4.1.2.3.1** with the following modification. For the intake being evaluated.

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multiply its dilution weight from Table 4-13 (section 4.1.2.3.1) by a value selected from Table 4-27. Use the resulting product, not the value from Table 4-13, as the dilution weight for the intake for the ground water to surface water component. Do not round this product to the nearest integer. Select the value from Table 4-27 based on

Select the value from Table 4-27 based on the angle Q, the angle defined by the sources at the site and either the two points at the intersection of the surface water body and the 1-mile distance ring of any two other points of the surface water body within the 1mile distance ring, whichever results in the largest angle. (See Figure 4-3 for an example of how to determine Q.) If the surface water body does not extend to the 1-mile ring at one or both ends. define Θ using the surface water endpoint(s) within the 1-mile ring or any two other points of the surface water body within the 3-mile distance ring, whichever a results in the largest angle.

TABLE 4-27.--DILUTION WEIGHT ADJUSTMENTS

00 Greater than 0 to 180 Greater than 18 to 540 Greater than 18 to 540 Greater than 90 to 1250 Greater than 125 to 1620 Greater than 162 to 1950 Greater than 198 to 2740 Greater than 234 to 2700 0.0	Angle O (d	legrees) .	 Ae- signed value*
Greater than 270 to 308	0 Greater than 0 to 18 Greater than 18 to 54 Greater than 18 to 90 Greater than 10 to 125. Greater than 125 to 142 Greater than 105 to 124 Greater than 196 to 224 Greater than 234 to 270 Greater than 201 to 324	2	0 0.05 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8

* Do not round to nearest integer.

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Coxicity/ Nobility/		Bioaccus	Mulation Pot	ential Fact	or Value		
Persistence Pactor Value	\$0,000	5,000	500	50	5	0.5	
10,000	5 x 10 ⁸	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	
4,000	2 x 10 ⁸	2 x 10 ⁷	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000	•
2,000	1 x 10 ⁸	1 x 10 ⁷	1 x 10 ⁶	1 x 10 ⁵	1×10^4	1,000	
1,000	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500	
800	4 x 10 ⁷	4 x 10 ⁶	4 x 10 ⁵	4 x 10 ⁴	4,000	400	
700	3.5×10^7	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	•
400	2 x 10 ⁷	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000	200	
200	1 x 10 ⁷	1 x 10 ⁶	1 x 10 ⁵	1×10^4	1,000	100	
140	7 x 10 ⁶	7 x 10 ⁵	7 x 10 ⁴	7,000	700	. 70	
100	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50	
80	4 x 10 ⁶	4 x 10 ⁵	4 x 10 ⁴	4,000	400	40	•
70	3.5×10^6	.3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	35	
40	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000	200	20	
20	1 x 10 ⁶	1 x 10 ⁵	1 x 10 ⁴	1,000	100	10	
14	7 x 10 ⁵	7 x 10 ⁴	7,000	700	70	7	
10	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50	5	
8	4 x 10 ⁵	4 x 10 ⁴	4,000	400	40	4	
7 .	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	350	35	3.5	
4	2 x 10 ⁵	2 x 10 ⁴	2,000	200	20	2	•
2	1 x 10 ⁵	1 x 10 ⁴	1,000	100	10	1	
1.4	7 x 10 ⁴	7,000	700	.70	7.	0.7	

TABLE 4-28 TOXICITY/MOBILITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES[®] 51583

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		· · · · · · · · · ·					geg national generations
Tenicity/ Hobility/		Bioaccum	lation Pote	ntial Fact	os Value		
Pactor Nalue	50,000	5,000.	500	50	5	0.5	
1.0	5 x 10 ⁴	5,000	500	50	.	0.5	
0.8	4 x 10 ⁴	4,000	400	40	4	0.4	
0.7	3.5 x 10 ⁴	3,500	350	35	3.5	C.35	
-0.4	2 x 10 ⁴	2,000	200	20	2	0.2	
0.2	1 x 10 ⁴	1,000	100	10	1	0.1	
0.14	7,000	700	70	7	0.7	0.07	
0.1	5,000	500	50	5	0.5	0.05	
0.08	4,000	600	40	4	0.4	0.04	• • •
0.07	3,500	350	35	3 5	0.35	0.035	
0.04	2,000	200	20	2	0.2	9.02	
0.02	1,000	100	10	1	0	ê.01	
0.014	700	70	7	0.7	0.07	0.007	
0.01	500	50	5	0.5	0.05	0.005	
0.006	- 400	40	4	0.4	0.04	0.004	
0,007	350	-35	3.5	0.35	0.035	0.0035	
0.004	200	20	2	0.2	0.02	0.002	
0.002	100	10	1	0.1	0.01	J >01	
0.0014	70	7	0.7	0,07	0.007	7 x 10-4	
0.001	50	5	0.5	0.05	. 0.095,	5 x 10-4	
\$ x 10 ⁻⁶	49	4	0.4	0.04	0.004	4 x 10 ⁻⁴	
7 x 10-4	35	3.5	0.35	0.035	0.0035	3.5 x 10 ⁻⁴	
4 x 10 ⁻⁴	20	2	0.2	0.02	9.902	2-z 10-4	
	•	2	23	······	······································		
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TABLE 4-28 (Continued)

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Toxicity/					ton Noluo	· · · · · · · · · · · · · · · · · · ·
Persistence Factor Value	50,000	Біо 5,000	accumulation P 500	50	S	0.5
2 x 10 ⁻⁴	10	1	0.1	0.01	0.001	1 x 10 ⁻⁴
1.4 x 10 ⁻⁴	7	0.7	0.07	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵
1×10^{-4}	5	0.5	0.05	0.005	5 x 10 ⁻⁴	5 x 10 ⁻⁵
8 x 10 ⁻⁵	4	0.4	0.04	0.004	4 x 10 ⁻⁴	4 x 10 ⁻⁵
7 x 10 ⁻⁵	3.5	0.35	0.035	0.0035	3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵
4 x 10 ⁻⁵	2	0.2	0.02	0.002	2 x 10 ⁻⁴	2 x 10 ⁻⁵
2 x 10 ⁻⁵	1	0.1	0.01	0.001	1×10^{-4}	1 x 10 ⁻⁵
L.4 x 10 ⁻⁵	0.7	0.07	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵	7 x 10 ⁻⁶
8 x 10 ⁻⁶	0.4	0.04	- 0.004	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 x 10 ⁻⁶
7 × 10 ⁻⁶	0.35	0.035	0.0035	3.5×10^{-4}	3.5 x 10 ⁻⁵	3.5 x 10 ⁻⁶
2×10^{-6}	0.1	0.01	0.001	1×10^{-4}	1 x 10 ⁻⁵	1 x 10 ⁻⁶
L.4 x 10 ⁻⁶	0.07	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁷
8 x 10 ⁻⁷	0.04	¢.004	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷
7 x 10-7	0.035	0.0035	- 3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵	3.5 x 10 ⁻⁶	3.5×10^{-7}
2 x 10 ⁻⁷	0.01	0.001	1×10^{-4}	1 x 10 ⁻⁵	1 x 10 ⁻⁶	1 x 10 ⁻⁷
1.4 x 10 ⁻⁷	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸
8 x 10 ⁻⁸	0.004	4 x · 10-4	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷	4 x 10 ⁻⁸
7 x 10 ⁻⁸	0.0035	3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵	3.5 x 10 ⁻⁶	3.5 x 10 ⁻⁷	3.5 x 10 ⁻⁸
2 x 10 ⁻⁸	0.001	1 x 10 ⁻⁴	1 x 10-5	1 x 10 ⁻⁶	1 x 10 ⁻⁷	1 x 10 ⁻⁸
1.4 x 10 ⁻⁸	7 x 10 ⁻⁴	7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ⁻⁹

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Toxicity/ Hobility/	Bioaccumulation Potential Factor Value						
Persistence Factor Value	50,000	5,000	500	50 <u>-</u>	- 5	0.5	
8 x 10 ⁻⁹	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷	4 x 10 ⁻⁸	4 x 10 ⁻⁹	
2 x 10 ⁻⁹	1 x 10 ⁻⁴	1 x 10 ⁻⁵	1 x 10 ⁻⁶	1 × 10 ⁻⁷	1 x 10 ⁻⁸	1 x 10 ⁻⁹	
1.4 x 10 ⁻⁹	7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ⁻⁹	7 x 10-10	
\$ x 10 ⁻¹⁰	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷	4 x 10 ⁻⁸	4 x 10 ⁻⁹	4 x 10 ⁻¹⁰	
1.4 x 10-10	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ^{-9.}	7 x 10-10	4 x 10-11	
1.4 x 10-11	7 x 10 ⁻⁷	7 x 10-8	7 x 10 ⁻⁹	7 x 10-10	7 x 10-11	7 x 10-12	
1.4 x 10-12	7 x 10 ⁻⁸	7 x 10-9	7 x 10-30	7 x 10-11	7 x 10-12	7 x 10-13	
	. 0	0	0	0	0	0	

TABLE 4-28 (Concluded)

"Do not round to nearest integer.

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4.2.2.3.2 *Reputation*. Evaluate the spulation factor for the watershed based on three factors: Level I concentrations, Level II concentrations, and potential contamination. Determine which factor applies to an intake as specified in section 4.2.2.3. Determine the lation to be counted for that intake as DODU specified in section 4.1.2.8.2, using the target distance limits in section 4.2.1.4 and the hazardous substance migration path in section 4.2.1.2.

4.2.2.3.2.1 Level I concentrations. Assign a value to this factor as specified in section 412322

4.2.2.3.2.2 Level // concentrations: Assign a value to this factor as specified in section 412323

422223 Asiential contamination: For ack applicable type of surface water body in able 4-24, determine the dilution-weighted Table 4-14, determine the dilution-weigh population value as specified in action 4.1.2.3.2.4. Select the appropriate dilution weight adjustment value from Table 4-27 as specified in section 4.2.2.3.1.

Calculate the value for the potential contamination factor (PC) for the watershed as follows:

$$PC = \frac{A}{10} \frac{n}{10} W_{i}$$

where

A=Dilution weight adjustment value from Table 4-27. W₁=Dilution-we

-Dilution-weighted population from Table 4-34 for surface water body type 1.

iber of different surface water body types in the watershed.

If PC is less then 1, do not round it to the nearest integer; if PC is 1 or more, round to the nearest integer. Bater the value in Table 4-25

4.2.2.2.2.4 Colculation of population factor value. Sum the factor values for Lovel I concentrations, Lovel II concentrations, and potential cantamination. Do not round this

sum to the nearest integer. Assign this sum as the population factor value for the watershed. the population factor value for Enter this value in Tuble 4-25.

42233 Besources. Assis n a value to the sources factor as specified in section 41233

47.23A Calculation of drinking water threat surgets factor category value. But the nearest injuke, population, and resources factor values for the watershed. Do not round this sum to the measure integer. Assign this sum as the drinking water threat-targets factor category value for the watershed. Enter this value in Tuble 4-25.

4.2.2.A Calculation of drinking water threat score for a watershed. Multiply the drinking water threat factor category values for likelihood of release, waste characteristics, and targets for the waterahed, and round the product to the nearest inte Then divide by 82,500. Assign the resulting e, subject to a maximum of 100, as the valu drinking water threat score for the watershed. Enter this accre in Table 4-25.

4.2.3 Human food chain threat. Evaluate the human food chain threat for a watersh based on three factor categories: likelihood of e, waste characteristics, and targets. relea

4.2.3.1 Human food chain threatlikelihood of release. Assign the sam likelihood of release factor category value for the human food chain threat for the watershed as would be assigned in section 4.2.2.1.3 for the drinking water threat. Enter this value in Table 4-2

4.3.3.2 Human food chain threat-waste characteristics. Evaluate the waste characteristics factor category for each watershed based on two factors: texicity/ mobility/persistence/bioaccumulation and

mobility/persistence/unrecommutations and herardous waste quantity. 4.2.3.2.1 Trackity/mobility/persistence/ bioaccumulation. Evaluate all those hazardous subtances eligible to be evaluated for toxicity/mobility/persistence in the subtances that for the watershed the drinking water threat for the watershed (see section 4.2.2.2.1).

4.2.3.2.1.1 Toxicity. Assign a toxicity factor value to each hazardous substance as cilied in section 24.1.1.

423212 Mobility. Anni n a ground water mobility factor value to each hazardous substance as specified fo stance as specified for th

drinking water threat (see section 4.2.2.2.1.2). 4.2.3.2.1.3 Persistence. Assign a surface water persistence factor value to each bazardous substance as specified for the drinking water threat (see section 4.2.2.2.1.3). except: use the predominant water category (that is, lakes; or rivers, oceans, coastal tidal waters, or Great Lakes) between the probable point of entry and the nearest fishery (not the searest drinking water or resources intake) slong the hazardous substance migration path for the watershed to determine which portion of Table 4-10 to use. Determine the predominant water category based on distance as specified in section 4.1.2.2.1.2.

42321A Bioaccumulation potential Assign a bioaccumulation potential factor value to each hazardous substance as specified in section 4.1.2.2.1.3.

42321.5 Calculation of toxicity/ mobility/persistence/ bioaccumulation factor value. Assign each hazardous substance a taxicity/mobility factor value from Table 3-0 (section 3.2.1.3), based on the values assigned to the hexardous substance for the toxicity and mobility factors. Then assign each hezerdows substance a toxicity/ mobility/persistence factor value from Table 4-26, based on the values assigned for the toxicity/mobility and persistence factors. Then assign each herendous substance a toxicity/mobility/persistence/ bioaccumulation factor value from Table 4-28. Use the substance with the highest toxicity/mobility/persistence/ bioaccumulation factor value for the watershed to assign the value to this factor for the watershed. Enter this value in Table 4-25.

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42222 Annualize waste quantly. Assign the same factor value for basedown waste quantify for the wasterbad as would be assigned in cention 42222 for the deinking water thered. Butter this value in Table 4-32.

an food chain 42223 Calculation of Just -سليو و . For the h ad in sur an 423215, une Ha 2.2 ly/ pasisionse factor value Intian polyntial factor value ----s to quit n to the way n a v Trans. Pa et, mait e f ۶'n have writte go-networked, subject to a dust of 1x(1)⁶. These ar Mangaranteries te quantity factor L, exhiptet to a' pa product all'a versionalistica pro-ristato for the being and a substance. I to a martinean product of 1 x 10⁴. I to a martinean product of 1 x 10⁴. . Jaket ublist to a standa off to a mathematic product, or 1.5.2007 of an this extrant product, assign a value of Table 2-V (conferent 24321) for the busines I choin thread-water characteristication facts given for the watershed. Briter this value -l data ti in Table 4-55.

4223 House feel chair threat triget. Arabiest two larget licture for the visionized bool dash tedetiked and populates. "For both Textus, determine velocter the target labories are explicit to Lovel 1 constantion, Lovel 8 constitutions, or potential houses fixed dash contentions, or potential houses fixed dash contentions, or potential houses fixed dash contentions, or potential houses fixed dashes contactions, or potential houses fixed data and the sections 4.2.2.4, edificult to the potential houses specified in sections (21.3 and 4.2.2.2)

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A3.3.3. And dealer individual Analys a other to the field dashs individual Analys a garifiel in capitor-4.1.3.4.1 join the following training the appropriate disting verifiel from Table 4-27, as question to calculat from Table 4-27, as question to calculate from Table 4-42, as the dilation weight in assigning the Instart value. Do not result the product to the measure literate. Hence the value designed in Table 4-25.

4.21.32. Agendates Botheste far population factor for the variabled based on three factors: Lovel I conserintflues, Lovel II contentioillens, and potential bases ford chest extinuination. Discussion which of these factors is to be optical to each factory as specified in cection 4.2.2.2.

423321 Lovel / consumptions. Assign a value to this faster as opecified in section 4123221. Enter this value in Table 4-25.

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423322 Level II concentrations. Assign a value to this factor as specified in section 43.3322 Botter this value in Table 4-25.

4.2.3.2.3 Potential with the in 1 about 4-24. 4.2.3.2.3 Potential lumans food closin contamination. Assign a value to this factor as specified in section 4.1.3.2.3 with the following modification. For each fishery being contasted, multiply the appropriate dilution weight for that fishery from Table 4-13 by the collectment value selected from Table 4-27, as specified in section 4.2.2.3. Use the percentage product, not the value from Table 4-23, as the dilution weight for the fishery. Do not round this preduct to the meanest integer. Enter the value conjunction for Lave for 4.2.3.2.4 Colculation of population factor value. Sum the factor values for Lavel 1

42.3.3.2.4 Colorators of population factor runns. Sum the factor values for Level 1 concentritiess, Level II concentrations, and potential human field chain contamination for the waterahed. Do not round this sum to the measure integer. Assign this sum as the population factor value for the waterahed. Bater this value in Table 4-25.

proprietation income values are the water surface. Enter this values in Table 4-25. 4.3.3.3. Colonistics of human food choice thread dargets factor category value. Sum the faced chain technical and population factor values for the watershed. Do not reased this can to the nearest integer. Assign this care as the human food chois thread-largets factor category value for the watershed. Enter this value in Table 4-38.

calegory value for the watermost. Examwalue in Table 4-35. "4.2.6.4" Collection of human food chain threat score for a waterplack biology the human food chain threat factor category values for Multhood of release, warts characteristics, and targets for the watershell, and sound the predect to the measure integer. This divide by 62,000. Acaign the resulting value, subject to a maximum of 500, so the human food chain threat score for the valueshed. Bater the score in Table 4-85.

4.2.4 Breiroussento' closest Declaste the autosenesstal threat for the vestershed based on these factor categories: Multheed of planes, waste characteristics, and targets. 4.2.4.1 Breiroussen's Closest-Multheed of spinese. Assign the same Wastineed of release

42.4.1 Burdenmission' threat-like Shored of reduces. Assign the same likelihood of release factor category value for the environmental threat for the weatershed as would be easigned to excite 4.2.2.3 for the deisking water threat. Bater this value in Table 4-25. 4.2.4.2 Burdenmental threat waste

4.2.4.2. Broirongents/ threat-waste characteristics. Durbate the wester characteristics factor category for each wetershed based as two factors: eccoyoten testicity/mobility/persistence/ biotecompletion and baserdour wester constitive.

42423 Bosystem tacicity/mobility/

these homolous substances eligible to be evaluated for trainity/mobility/persistence in the delaking water threat for the watershed (see section 4.2.2.2.1).

424211 Response incidity. Assign an ecomputen incidity factor value to each basissions substance as specified in section 414211.

424212 Misbilly. Assign a ground water mability factor video to each hearstone substance as specified in section 422212 for the delaking water threat. 424213 Paralistance Assign a surface

«.2.4.2.1.3 Persistance. Anoign a surface vector persistance factor value to each hormolous substance as specified in section 4.2.2.2.1.3 for the drinking vector threat, excerpt use the predominant water company (that in labor, or rivers, oceans, coastal tidal vectors, or Grout Labor) between the probable paint of easy and the memori drinking water our recourses instead along the homedows substance migration pairs for the vectorshed to determine which pertins of Table 4-29 to use. Determine the posteminent vector category based on distance as specified in species 4.12.2.1.2.

ALALLA Baryotan bisecconsistion printial Action as economic bisecconsistion bisecconsisting an economic lister when to each insurface substance as specified in section 414213.

42A218 Colonistin of occupation techty/militily/pendetecis/ Mesocumulation factor union Aerign or ign each a lucicity/ -----Ny factor value from Table 3-0 facet 1215, based on the veh and and made to the states for the pe بأجزر وي - factors. The a and ----2.0 1 ••••• -h d pr ne Th less orbitance an occupit delty/ ň tri -lation facts a Table 4-30, based on th -, in the second s of for the occupation texticity/mobility/ its and an nial Incluin. Beliet the substa presence acception toxicity/mobility/ persistence/lisectonumbries factor volue for the watered and use 2 to gazin the volue to fair factor in the watershell. Enter this to this factor for the waters value in Table 4-25.

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Ecosystem	Persistence Factor Value						
Toxicity/Hobility Factor Value	1.0	0.4	0.07	0.0007			
10,000	10,000	4,000	700	7			
2,000	2,000	800	140	1.4	•		
1,000	1,000	400	70	0.7			
200	200	. 80	14	0.14			
100	100	40	7	0.07			
20	20	8	1.4	0.014			
10	10	4 '	0.7	0.007			
2	2	0.8	0.14	0.0014			
1	1	0.4	0.07	7×10^{-4}			
0.2	0.2	0.08	0.014	1.4×10^{-4}			
0.1	0.1	0.04	0.007	7 x 10 ⁻⁵			
0.02	0.02	0.008	0.0014	1.4 x 10 ⁻⁵			
0.01	0.01	0.004	7 x 10 ⁻⁴	7 x 10 ⁻⁶			
0.002	0.002	8 x 10 ⁻⁴	1.4×10^{-4}	1.4×10^{-6}			
0.001	0.001	4×10^{-4}	7 x 10 ⁻⁵	7 x 10 ⁻⁷			
2×10^{-4}	2×10^{-4}	8 x 10 ⁻⁵	1.4×10^{-5}	1.4×10^{-7}			
1 x 10 ⁻⁴	1 x 10 ⁻⁴	4 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁸			
2 x 10 ⁻⁵	2 x 10 ⁻⁵	8 x 10 ⁻⁶	1.4×10^{-6}	1.4×10^{-8}			
2 x 10 ⁻⁶	2 x 10 ⁻⁶	8 x 10 ⁻⁷	1.4 x 10 ⁻⁷	1.4×10^{-9}			
2 x 10 ⁻⁷	2 x 10 ⁻⁷	8 x 10 ⁻⁸	1.4×10^{-8}	1.4 x 10 ⁻¹⁰			
2 x 10 ⁻⁸	2 x 10 ⁻⁸	8 x 10 ⁻⁹	1.4 x 10 ⁻⁹	1.4 x 10 ⁻¹¹			
2 x 10 ⁻⁹	2 x 10 ⁻⁹	8 x 10 ⁻¹⁰	1.4 x 10 ⁻¹⁰	1.4×10^{-12}			
0	0	0	. 0	·. • O			

TABLE 4-29 ECOSYSTEM TOXICITY/MOBILITY/PERSISTENCE FACTOR VALUES[®]

^aDo not round to nearest integer.

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Icosystem	-						
Turiolay/	Francis	rysten Bleace	mulation Pot	ential Tact	T Velue		Sector of the
Persistance: Tector Value	50, 000	5,000	500	50	5	0.5	
10.000	5 x 10 ⁸	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,900	
4,000	·2 x 10 ⁸	2 x 10 ⁷	2 x 10 ⁶	2 x 10 ⁵	2 x 10 ⁴	2,000	
2,000	1 x 10 ⁸	1 x 10 ⁷	1×10^6	1 x 10 ⁵	1 ± 10^4	1,000	
1.000	5 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁵	5 x 10 ⁴	5,000	500	
800	4 x 10 ⁷	4 x 10 ⁶	4 x 10 ⁵	4 x 10 ⁴	4,000	400	
700	3.5 x 10 ⁷ -	3.5 x 10 ⁶	3.5 x 10 ⁵	3.5 x 10 ⁴	3,500	`350 ´	
400	2 x 10 ⁷ .	2 x 10	2 x 10 ⁵	2 x 10 ⁴	2,000	200	
200	1 x 10 ⁷	× 1 105	1 x 10 ⁵	1 x 10 ⁴	1,600	190	
140	7 2 10	7 x 10 ⁵	7 x 10 ⁴ .	7,000	700	70_	
100	5 x 196	5 x 10 ⁵	5 x 10 ⁴	5,000	500	50	
	4 x 10 ⁶ .	4 x 10 ⁵	-4-x 10 ⁴	4,000	- 400	- 40	
70	9.5 x 10 ⁶	3.5 x 10 ⁸	3.5 x 10 ⁴	3,500	350	: 35	
4 ••	2 x 10 ⁶	2° x 10 ⁵ ^	2 x 10 ⁴	2,000	200	20	
- 20	1 x 10 ⁶	1 x 10 ⁵	1 x 10 ⁴	1,000	100	10	
14	7 x 10 ⁵	7 x 10 ⁴	7,000	700	70	7	
	5×105	5 x 10 ⁴	5,000	500	50	5	
•	4 x 10 ⁵	4 ± 10 ⁴	4,000	400	40	4	
· · · J	3.5 x 10 ³	3.5 x 10 ⁴	3,500	350	35	3.5	
•	2 x 10 ³	2 x 10 ⁴	.2,000	290	20	2	
2	1 × 105	1 x 19 ⁴	1,000	100	10	1	
1.4	- 7 1: 10*	7,000	`700	70	7	0.7	
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	ا معنی محمد کار محمد ا	•	• •	• • • •		•	

TABLE 4-30 BOOSTSTEE TORICITY/HOBILITY/PRESISTERCE/BIOACCUMULATION PACTOR WALKES

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Ecosystem Toxicity/ Nobility/	Esos	• • • • • • • • • • • •					
Persistence Factor Value	50,000	5,000	500	50	5	0.5	.1
1.0	5 x 10 ⁴	5,000	. 500	50	5	0.5	
0.8	4 x 10 ⁴	4,000	400	40	. 4	0.4	
0.7	3.5 x 10 ⁴	3,500	350	35	3.5	0.35	
0.4	2 x 10 ⁴	2,000	200	. 20	2.	0.2	• • • • • • •
0.2	1 x 10 ⁴	1,000	100	10	1	0.1	•
0.14	7,000	700	70.	7	0.7	0.07	· · · · ·
0.1	5,000	500	50	5	0.5	0.05	
0.08	4,000	400	40	4	0.4	0.04	• •
0.07	3,500	- 350	35	3.5	0.35	0.035	-
0.04	2,000	200	20	2	0.2	0.02	
0.02	1,000	100	10	. 1	. 0.1	0.01	· · · ·
0.014	700	70	7	0.7	0.07	0.007	
0.01	500	50	5	0.5	0.05	0.005	
0.008	400	40	4	0.4	0.04	0.004	
0.007	· · · · · · · · · · · · · · · · · · ·	35	3.5	0,35	0.035	0.0035	. <u>.</u>
0.004	200	20	2	0.2	0.02	0.002	
0.002	100	10	1	0.1	0.01	0.001	
0.0014	70	7	0.7	0.07	0.007	7 x 10-4	
0.001	50	5	0.5	0.05	0.005 ~	5 x 10 ⁻⁴	
8 x 10 ⁻⁴	40	 4	0.4	0.04	0.004	4 x 10 ⁻⁴	

0.035

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 3.5×10^{-4}

2 x 10-4

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TABLE 4-30 (Continued)

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7 x 10⁻⁴

4 x 10⁻⁴

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Ecosystem Toxicity/ Hobility/	Ē	cosystem Bie	sccumulation	Potential Fa	: ctor Value	-
Persistence Factor Value	50,000	5,000	500	50	5	0.5
2 x 10 ⁻⁴	10	1	0.1	0.01	0.001	1×10^{-4}
1.4 x 10 ⁻⁴	7	0.7	0.07	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵
1 x 10 ⁻⁴	5 -	0.5	0.05	0.005	5 x 10 ⁻⁴	5 x 10 ⁻⁵
8 x 10 ⁻⁵	4	04	0.04 .	0.064	4 x 10 ⁻⁴	4 x 10 ⁻⁵
7 x 10 ⁻⁵	3.5	0.35	0.035	0.0035	3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵
4 x 10 ⁻⁵	2	0.2	0.02	0.002	2×10^{-4}	2 x 10 ⁻⁵
2 x 10 ⁻⁵	 1.	0.1	0.01	0.001	1 x 10 ⁻⁴	1 x 10 ⁻⁵
1.4 x 10 ⁻⁵	0.7	0.07	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵	7 x 10 ⁻⁶
8 x 10 ⁻⁶	0.4	0.04	0.004	4×10^{-4}	4 x 10 ⁻⁵	4 x 10 ⁻⁶
7 x 10 ⁻⁶	-0.35	0.035	0.0035	3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵	35 x 10 ⁻⁶
2 x 10 ⁻⁶	0.1	0.01	0.001	1×10^{-4}	1 x 19-5	1 x 10 ⁻⁶
1.4 x 10 ⁻⁶	0.07	0.007	7 x 10 ⁻⁴	7 x 10 ⁻⁵	7 x 10-6	7 x 10 ⁻⁷
8 x 10 ⁻⁷	.0.04	0.004	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷
7 <u>× 10-7</u>	0.035	0.0835	3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵	3.5 x 10 ⁻⁶	3 5 x 10-7
2×10^{-7}	0.01	6 093	1×10^{-4}	1 x 10 ⁻⁵	1 x 10 ⁻⁶	- 1 x 10-7
1 4 x 10 ⁻⁷	0.097	7 x 10-4	7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸
8 x 10 ⁻⁸	0.004	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷	4 x 10 ⁻⁸
7 x 10 ⁻⁸	0.0035	3.5 x 10 ⁻⁴	3.5 x 10 ⁻⁵	3.5 x 10 ⁻⁶	3.5 x 10 ⁻⁷	3.5 x 10 ⁻⁸
2 x 10 ⁻⁸	0.001	1 × 10 ⁻⁴	1×10^{-5}	1 x 10 ⁻⁶	1 x 10 ⁻⁷	1 x 10 ⁻⁸
1.4 x 10 ⁻⁸	7 x 10 ⁻⁴	7 x 10-5	/ x 10 ⁻⁶	/ x 10 ⁻⁷	/ x 10 ⁻⁸	7 x 10 ⁻⁹

TABLE 4-30 (Continued)

234

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TABLE 4-30 (Concluded) .

Ecosystem Toxicity/ Mobility/	Ecosystem Bioaccumulation Potential Factor Value							
Persistence Factor Value	50,000	5,000	500	50	- 5	0.5		
8 x 10 ⁻⁹	4 x 10 ⁻⁴	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷	4 x 10 ⁻⁸	4 x 10 ⁻⁹		
2 x 10 ⁻⁹	1×10^{-4}	1 x 10 ⁻⁵	1 x 10 ⁻⁶	1 x 10 ⁻⁷	1 x 10 ⁻⁸	1×10^{-9}		
1.4 x 10 ⁻⁹	.7 x 10 ⁻⁵	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ⁻⁹	7 x 10 ⁻¹⁰		
8 x 10-10	4 x 10 ⁻⁵	4 x 10 ⁻⁶	4 x 10 ⁻⁷	4 x 10 ⁻⁸	4 x 10 ⁻⁹	4 x 10 ⁻¹⁰		
1.4 x 10 ⁻¹⁰	7 x 10 ⁻⁶	7 x 10 ⁻⁷	7 x 10 ⁻⁸	7 x 10 ⁻⁹	7 x 10 ⁻¹⁰	4 x 10-11		
1 4 x 10 ⁻¹¹	7 x 10-7	7 x 10 ⁻⁸	· 7 x 10 ⁻⁹	7 x 10 ⁻¹⁰	7 × 10-11	7 x 10 ⁻¹²		
1 4 x 10 ⁻¹²	7 x 10 ⁻⁸	7 x 10 ⁻⁹	7 x 10 ⁻¹⁰	7 x 10 ⁻¹¹	7 x 10 ⁻¹²	7 x 10 ⁻¹³		
0	0	0	G	0	0	Q		

²Do not round to nearest integer.

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235

424.22 Housedness wants quantity. origin the owner factor value for bosondors note quantity for the wannahood or vessel be origined in section 42222 for the drinking rater thread. Bater this value in Table 4-32. 42423 Colombation of sector company

and sense characteristics is factor category ar use wetershad in section 42421.5, use it receives toricity/mobility/productioners lecter, where and conservation bioeccumulations where the factor value as failures to assign a value to the waste characticitation factor utagety. First, ambiging the accumuters and the beamstees waste conservation and the beamstees waste conservation and the beamstees waste conservation and in section 424215, use he testelly/makility/persistence factor value and the honordown weats quantity factor value for the waterback, subject to a maximum product of 1xCM². Then ambigity his product by the occupytom ideocommutation protonial factor value for fair homodown substance, subject to a machine product of 1xCM². Based on this product, assign a value from Table 3-7 (section 24.5.1) to the earth-momental threat-reate characteristics antoneous for the house in a econi 262.41 0 to entry for the note characteristics entry for the standard. Bater the value to Table 6-23. 42.43 Breizenental devel legat. indente the conferencental devel legat.

si dargatar. atter category for a vesterated using our start category for a vesterated using our start category for a vesterated to be ctat considre andreanagte. 42431 Sanative anvirunne

1243.1 Smaller environments Brahn and on three factors: Lovel I mentionales, Lovel II controllem, Lovel II concentrations, and testing controllem, Determine which terfiel contententies. Determine which plies to each sensitive excitentent or scilled in sectors 4.1.4.1.1, except: use only ter sequites from the conjuct water in-ter sequent and only these hermoters interces in such security that must the editmost in sectors 4.2.1.3 and 4.2.1.4.

424311 Lovel / concentrations. Assigned to the factor on specified in section 14311. Enter this value in Table 4-35. . 414311. Beter file w

414311. Balle une vene la rene e-25. 424312 Lovel II concentrations. Assign a value to this factor on operfiled in section 414312 Beter this value in Table 4-55. 414313, Potential contemination. Assign

a value to this factor as specified in section

.

4.14.3.1.3 with the following modification. Multiply the appropriate dilution weight from Table 4-13 for the sensitive environments in each type of surface water body by the it value selected from Table 4-27. a dia as specified in section 4.2.2.3.1. Use the seculting product, not the value from Table 4-53, as the dilution weight for the sensitive a in that type of surface water body. Do not sound this product to the st integer. Enter the value assigned in Table 4-25.

424314 Colculation of environmental threat-targets factor congary value. Sum the values for Level I concentrations, Level II scations, and potential contamination far the watershed. Do not round this sum to the mannest integer. Assign this sum as the servicemental threat targets factor category Ine for the watershed. Enter this value in Table 4-25.

4244 Calculation of anvironmental theast score for a watershod. Multiply the autoamoutal fixest factor category values for Multhood of science, weste characteristics, and targets for the watershed, and stund the product to the nearest integer. Then divide by \$2,508. Assign the resulti . value, subject to a maximum of 60, as the environmental threat accre for the wetershed. Rater this score in Table 4-25.

425 Calculation of ground water to the contrasting of the second water, human food chain, and seviroums in al threater). Assign the resulting score, subject to a maximum value of 180, as the ground water to surface weter adgention component score for the watershed. Rater this score in Table and store 4.55

4.2.8 Colouistion of ground water to surface water asignation component score. Select the highest ground water to surface water migration component score from the weter migrafen component some aver the ground water to surface water migration ment scare for the site, subject to a 8

dama score of 100. Hoter this score in Table 4-35.

43 Calculation of seriface water dynatics pathway score. Determine the afface water adjustics pathway score as

follows: • If only one of the two surface water mignotics components (overland/flood or ground water to surface water) is scored, anigh the score of that component as the surface water mignotics pathway score. • If both components are scored, solect the higher of the two component score of from sections 4.1.0 and 4.2.4. Assign that score as the surface water mignities pathway score.

5.0 Soil Expense Padrway

Budante the soil expresses patimery based on two theorem: Resident population theorem and nearby population theorem. Brokente both ad southy population lation th Angerby populations contrasts processes over the based on these factor collegation: Maced of exposure, wante characteristics, targets. Pigere 5-1 indicates the factors also within each factor collegary for each (Said đ١ -

type of ficeal. Determine the soil exposure policy score (6) in terms of the factor estagery values as follows:



- 12,-Likelihand of supreme factor category value for threat i (that is, solidant population firmet ar nearby population thread).
- WC,-Waste characteristics factor category value for threat i.

T₁=Tangola factor category value for threat i. SP=Scaling factor.

Table 5-1 outlines the specific colculation

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TABLE 5-1 .- SOIL EXPOSURE PATHWAY SCORESHEET

Pactor categories and factors	Maximum Viteo	
Resident Population Threat		
Andhaad of Capezure	1	
1. Lisibad d'Eparet-	- 669	
Inste Characteristics		
	- !!	
S. Handburg Wards Country.	- 🛄	
	- 100	·
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		1
		
		
	- 2] —
	- <u> </u>	· ·
	- 2	
	- 5	·
		·
		1
· Husely Population Threat	i	
Andhani al Bannan		
12. Annaharan (Annahala)	. 100	
13. Ann al Contestantin		
14. Mathematical Research		
	64	
16. Hanning Wester County	— — —	
R Winte Commentation		
	7	1
18. Manufar Indiation	1	
	é	
28. Territo Bern 18 + 19		
hands from a film Theorem		
21. Bunder Demidden Bauet Base 14 x 17 x 28		
	-	

in when applies to wante discertabilities category. In when call applicable, allo minimum when applies to factor. Haviver, pallway accre based solely on tureshiel conditive evolution minimal in material billings. as is limited to mark um of 60

mour considerations. Brainste the regativery based on areas of reteningtion 581 Ġ. ده ا -1 -0

· Consider observed contention to be nt et sampling incutions where analytic mes indicates that:

- L'hours des substance attributable to the alto is present at a concentration significantly above background levale A 1----eignificantly above background lavale for the atte (non Table 3-3 in section 2.3 for the entrois for downlong assigned significance), and -This hanneless substance. If not present at the suffice, is severed by 2 figt or base of cover material (for example,
- .

.

• Desklish array of observed contamination broad on sampling broations at which there is observed contamination or

- -Per all sources except contembated sell, if observed contextention from the allo is present at any compliant location while the senace, conside that earlier source to be an area of observed contamination.
- Per conteminated soil, consider both th ng location(o) with observed similar from the alle and the ing between such locations to a lying bet tions to mination be an area of observed can

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is available information indicates starwise.

• If an area of observed contamination for perties of each as area) is covered by a permanent, or otherwise maintained. ecountielly impensionly material (for ecountielly impensionly material (for ecounties, anglesit) that is not more than 2 feet thick, exclude that area (or portion of the sees) in evaluating the sell exposure ×.

 Per as area of observed contamination consider only these beamvices substances that most the criteria for observed ation. commination for that area to be associated with that area in evaluating the soil exposure strucy (see section 2.2.2). If these is observed conta -

If there is observed contamination, early screes for the resident population threat and the nearby population threat, as specified in mattern is a subscript of the second ms 5.1 and 5.2. If there is no observed and a sties, assign the soil exposure my a scare of S. .

5.1 Annidest Population Throat. Brahaste the maident population throat only if there is an area of observed continuination in one or

an area of observed contamination in one or more of the following locations: • While the property boundary of a solidance, school, or day care center and while all fout of the suspective residence, school, or day care coster, or • While a workplace property boundary and while 200 feet of a workplace area, or

.

 Within the homologies of a resource specified in section \$1.3.4, or
 Within the homologies of a terrestrick sensitive environment specified in section 5115

I not, assign the resident population threat a value of 0, outer this value in Table 5-1, and proceed to the nearby population threat

proceed to the Burry population according to the Burry population Assign a value of 200 to the Multhand of exposure factor category for the resident population threat if there is an area of electronic contamination in one or more locations lister in section 5.1. But the value in Table 5-1.

 sectors 3.1, main the venue in 12002 5-1.
 5.1.2 Whete characteristics. Brokete venue characteristics based on two factors: texticity and benacleus weste quentity.
 Brelevie only these honorhous substances Events only white many law a contact of that most the citize for observed contamination at the obs (see section 5.8.1). 5.1.2.1 Taxicity. Assign a toxicity factor value to each hazardous substance as

value to exclusive services of a specified in section 2.4.1.1. Use the basedous substance with the bighest taxicity factor value to seeign the value to the taxicity factor for the resident population threat. Enter this value in Table 5-1.

5.1.2.2 However, weste quantity. Assig issuedoes waste quantity factor value as specified in section 2.4.2. In optimying the ntity. Annign hazardous waste quantity, use Table 5-2 and • Consider only the first 2 feet of depth of an area of observed contamination, except as specified for the volume measure.

 Use the volu me measure (see section 2.4.2.1.3) only for those types of areas of observed contamination listed in Tier C of Table 5-2. In evaluating the volume measure for these listed areas of observed contamination, use the full volume, not just the volume within the top 2 feet.

• Use the area measure (see section 2.4.2.1.4), not the volume measure, for all other types of areas of observed

contamination, even if their volume is known. Enter the value assigned in Table 5-1.

TABLE 5-2-HAZARDOUS WASTE QUAN-TITY EVALUATION EQUATIONS FOR SOIL EXPOSURE PATHWAY

Tier	Moseure	-Units	Equation for assigning value*
A	Hezardous Constituent	Ð	С
B.	Guenility (C) Hezerdoue Winsteatream	•	W/5,000
C•	Volume (V) Surface	yde	V/2.5
	Drume ⁴ Tanks and Containers Other	gellon yd ^a	V/500 V/2.5
D	Then Drume Area (A) Landili		A/34,000
	Surface Surface	1. 1 .	A/13 A/13
	(Buried/backlilled)	また。 第1	A/270 A/34
	Contaminated Sol	11 *	A/34,000

*Do not round nearest integer. - Convect volume to mass when necessary: 1 ton=2,000 pounds=1 cubic yard=4 drums=200 cubics.

allons. * Use volume m ure only for surface impoun nts containing hazardous substances present as uide. Use area measures in Tier D for dry surface poundments and for buried/backilled surface-im-

undmants. • If actual volume of drafts is unavailable, secure a land surface area under pile; not surface

area of pile.

5.1.2.3 Calculation of waste

characteristics factor category value. Multiply the toxicity and hazardous waste quantity factor values, subject to a maximum product of 1 × 10^a. Based on this product, arsign a value from Table 2-7 (section 2.4.3.1) to the waste characteristics factor category. Enter this value in Table 5-1.

5.1.3. Targets. Evaluate the targets factor. category for the resident population threat based on five factors: resident individual, resident population, workers, resources, and

errestrial sensitive environments. In evaluating the targets factor category for terrestrial sensitive environm

the resident population threat, count only the following as targets: . . .

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 Resident individual—a person living or attending school or day care on a property with an area of observed contamination and whose residence, school, or day care center. respectively, is on or within 200 feet of the area of observed contamination.

· Worker-a person working on a property with an area of observed contamination and whose workplace area is on or within 200 feet of the area of observed contamination.

· Resources located on an area of

observed contamination, as specified in section 5.1.

· Terrestrial sensitive environments located on an area of observed

contamination, as specified in section 5.1. 5.1.3.1 Resident individual Evaluate this factor based on whether there is a resident individual, as specified in section 5.1.3, who is subject to Level 1 or Level 11 concentrations.

First, determine those areas of observed. contamination subject to Lovel I

concentrations and those subject to Level II concentrations as specified in sections 2.5.1 and 2.5.2. Use the health-based benchmarks from Table 5-3 in determining the level of contamination. Then assign a value to the resident individual factor as follows:

. Assign a value of 50 if there is at least one resident individual for one or more areas subject to Level I concentrations.

· Assign a value of 45 if there is no such resident individuals, but there is at least one resident individual for one or more areas subject to Level II concentrations.

 Anden a value of 0 if there is no resident individual.

Enter the value assigned in Table 5-1. 5.1.3.3 Resident population. Evaluate resident population based on two factors: Level I concentrations and Level II concentrations. Determine which factor applies as specified in sections 2.5.1 and 2.5.2. using the health-based benchmarks from Table 5-3. Evaluate populations subject to Level I concentrations as specified in section 5.1.3.2.1 and populations subject to Level II concentrations as specified in section 51322

TABLE 5-3.-HEALTH-BASED BENCH-MARKS FOR HAZARDOUS SUBSTANCES IN SOILS . .

· Screening concentration for cancer corresponding to that concentration that corresponds to the 10" individual cancer risk for oral exposures.

· Screening conceptration for noncances toxicological responses corresponding to the Reference Dose (RfD) for oral exposures.

Count only those persons meeting the criteria for resident individual as specified in -.

section 5.1.3. In estimating the number of people living on property with an area of h erved contamination, when the estimate in based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located.

5.1.5.2.1 Level / concentrations. Sum the number of resident individuals subject to Level I concentrations and multiply this sum by 10. Assign the resulting product as the value for this factor. Enter this value in Table 5-1.

51.3.2.2 Level II concentrations. Sum the number of resident individuals subject to Level II concentrations. Do not include those people already counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in Table

5.1.3.2.3 Calculation of resident population factor value. Sum the factor values for Level I concentrations and Level II concentrations. Assign this sum as the resident population factor value. Enter this value in Table 5-1.

5.1.3.3 Workers. Evaluate this factor based on the number of workers that meet the section 5.1.3 criteria. Assign a value for these workers using Table 5-4. Enter this value in Table 5-1.

- TABLE 5-4.--FACTOR VALUES FOR WORKERS

	-		·	
•	. Number of	workers		Assigned value
				0
1 to 10 101 to	0 1,900			5 10
Greete	r than 1,000			15

5.1.3.4 Resources, Evaluate the resources factor as follower

· Assign a value of 5 to the resources factor if one or more of the following is present on an area of observed contamination at the site:

-Commercial agriculture. -Commercial silviculture.

-Commercial livestock production or

commercial livestock grazing. . Assign a value of 0 if none of the above

are present.

Enter the value assigned in Table 5-1. 5.1.3.5 Terrestrial sensitive environments. Assign value(s) from Table 5-5 to each restrial sensitive environment that meets the eligibility criteria of section 5.1.3.

ES= Σ 6, i=1

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Calculate a value (ES) for terrestrial sensitive environments as follows:

where:

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S-Value(s) assigned from Table 5-5 to terrestrial sensitive environment i.

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after of instatulal countries references meeting section \$1.3 - de -

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es the patherny score based solely on al constitut contragments is builted damp of 60, determine the value for tatal set 10 8 3 --talal sound ire and in factor **in 1** as falleren

TABLE 5-6 .-- TENNESTMAL SEMENTIVE ENVIRONMENTS RATING VALUES

Transitiel sampling and transmiss	
Terresta office habes" for Pederal despector codespect or Base	
National Park Designated Foderal Wildowess Area	
Natural Management Persential Indian Income to be used by Personal Analysister or property	-
National Pressers (amethic) Halloud or State Transition Vill- De Religes	-
Federal Said designated for pro- tection of restand constraines. Administratively proposed Protocol	
Terrestad over effert for breed- ing by lage or dense approp- ters of science "	
Ternetial heidet lesens to be used by State designated endergand or Stratement species	
essel by species under solver as to its Falsed designated engan- genel or fundamed dates	
Sate finds designated for while or grave designated lighted Arres	35
das, impactant to andreases of unique blute communities	

"Called habitst an defend in 50 CFR 40LBE. Table 5-7. Bater this value in Table 5-1.

Multiply the values assigned to the eddent provident threat for Multimed of spaces (LD, waste characteristics (WC), at EB. Divisio the product by 40,000.

-If the secult is 60 or loss, arrige the value III as the transition secultive contemposes factor value. -If the secult concerds 60, coloriste a volue BC as fallows:

BC - (**) (#2.500)

resupe the value BC as the termetrial sensitive contexaments factor value. Do not reused this value to the memory interpre-metric value assigned for the termetrial commitive contexaments factor in Table 5-1. 5.1.2.8 Colouderies of methods population termetric contexamy value. Sum the values for the resident individual, resident

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the resident population throat. Enter this value in Table 5-1.

5.1.4 Calculation of resident population threat scare. Multiply the values for hand of exposure, weste characteristics. and targets for the resident population threat, and recent the product to the nearest integer. Assign this product as the resident population threat score. Enter this score in Table 5-L

5.2 Meanly population threat include in the nearby population only those individuals who live or attand school within a 1-mile travel distance of an area of observed contamination at the site and who do not most the criteria for secident individual as specified in section 5.1.1.

Do not consider areas of observed intian that have an attractiveness/ accessibility factor value of 0 (see section. 5.2.1.1) in evaluating the nearby population ألمسمله

5.2.1 Likelihood of expense. Eveloate two factors for the likelihood of expense factor category for the nearby populat threat: allowed venues / accessibility and area of contemportunities

5.2.1.1. Attractiveness/accessibility. Aurign a value for attractiveness/ accessibility ben Table 5-6 to each area of observed contemination, excluding any land used for socidences. Select the highest value od to the areas evaluated and use it as the value for the attractiveness/accessibility factor. Rater this value in Table 5-1.

5.2.1.2 Area of contemination. Evaluate area of contemination based on the total area of the areas of observed contamination at the site. Count only the area(a) that most the criteria in section \$.8.1 and that receive an attractiveness/accessibility value genter them 0. Assign a value to this factor from

TABLE 5-6 .- ATTRACTIVENESS/ ACCESSION/TY VALUES

Area of observed contentration	
Designated recreational area	100
enangia, fabing, tating, softent)	75
for example, vacant late in urban artigi	75
access improvements-for experies, grand cases, with some public recrea-	50
Penely and arts with no read in- provenient, with some public recru-	ø
Accessible, with no public recrustion with Removed by maintained force or	10
estilization of multiplications for and reliant lighting	5
entince of public recruition use	0

TABLE 5-7 .- AREA OF CONTAMINATION FACTOR VALUES

Total area of the areas of observed contamination (arguine fact)	
Loss Den er agud to 5,000	5 20 40
Greater than 250,000 to 570,000 Greater than 375,000 to 500,000 Greater than 300,000	80 80 108

52.1.3 Likelihood of exposure factor category value. Assign a value from Table 5-6 to fine Mullihood of exposure factor category, based on the values sociated to the structiveness/accessibility and area of contamination factors. Enter this value in Table S-1.

TABLE 5-8.---NEARBY POPULATION LIKELI-HORD OF EXPOSURE FACTOR VALUES

Area of contamination factor	Alaschessen/accestbilly						
		75	8	8	18	5	ŀ
109	-	580	5		15	50 55	
Ø		89	88	8.8	8	5	00
20	15	3 10	5	5 5	5 5	5 5	0

5.2.2 Waste characteristics. Brahaste weste characteristics based on two factors: tenicity and humadons weste quantity. Brahaste only these busardous substances that must the criteria for charge contamination (see contain by constraint contamination (see section 5.0.1) at some that can be assigned an athentiveness./ accountably factor when genetic than 0. 5.2.2.1 Texcisity: Assign a texticity factor value as specified in section 2.4.1.1 to each

section 5.2.2. Use the humanism ------nie in ----vice the highest testing sciences of a solar the highest testing factor value to cooler the value to the testing factor for the testing propulation threat. Inter this value in Table 5-1.

1 mm r-c. 5.2.2. Hangedour waste quantity. Assign a value to the housedous waste quantity factor as apacified in usedies 5.1.2.2. except: consider only these areas of observed contamination that can be assigned an attractiveness, accountility factor value greater than 0. Ther the value assigned in Table 5.4 Table 5-1.

\$223 Culculat n of wants characteristics factor catagory va Multiply the testicity and immedia quantity factor values, subject to (luus weste Manifely the trackely and humanian wave quantity factor values, subject to a maximum product of 1×10^{-5} . Based on this product, arright a value from Table 3-7 (section 24.5,1) to the waste characteristics factor cologory. Enter this value in Table 5-1.

Enter Bait Value in 1966 5-1. 5.2.3 Targets. Brokets the largets factory congery for the analy population threat based on two factors: analy individual and population within a 1-spike travel distance n the site.

5.2.3.1 Nearby individual. If one or mor persons must the section 5.1.3 criteria for a

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resident individual, assign this factor a value of 0. Enter this value in Table 5–1.

If no person meets the criteria for a resident individual, determine the shorte travel distance from the site to any residence or school. In determining the travel distance, measure the shortest overland distance an individual would travel from a residence or school to the nearest area of observed contamination for the site with an attractiveness/accessibility factor value greater than 0. If there are no netural barriers to travel, measure the travel distance as the shortest straight-line distance from the residence or school to the area of observed contamination. If natural barriers exist ffor example, a river), measure the travel distance as the shortest straight-line distance from the residence or school to the nearest crossing point and from there as the shortest straight-line distance to the area of observed contamination. Based on the shortest travel distance, assign a value from Table 5-9 to the nearest individual factor. Enter this value in Table 5-1.

TABLE	5-91	VEARBY	INDIVIDUAL	FACTOR
		VALU	ES	

Travel distance for nearby individual (miles)	Assigns value
Greater than 0 to %	- 1ª
Greater than % to 1	0

*Assign a value of 0 if one or more persons mee the section 5.1.3 criteria for resident individual.

5.2.3.2 Population within 1 mile. Determine the population within each travel distance category of Table 5-10. Count residents and students who attend school within this travel distance. Do not include those people already counted in the resident population threat. Determine travel distances as specified in section 5.2.3.1.

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located... Based on the number of people included within a travel distance category, assign a distance-weighted population value for that travel distance from Table 5–10.

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Calculate the value for the population within 1 mile factor (PN) as follows:

 $PN = \frac{1}{10} \frac{3}{\Sigma} W$

where:

W_i=Distance-weighted population value from Table 5–10 for travel distance

category i. If PN is less than 1, do not round it to the nearest integer, if PN is 1 or more, round to the nearest integer. Enter this value in Table 5-1.

8.2.3.3 Calculation of nearby population targets factor category value. Sum the values for the nearby individual factor and the population within 1 mile factor. Do not round this sum to the nearest integer. Assign this sum as the targets factor category value for the nearby population threat. Enter this value in Table 5-1.

TABLE 5-10 .-- DISTANCE-WEIGHTED POPULATION VALUES FOR NEARBY POPULATION THREAT *

			+	Number of p	people with	in the trave	i distance d	alegory		•	<u> </u>
Travel distance category (miles)	0 110 10	11 lb 30	31 10 100	.101 to 300	301 to 1,000	1:001 to 3:000	3,001 to 10,000	10,001 10 30,000	30,001 10 100,000	100,001 10 300,000	- 300,001 to 1,000,000
Greater than 0 to %(Greater than % to %(Greater item % to 1	0 0.1 0 0.05 0 0.02	0.4 0.2 0.1	1.0 0.7 0.3	4 2 1	13 7 3	41 20 10	130 85 33	408 204 102	1,303 652 326	4,081 2,041 1,020	13,034 6,517 3,258

*Round the number of people present within a travel distance category to nearest integer. Do not round the assigned distance-weighted population value to

5.2.4 Calculation of nearby population threat score. Multiply the values for likelihood of exposure, waste characteristics, and round the product to the nearby population threat, asign this product as the nearby population threat score. Enter this score in Table 5-1.

threat score, more this score in label 3-1. 5.3. Calculation of soil exposure pathway score. Sum the resident population threat score and the nearby population threat score, and divide the sum by 82,500. Assign the resulting value, subject to a maximum of 100, as the soil exposure pathway score (S_a). Enter this score in Table 5-1. 6.0 Air Migration Pathway

Evaluate the air migration pathway based on three factor categories: likelihood of release, waste characteristics, and targets. Figure 8-1 indicates the factors included within each factor category.

Determine the air migration pathway score {S_e} in terms of the factor category values as follows:



where:

LR = Likelihood of release factor category value.

WC=Waste characteristics factor category value.

T=Targets factor category value.

SF=Scaling factor. Table 6-1 outlines the specific calculation.

procedure.

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OVERVIEW OF AIR MIGRATION PATHWAY

TABLE 6-1 .-- AIR MIGRATION PATHWAY SCORESHEET

Factor categories and factors	Maximum velue	Value assigned
Likelihood of Release		
1. Obervid Release	. 550	
2. Potential to Release:		
22. Gais Foldmar D Helesse	500	
20. District to Belease Brither of loss 2a and 2b)	500	· - ·
3. Litelihood of Release Biober of Inset Land 20	550	
Waste Characteristics		
4. Toxicity/Mobility	(1)	
5. Hazardous Waste Cuently	(a)	 .
6. Waste Cheracteristics	100	
Targets	•	
	50	1 —
Ra Land Concentrations	6 4	
Ab Level & Concentrations		-
Bc. Potential Contentination	.	Ξ
8d. Papulation Gines Sa+8b+8c)	b h	_
9. Resources	5	-
10. Sensitive Environments		1.
10a. Actual Contemination	(0)	
10b. Potential Contamination	(C)	l
10C. Sensitive Environments (mas 10a + 10b)	10	·
	101	I —
12 Pathany Source 63 1/ (Source 3×6×11)/62 5001 4	100	•

rum value applies to waste characteristics category. num value not applicable. ecilic maximum value applies to factor. However, pr

es to factor. However, pathway score based solely on sensitive environments is limited to maximum of 60. specific me *Do not round to nearest intege

8.1 Likelihood of Release. Evaluate the likelihood of release factor category in terms of an observed release factor or a potential to release factor.

6.1.1 Observed release. Establish an observed release to the atmosphere by demonstrating that the site has released a hazardous substance to the atmosphere. Base this demonstration on either:

 Direct observation—a material (for example, particulate matter) that contains oue or more hazardous substances has been seen entering the atmosphere directly. When evidence supports the inference of a release of a material that contains one or more hazardous substances by the site to the atmosphere, demonstrated adverse effects accumulated with that release may be used to establish an observed release

Chemical analysis on analysis of air samples indicates that the concentration of

ambient hezerdous substance(s) has increased significantly above the background concentration for the site (see section 2.3). Some portion of the significant increase must be attributable to the site to establish the observed release.

If an observed release can be established, assign an observed release factor value of 550, enter this value in Table 6-1, and proceed to section 6.1.3. If an observed release cannot be established, assign an observed release factor value of 0, enter this value in Table 6-1, and proceed to section 61.2

6.1.2 Potential to release. Evaluate potential to release only if an observed release cannot be established. Determine the potential to release factor value for the site by separately evaluating the gas potential to release and the particulate potential to release for each source at the site. Select the

highest potential to release value (aither gas or perticulate) calculated for the sources evaluated and assign that value as the site potential to release factor value as specified below.

6.1.2.1 Gas potential to release. Evaluate gas potential to release for those sources that contain gaseous hazardous substances-that is, those hazardous substances with a vapor pressure greater than or equal to 10" torr.

Evaluate gas potential to release for each source based on three factors: gas containment, gas source type, and gas migration potential. Calculate the gas potential to release value as illustrated in Table 6-2. Combine sources with similar characteristics into a single source in evaluating the gas potential to release factors.

TABLE 6-2.-GAS POTENTIAL TO RELEASE EVALUATION

Source	Source type =	Ges containment factor value ^b	Gas source type Gas migration potential factor value 4		Sum	Gas source value
		A	8	C ·	(8 ∔C)	A(B+C)
2						
l R					······	
· · · · · · · · · · · · · · · · · · ·						
7						
L	l			L		
	Ges Poir	ntial to Relate Facto	r (Solect the Highest 6	Sas Source Valuet		

ter a Source Type listed in Table 4-4. Ter Gas Containment Factor Value from section 6.1.2.1.1. Her Gas Source Type Factor Value from section 6.1.2.1.2. Her Gas Migration Potential Factor Value from section 6.1.2.1.3.

61211 Gas containerst Assign each source a value from Table 6-8 for gas containment. Use the lowest value from

Table 8-8 that applies to the source, except: antign a value of 10 if there is evidence of bioges release or if there is an active fire within the source.

TABLE 6-3.-GAS CONTABLED T FACTOR VALUES

Ças cartalarını dassiştan	Annipped Vites
Al charless carept fiese specifically lated below	
	1 10
Baute substantially currented by anglessing whether and an other carticities specifically described in this table applies	
Uncontracting to a state of the second state o	
Seres Utly vegeties alle ende of set] ;
Uncertainty and Gener 21 hast and 23 hast • Series legally vegetated with generalizing an expressional and].'
-Cover sell type resident to gen algebien "	1 7
Sense substantially regulated with this expression of and sover sail type resistant to gas migration * Other	1 . 10
Uncenteningted and eaver <1 lost: • Source Legally vigotisted with escentially as appeard and cover sell type resistant to gas migration •	7 '
Construction of the second secon	1 7
entres angles stary or mails, many operations. • Tably political tem watther by regularly impacted. Maintained contra	

This value must be used if applicable.
 Canadar matrix the galaxies and saturated essage-primed saturation to gas migration. Consider all other solis narroublant.

6.1.2.1.2 Gue senare type. Assign a value for gue senare type to each senare as follows: • Determine if the senare marks the minimum dee requirement based on the senare basarites wate quantity value (see eccline 24.2.1.6). If the senare provides a senare basarites wate quantity value of 4.5 or mass, equilibri the senare to meet the minimum dee requirement. • If the senare marks the minimum size requirement, and in 1.6 value form Table 6-4 for gue senare type.

• If the second does not most the minimum size requirement, singly it a value of 0 for gas senece type.

If no secure at the airs meets the minimum size requirement, assign each secure at the airs a value from Table 6-4 for gas source -

TABLE 6-4 -- BOLINCE TYPE FACTOR VALUES

		Antyped		
Struce Ale	•••			
Actor to one	14			
Customer er tenta (kulad/kalan-				
• Enterne of blages release	30 11	2		
Carlaines er fille, det densken gestiltet	-	14		
Stationer()		11 12		

.

TABLE 6-4 -- SOURCE TYPE FACTOR VALUES-Concluded

	Antipart		
Starce filte	9		
Lenath: • E-idance of biogen release • No coldence of biogen release	30 11	22	
 Talings plit. Samp nadal er junk plit		30 17	
Contrict water pla Other water plan Surface impoundments flucted/	11	20	
Buidence of binges minnes The ordinance of binges minnes Softeen impermisent (not buried)	33 11	22	
• Obut	19 28	 0	
share sharillad	0		

6.1.2.1.3 Ges migration potential Brabuste this factor for each source as follows: • Assign a value for gas migration

potential to each of the passous bezordous substances associated with the source (see section 1.1.1] as follows:

- -Anign volues from Table 5-5 for vapor presente and Henry's constant to each beamdous substance. If Henry's constant cannot be determined for a seardons substance, easign that adous substance a value of 2 for
- the Henry's constant component. han the two values assigned to the bezardous rebetance.

- Brood on this sure, assign the houseday substance a value from Table 5-6 for gas migration potential. -
- Assign a value for gas migration stantial to each source as follows: -
- **Date**
 - -Select three hourdout subessecieted with the source:
 - ---If more then three generate betterben substances can be searcisted with the source, select three that here the highest gas migration potential wine's
 - -- If forer than these gassess hasardeus substances can be associated with a source, select all of them.
 - Average for gas subsetion potential values assigned to the subsetial beautions substances.
 - Based on this evenue value, assign the sevence a gas magnetical potential value source a gas mager from Table 6-7.

TABLE 6-5 .--- VALLES FOR VAPOR PRESSURE AND HENRY'S CONSTANT

Vapor processo (San)	Aniput
Grader Gen 10	3 2 1

.

itany's constant (ato-differe)	Annipunt
Greater than 10 ⁻³	3 2 1

,

.

.

TABLE 6-6 --- GAS MIGRATION POTENTIAL --VALUES FOR A HAZARDOUS SUBSTANCE

Sum of values for vapor pressure and	Assigned
Henry's constant	value
0	0 6 11 17

TABLE 6-7 .--- GAS MIGRATION POTENTIAL VALUES FOR THE SOURCE

Average of gas migration potential values for three hitzardous substances *					Assigned value	
0 10 < 3					0	
30 < 0	••				•	•

TABLE 8-7 .- GAS MIGRATION POTENTIAL VALUES FOR THE SOURCE-Concluded

Average of gas migration potential values for three hazerdous substances *	Assigned value
8 to < 14	51
14 to 17	17

* If fewer than three hazardous substances can be sciented with the source, compute the everage ad only on those hezerdous substances that can

6.1.2.1.4 Calculation of gas potential to release value. Determine the gas potential to release value for each source as illustrated in Table 6-2. For each source, sum the gas source type factor value and gas migration potential factor value and multiply this sum by the gas containment factor value. Select the highest product calculated for the sources evaluated and assign it as the gas potential to release value for the site. Enter this value in Table 6-1.

6.1.2.2 Particulate potential to release. Evaluate particulate potential to release for

those sources that contain particulate hazardous substances-that is, those hazardous substances with a vapor pressure less than or equal to 10^{-1} torr.

Evaluate particulate potential to release for each source based on three factors: particulate containment, particulate source type, and particulate migration potential. Calculate the particulate potential to release value as illustrated in Table 6-8. Combine sources with similar characteristics into a single source in evaluating the particulate potential to release factors.

6.1.2.2.1 Particulate containment. Assign each source a value from Table 6-9 for particulate containment. Use the lowest value from Table 6-9 that applies to the source.

6.1.2.2.2 Particulate source type. Assign a value for particulate source type to each source in the same manner as specified for gas sources in section 6.1.2.1.2.

6.1.2.2.3 Particulate migration potential. Based on the site location, assign a value from Figure 6-2 for particulate migration potential. Assign this same value to each source at the site.

1

TABLE 6-8.—PARTICULATE POTENTIAL TO RELEASE EVALUATION

Source	Source type *	Particulate containment factor. value *	Particulate type factor value *	Particulate migration potential factor value ⁴	Sum	Particulate source value				
1		A :	B	C	(B+C)	A (B+C)				
2										
3		······	· · · · · · · · · · · · · · · · · · ·		······································	<u> </u>				
5		· · · · · · · · · · · · · · · · · · ·			······································					
6										
7		ļ								
Particulate Potential to Refease Factor Value (Select Highest Particulate Source Value)										

ed in Table 6o Type list

alue from section 6.1.2.2.1. alue from section 8.1.2.2.2. ctor Value from section 6.1.2.2.3.

TABLE 6-0.-PARTICULATE CONTAINMENT FACTOR VALUES

Particulate containment description	Assigned value .
All situations except those specifically listed below	10
Source contains only periodiale hezardous substances totally covered by liquids	0
Source substantially surrounded by engineered windbrask and no other containment specifically described in this table applies	1.7 6.
Source covered with essentially impermeable, regularly inspected, maintained cover	. 0
U-contaminated soil cover > 5 feet	1
 Source substantially vegetated with little or no exposed soil	0
Source lightly vegetated with much exposed soil	3
Source substantially devoid of vegetation	7
Uncontaminated soil cover > 1 foot and < 8 feet:	
Source beauty vacatated with essentially no exposed soil:	· ·
-Cover soil type resistant to case micration *	3
-Cover soil type not resistant to ose migration * or unknown	7
Source substantially vigostated with little exposed soil and cover soil type resistant to gas migration *	7
+ Other	. 10
Unconteminated and cover < 1 fast:	
• Source hereit wortsted with essentially no emosed coll and cover coll type resistant to get micration *	7
• Other	10
Totally or partially ancionad within structurally intact building and no other containment executed in this table applies	.7
Source consists adiaby of containents	
Al containers contain only louids	
All containers intact, seeled, and totally protected from weather by requisity inspected, maintained cover	ŏ
• All containers intert and seeled	a a
• Other	10
	1

Consider moist fine-grained and saturated coarse-grained solls resistant to gas migration. Consider all other solls nonresistant.

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FIGURE 6-2.-PARTICULATE MIGRATION POTENTIAL FACTOR VALUES-CONCLUDED

Location	Particulate migration potential assigned value
Haveilian Ialanda Hilo, Havail Hinotuta, Cahu Kahului, Maul Larini Larini Larini Larini Larini Motokai Motokai	0 17 17 17 11 17
Guara Johnston Island Koror Island Kwejalein Island Mujuro, Marchall Islanda Pego Pago, Asserican Samoa Porispe Island Truti, Caroline Islands	5 17 0 6 0 0
Vap Island. Aleska Ancharsge Berrow	17 0 17 17 17 17 17
Big Delta	17 8 17 17 11 0 11 0
McGrath Norne St. Paul Island Talkoete Unstaldoot Viddaz Viddaz Amarican Visgin Islands	17 11 11 6 17 0 0
St. Crobr	17 11 11 6 6 11 6
Ponce	17 11

For site locations not on Figure 6-2, and for site locations near the boundary points on Figure 6-2, assign a value as follows. First, lculate a Thornthwaite P-E index using the following equation:

 $PE = \sum_{j=1}^{16} 115 \left[P_j / (T_j - 10) \right]^{10/9}$

PE=Thornthwaite P-E index. P.= Mean monthly precipitation for month i, in inches.

where:

T.-Mean monthly temperature for month i, in degrees Fahrenheit; for any month having a mean monthly temperature less

than 28.4 T, use 28.4 T. d on the calculated Thornthwaite P-B index, absign a source particulate migration potential value to the site from Table 6-10: Assign this same value to each source at the site.

TABLE 6-10 .- PARTICULATE MIGRATION POTENTIAL VALUES

Π	nomthwaite f	-E Index	Assigned
Greater th 85 to 150. 50 to less Less then	un 150 than 85 50		0 6 11 17

6.1.2.2.4 Calculation of particulate stantial to release value. Determine the particulate potential to release value for each source as illustrated in Table 6-8. For each source, sum its particulate source type factor value and particulate migration potential factor value and multiply this sum by its particulate containment factor value. Select the highest product calculated for the sources evaluated and assign it as the particulate potential to release value for the site. Enter the value in Table 6-1.

6.1.2.3 Calculation of potential to release factor value for the site. Select the higher of the gas potential to release value assigned in section 6.1.2.1.4 and the particulate potential to release value assigned in section 6.1.2.2.4 Assign the value selected as the site potential to release factor value. Enter this value in Table 6-1.

6.1.3 Calculation of likelihood of release factor category value. If an observed release is established, assign the observed release factor value of 550 as the likelihood of releas factor category value. Otherwise, assign the site potential to release factor value as the likelihood of release factor category value. Enter the value in Table 6-1.

6.2 Waste characteristics. Evaluate the waste characteristics factor category based on two factors: toxicity/mobility and hezerdous weste quantity. Evaluate only those bazardous substances available to migrate from the sources at the site to the atmosphere. Such hazardous substances Incinde:

 Hezardous substances that meet the criteria for an observed release to the atinoi herė.

 All gaseous hazardous substances associated with a source that has a ge containment factor value greater than 0 (see section 2.2.2, 2.2.3, and 8.1.2.1.1).

 All particulate hazardous substances associated with a source that has a particulate containment factor value greater than 0 (see section 2.2.2, 2.2.3, and 6.1.2.2.1).

6.2.1 Toxicity/mobility. For each hezardous substance, assign a toxicity factor value, a mobility factor value, and a combined toxicity/mobility factor value as specified below. Select the toxicity/mobility ctor value for the air migration pathway as specified in section 6.2.1.3.

8.2.1.1 Toxicity. Assign a toxicity factor value to each hazardous substance as specified in section 2.4.1.1.

6.2.1.2. Mobility. Assign a mobility factor value to each hazardous substance as follows

· Geseous hazardous substance.

- Assign a mobility factor value of 1 to each gaseous hazardous substance that meets the criteria for an observed release to the atmosphere.
- Assign a mobility factor value from Table 6-11, based on vapor pressure, to each gaseous bazardous substance that does not meet the criteria for an observed release.
- Particulate hazardous substance.
- Assign a mobility factor value of 0.02 to each particulate hazardous substance that meets the criteria for an observed release to the atmosphere. Assign a mobility factor value from Figure 6-3, based on the site's location. to each particulate hazardous substance that does not meet the criteria for an observed release. (Assign all such particulate hazardous substances this same value.)

For site locations not on Figure 6-3 and for site locations near the boundary points on Figure 6-3, assign a mobility factor value to each particulate hazardous substance that does not meet the criteria for an observed

release as follows:

Calculate a value M:

M=0.0182 (U*/(PE)*) where:

U-Mean average annual wind speed (meters per second). PE=Thornthwaite P-B index from section 6.1.2.2.3.

Based on the value M, assign a mobility factor value from Table 6 12 to each particulate hazardous substance.

Gaseous and particulate hazardous mhatances

For a hazardous substance potentially present in both gaseous and particulate forms, select the higher of the factor values for gas mobility and particulate mobility for that substance and assign that value as the mobility factor value for the hazardous aubstance.

6.2.1.3 Calculation of toxicity/mobility factor-value. Assign each hazardous abstance a toxicity/mobility factor value from Table 6-13, based on the values assigned to the hazardous substance for the toxicity and mobility factors. Use the azardous substance with the highest toxicity/mobility factor value to assign value to the toxicity/mobility factor for the air migration pathway. Enter this value in Table 5-1.

TABLE 6-11.--GAS MOBILITY FACTOR VILLERS

TABLE 6-11.-GAS MOBILITY FACTOR VALUED-Concluded

* Do not round to assess integer.

.....

BRANK CORE SHO

i

ŝ

 Vaguer pressure (Tung)
 Antipres

 Genetar Stan 10⁻¹
 1.0

 Genetar Stan 10⁻¹
 1.0

 Genetar Stan 10⁻¹
 1.2

 Genetar Stan 10⁻¹
 10⁻¹

Vaper pressure (Tent	Andgened Value *
Greater San 10 ⁻¹ to 10 ⁻¹	8.502 0.0082



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/ Vol. 55; No. 241 / Friday, December 14, 1980 / Rules and Regulations





^aDo not round to nearest integer.

FIGURE 6-3 PARTICULATE MOBILITY FACTOR VALUES[®] (CONTINUED)

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FIGURE 6-3. PARTICULATE MORLITY FACTOR VALUES-CONTINUED

Lasten	
Pecific Islands Gaun Jahardan Island Hayer Mand Hayer Mand Hayer Mand Page Page, Anaplest Suma Page Page, Anaplest Suma Page Island Page Island Yap Island Yap Island	Lante Lante Lantes Lantes Lantes Lantes Lantes Lantes Lantes

FIGURE 6-3 -- PARTICULATE MOBILITY FACTOR VALUES-CONCLUDED

Location en Virgin islands St. Costr. 0.00 0.0002 St. Thomas 0.0002

TABLE 6-12 .- PARTICLE ATE MOBILITY FACTOR VALUES

۲.	Andpad vitre*
Greater than 1.4 × 10-*	0.02
Greater than 4.4 × 10 ⁻¹ 10	6.806
4.4 × 10 ⁻¹	0.002
1.4 × 10 ⁻⁴	0.0000
Greater than 4.4 x 10 ⁻⁶ to	
Loss than or equal to 4.4 x 10"*	0.00000

Do not musel to network interest.

TABLE 8-13 -- TOROCITY/MOBILITY FACTOR VALUES *

		Taxially lactor value							
	10.000	1,000	100	10	1	•			
12	16,000	1,000	100	10	1	0			
	200			i i i i i i i i i i i i i i i i i i i		ĕ			
	20	2	0.2						
	2	6.2	-						
	0.2	0.82	0.002	•	0.00002	Ō			

*Do not round to measure integer.

6.2.2 Histordeur wente quantity. Aoriga a insurdeur wente quantity fictur value for the or migration patienty as specified in section 24.2. Bater this value in Table 6-2.

A.2. Datase this values in Table 6-1. 0.2.3 Calculation of wants characteristics inter-category value. Multiply the trajectry ratio quantity factor value, subject to a method, and by a value from Table 3-7 method. And a value from Table 3-7 method. A state of the value in Table 6-4. and a

research 24.3.1 is the ware characteristical of factor catagory. Both dis value in Table 0-1. 4.3 Targets. Bruhast the tagets factor catagory based on four factour assess individual, inter, mourner, and separative polotion, sciences, and seadow economics. Exclude only these targets (for sample, individuals, contribut contributions) cated within the 4-contributions of concept If an observed science is tableded beyond the 4-cole target distance all, include they additional targets that are socilied below in this section and is section

414 34. Deducto the measure individual and reputeting factors based on whether the reput pepulations are subject to Lovel 1 encontextuations. Lovel 21 concentrations, or retartial contemporters. Determine which splites to a taget pepulation as fallows. If no results must the criteris for an hearvest subces to als and 21 there is no hearvest subces by direct observation, consider the estimation within the main taget distance limit to be subject to contexting extendentian. 0

tential contemboritor.

If one or more supplies most the criteria for

E can at more samples must the criteria for an observed minore to air or if there is an observed solence by direct observation, evolute the population as follows: • Determine the most distant sample location that mosts the criteria for Level 1 concentrations as specified in sections 2.5.3, and 2.5.2 and the most distant location (that is some location on direct location (that in, comple location or direct inclusion (chin becation) that mosts the actions for Lovel II concentrations. Use the health-based benchmarks from Table 6-14 in determining the level of course the level of contamination for sample locations. If the most distant Level B location is chosen to a source than the most distant Level B location. • Determine the single most distant location (sample location or direct observation location) that m. to the criteria for Local Law Level B constructurions. minution for so

for Level I or Level II concentrations.

ser Level 1 or Level 8 concentrations. • If this single most distant location is within the 4-mile target distance limit, identify the distance categories from Table 0-15 is which the selected Level 1 concentrations sample and Level 8 concentrations sample (or direct observation location) are located:

- -Ceasifier the terget population anywhere within this furthest Level | distance category, or anywhere within a distance category closer to a source at the site, as subject to Level | 000 .
- -Consider the target population located beyond any Level I distance

cotogories, up to and including the population paywhere within the furthest Loval II distance category, as whigher to Loval II concentrations.

explore to Leves a conservation Consider the sensitive of the target population within the 4-safe target distance limit or subject to potential contemination.

• If the single most distant Jocation is beyond the 4-mile target distance limit, identify the distance at which the selected Level I concentrations easyle and Lovel II concentrations easyle (or disect observation location) are located:

- -If the Lovel I comple location to within the 4-mile target distance limit, identify the target population subject to Lovel I concentrations as specified obove.
 - -If the Lovel I campt in spectrate errors. -If the Lovel I campt distance limit, consider the target population located anywhere within a distance from the . any more want a applie pair he concerts of the size equal to the distance to this sample location to be subject to Loval I concentrations and include them in the evaluation.
 - Consider the target pepulation located beyond the Level I target pepulation, but located anywhere within a distance from the sources at the one open to the distance to the selected Level II location, to be subject to Level II concentrations and include them in the evidention.

-Do not include any target population as subject to potential contamination.

TABLE 6-14.--HEALTH-BASED BENCHMARKS FOR HAZARDOUS SUBSTANCES IN AIR

- Concentration corresponding to National Ambient Air Quality Standard (NAAQS).
- Concentration corresponding to National Emission Standards for Hazardous Air Pollutants (NESHAPs).
- Screening concentration for cancer corresponding to that concentration that corresponds to the 10⁻⁴ individual cancer risk for inhelation suppowers.
- Screening concentration for noncencer toxicological responses corresponding to the Reference Dose (RID) for inhelation exposures.

TABLE 6-15.---AIR MIGRATION PATHWAY DISTANCE WEIGHTS

Distance category (miles)	Assigned distance weight*
0	1.0 0.25 0.054 0.0051 0.0023 0.0023 0.0014 0

* Do not round to nearest integer.

8.3.1 Nearest individual. Assign the nearest individual factor a value as follows:

• If one or more residences or regularly occupied buildings or areas is subject to Level I concentrations as specified in section 0.3, assign a value of 50.

 If not, but if one or more a residences or regularly occupied buildings or areas is subject to Level H concentrations, assign a value of 45.

• If none of the residences and regularly occupied buildings and areas is subject to Level I or Lovel II concentrations; assign a value to this factor based on the shortest distance to any residence or regularly occupied building or area, as measured from any source at the site with an air migration containment factor value greater than 0. Based on this shortest distance, assign s value from Table 6–16 to the nearest individual factor.

Enter the value assigned in Table 6-1.

TABLE 6-16.—NEAREST INDIVIDUAL FACTOR VALUES

Distance to nearest individual (miles)	Assigned value
Level 1 concentrations *	50 45 20 7 2 1 0

* Distance does not apply.

6.3.2 Population. In evaluating the population factor, count residents, students, and workers regularly present within the target distance limit. Do not count transient populations such as customers and travelers passing through the area.

In estimating residential population, when the estimate is based on the number of residences, multiply each residence by the average number of persons per residence for the county in which the residence is located.

6.3.2.1 Level of contamination. Evaluate the population factor based on three factors: Level I concentrations, Level II

concentrations, and potential contamination. Evaluate the population subject to Level I concentrations (see section 6.3) as specified in section 6.3.2.2, the population subject to Level II concentrations as specified in section 6.3.2.3, and the population subject to potential contamination as specified in section 6.3.2.4.

For the potential contamination factor, use population ranges in evaluating the factor as specified in section 6.3.2.4. For the Level I and Level II concentrations factors, use the population estimate, not population ranges, in evaluating both factors.

6.3.2.2 Level I concentrations. Sum the number of people subject to Level I concentrations. Multiply this sum by 10. Assign the product as the value for this factor. Enter this value in Table 6-1.

6.3.2.3 Level II concentrations. Sum the number of people subject to Level II concentrations. Do not include those people already counted under the Level I concentrations factor. Assign this sum as the value for this factor. Enter this value in Table 6-1.

6.3.2.4 Potential contamination. Determine the number of people within each distance category of the target distance limit (see Table 6-15) who are subject to potential contamination. Do not include those people sitesdy counted under the Level I and Level II concentrations factors.

Based on the number of people present within a distance category, assign a distanceweighted population value for that distance category from Table 6-17. (Note that the distance-weighted population values in Table 6-17 incorporate the distance weights from Table 8-15. Do not multiply the values from Table 6-17 by these distance weights.)

Calculate the potential contamination factor value (PI) as follows:

$PI = \frac{1}{2} \sum_{i=1}^{n} W_i$

where:

W₁=Distance-weighted population from Table 6-17 for distance category i. n=Number of distance categories.

If Pl is less than 1, do not round it to the nearest integer: if Pl is 1 or more, round to the nearest integer. Enter this value in Table 6-1.

6.3.2.5 Calculation of population factor value. Sum the factor values for Level I concentrations, Level II concentrations, and potential contamination. Do not round this sum to the nearest integer. Assign this sum as the population factor value. Enter this value in Table 6-2.

TABLE 6-17 .-- DISTANCE-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FACTOR FOR AIR PATHWAY *

	Number of people within the distance category												
Distance category (mEda)	0	1 to 10	11 10 30	31 to 100	101 10 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 10 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,001 to 3,000,000
On a source Gester than 0 to 14	0000000	4 1 0.2 0.05 0.02 0.009 0.009	17 4 0.9 0.3 0.00 0.04 0.02	53 13 3 0.9 0.3 0.1 0.07	164 41 9 3 0.8 0.4 0.2	522 131 26 8 3 1 9,7	1,633 408 86 26 8 4 2	5,214 1,304 262 83 27 12 7	16,325 4,061 862 261 63 36 23	52,137 13,034 2,815 834 265 120 73	163,246 40,812 8,815 2,612 833 375 229	521,380 130,340 28,153 8,342 2,659 1,199 730	1,632,455 408,114 88,153 28,119 8,326 3,755 2,285

* Round the number of people present within a distance category to nearest integer. Do not round the assigned distance-weighted population velue to nearest integer.

6. 3 Resources. Evaluate the resources factor as follows:

 Assign a value of 5 if one or more of the following resources are present within one-

half mile of a source at the site having an air

igention operiolement fingtor volge granter

- -Commercial agriculture. -Commercial advisations.

-Major in distincted interestion area - Major in distinction and - Analyse while of 9 I state of these

pplice as present. If no complex uport the cultural for an instruct subsets to air and if there is no

electron release to air and if there is to electron ulease by direct electronics, consider all consider conferences beated, partially or which, while the target distance limit to be subject to priorital contententies. If one or more complex test the affects for an observed misses to air or if there is in observed subsets to direct theorytoins, determine the most distant location (that is, comple location or direct theorytoins invalue) that most the other is in tion) that mosts the exterio for an

 B the most distant location mosting the collection for an elegenced universe to within the 4-mile largert distance limit, identify the distance collegency from Table 6-45 in which it de lares £

- Canadar soughtre andreasants 'Secuted, partially or wholly, anyw while this distance category or approase while a distance category esputate villate a distance estagery clear to a source at the site as ordered to estad contententies. Consider all other constitute contentency is beached, partially or whelly, which the target distance has an estimate to potential contentiesters. the most distant location meeting the is for an element

• 11 If the most distant location moo to far an observed selecate is by ince at which it is hanged: -Consider consider antipegnet - **1** -ا عل

Cristifier searcher conferencess increted, pertitility or whethy, say who within a distance from the services a der othe equal to the distance to this incretion to be subject to actual contamination and include all each na ad essentions environments in the

-Do bet include any seasitive anticummate as subject to potential

LAA Actor of contembrates. Determine a constitute conference of conference of contembrates (L., there beyond faily as whally within a distance cong into to actual contembratical. Action with Days Table 4-82 (contine 41.4.1.1) with constitute conference and best to n. Di 6344 Admil of 414311 Ĩ,

ected contemination. The door condition contemposite that are worknow, contex as additional value from Table 6-10. In insighting a value from Table 6-10. Include only these patterns of postando incuted within distance comparise united to incuted within distance eininginia unifert i entrel contemination. If a wedland in incut perially in a distance and echel catteparten an persony a sur exhiet to general contentation for each for perpass perton in the distance entrying subject to privated contentation under the potential

.

•

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contemination factor in section 6.3.4.2. Determine the total across of workerds within these distance congeries subject to actual contemination and angin a value from Table 6-16 based on this total ecrospe. Céleslete the ectual contamination for

minution factor alue (EA) as follows:

WA - Value analysed from Tuble 6-18 for wedands in distance categories subject to actual contamination.

n-Number of sensitive suvironments subject to actual contamin

Baier the value sesigned in Table 6-1.

TABLE 6-18.-WETLANDS RATING VALUES FOR AR MORATION PATHWAY *

Waland ana (arrol)	
Lass then 1	0
1 to 10-	11 To
Geoder Sup 100 to 201	175
Granter fram 200 to 400	30
Geneter See 111	500

Walkands as defined in 48 CFR section 238.1.

6.3.4.2 Potential contemination. Determine these selective survivements located, partially or whelly, within the target detence limit that are subject to potential contemination. Assign value(a) from Table 4-21 to each semittive environment subject to potential contemination. Do not include these semittime environments already constant itive environments already counted for Table 4-33 under the actual

ination factor. For each distance category subject to exected contradaction, sum the value(a) seigned from Table 4-23 to the sensitive virtuments in thet distance category. If a militize excitational is located in more than ense distance astrony, assign the smaller and distance astrony, assign the smaller andronanced astro to that distance category having the highest distance weighting value -

a Table 6-15 For these sensitive early-assesses that are welfinds, assign an additional value from Table 6-58. In assigning a value from Table 6-58. Include only these pertison of vertaents located within distance categories subject to printial contemination, as specified in section 6.8.4.1. These the welfands in each Per these seen courses waves. I near ust werdances in each separate distance category as separate sensitive environments solely for purpose applying Table 6-18. Determine the total ecrosors of workeneds within each of these distance environments and the sole of these as al distance cologonias and assign a separate value from Table 0-38 for each distance

Colonists the poly ettel quat minetion factor value (EP) as fallows:

$IP = \frac{1}{10} \frac{1}{j=1} \{W_j + S_j D_j\}$

Wheeler

S. - Value(a) assigned from Table 4-23 to consiste stretenment in distance

S,= I Sa j=1

cologory j. cologory j. p - Number of consider confermants subject to secondial contembertion.

- to potential contentiation. W,=Value assigned from Table 6-29 for worked area in distance cologory j.
- D, Distance weight from Table 8-15 for distance cologory j.
- clistance colligary j. m = Number of distance colligaries subject to potential contamination. If IP is less than 1, do not sound it to the

nerest integer; if EP is 1 or more, south to the nearest integer. Buter the value artigand in Table 8-1.

6.3.4.3 Calculation of sensitive environments factor value. Sum the factor values for actual contamination and potential contemination. Do not sound this sum.

designated as ID, to the network integer. Decause the pathway scare based onlely on sensitive covisements is limited to a maximum of 60, use the value 22 to determine the value for the sometive

environments factor as follows: Maitiply the values assigned to Multiple of selence (LR), waste

characteristics (WC), and EB. Divide the product by \$2,500.

- -If the secolt is 60 or loss, assign the value ID as the consistve anvietam factor value.
- -If the result exceeds 60, calculate a value IIC as follows:

(00)(02,000) BC 🛥 **EEDIWC**

Assign the value BC as the sensitive servicements factor value. Do not round environments factor value. I this value to the nearest inte .

Bater the value assigned for the sensitive nents fatter in Table 6-1.

635 Calculation of targets factor regory value. Sum the neurost individual, prelation. managers and stargets individual. population, resources, and sensitive environments Tectur values. Do not round this run to the nearest integer. Adoign this own to the targets factor cologory value. Enter this value in Table 8-2.

4.4 Calculation of air interation pathway acars. Makingly the values for Malikeed of release, waste characteristics, and impos, and round the product to the nearest integer. Then divide by \$2,300. Assign the result Ň. value, orbitation y sectors constraints where of 200, a the air migration pathway acore [5,]. Botor this accore in Table 0-1. a value of 100, as

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7.0 Sites Containing Radioactive Substances.

In general, radioactive substances are hazardous substances under CERCLA and should be considered in HRS scoring. Releases of certain radioactive substances are, however, excluded from the definition of "release" in section 101(22) of CERCLA, as amended, and should not be considered in HRS scoring.

Evaluate sites containing radioactive substances using the instructions specified in sections 2 through 6, supplemented by the instructions in this section. These factors denoted with a "yes" in Table 7-1 are evaluated differently for sites containing radioactive substances than for sites containing only nonradioactive hazardous substances, while those denoted with a "no" are not evaluated differently and are not addressed in this section.

TABLE 7-'	1HRS I	FACTORS E	EVALUATED	DIFFERENTLY	FOR F	ADIONUCLIE	JE8

Ground water pathway	Status*	Surface water pathway	Status *	Soil exposure petimey	Status *	Air pathway	Status *
Likelihood of Release	·	Likelihood of Release		Likelihood of Exposure		Likelihood of Relates	
Observed Release	No No No	Observed Release	Yes No No	Observed Contamination Atractivenees/Accessibility to Nearby Residents Area of Contamination	Yes No No	Observed Release Gas Potential to Release Gas Containment	Yes No No
Uspen to Aquiter Travel Time	No No	Distance to Surface Water. Flood Frequency Flood Containment	No No No			Gas Migration Potential Particulate Potential to Refease	NO NO NO NO
Waste Characteristics	{ ·	Waste Characteristics	ł	Waste Characteristics		Waste Characteristics	1.
Tonicity	Yes	Toxicity/Ecotoxicity	Yes/	Toxicity	Yes	Toxicity	Yes
Mobility	No Yes	Persistence/Mobility Bioscomulation Potential Hazardous Waste Quantity	Yes/No No Yes	Hazardous Waste Quantity	Yes	Mobility Hazardous Waste Quantity	No Yes
Targets .		Targets	{	Targets	ļ	Targets	ł
Noerest Well	Yes* Yes* No No	Nearest Intake Drinking Water Population Resources Sanstitue Environments Human Food Chain Individ- ual Human Food Chain Popula- tion.	Yes* Yes* No Yes* Yes*	Resident Individual Resident Population	Yes" Yes" No No No	Neerest Individual Population Resources Sanstive Environments	Yes* Yes* No No
·				Population Within 1 Mile	No No		· .

Factors evaluated differently are denoted by "yes"; factors not evaluated differently are denoted by "no."
 Difference is in the determination of Level I and Level II concentrations.

In general, sites containing mixed radioactive and other basardous substances involve more evaluation than sites containing only radionuclides. For sites containing mixed radioactive and other hazardous substances, HRS factors are evaluated based on considerations of both the radioactive substances and the other hazardous substances in order to derive a single set of factor values for each factor category in each of the four pathways. Thus, th. HRS score for these sites reflects the combined potential hazards posed by both the radioactive and other hazardous substances.

Section 7 is organized by factor category, similar to sections 3 through 6. Pathwayspecific differences in evaluation criteria are specific dunder each factor category, as appropriate. These differences apply largely to the soil exposure pathway and to sites containing mixed radioactive and other hazardous substances. All evaluation criteria specified in sections 2 through 6 must be met, except where modified in section 7.

7.1 Likelihood of release/likelihood of exposure. Evaluate likelihood of release for the three migration pathways and likelihood of exposure for the soil exposure pathway as specified in sections 2 through 6, except: establish an observed release and observed contamination as specified in section 7.1.2. When an observed release cannot be established for a migration pathway, evaluate potential to release as specified in section 7.1.2. When observed contamination cannot be established, do not evaluate the soil exposure pathway.

7.1.1 Observed release/observed contamination. For radioactive substances, establish an observed release for each migration pathway by demonstrating that the site has released a radioactive substance to the pathway (or watershed or aquifer, as appropriate); establish observed contamination for the soil exposure pathway as indicated below. Base these demonstrations on one or more of the following, as appropriate to the pathway being evaluated:

Direct observation:

-For each migration pathway, a material that contains one or more radionuclides has been seen entering the atmosphere, surface water, or ground water, as appropriate, or is known to have entered ground water or surface water through direct deposition, or

-For the surface water migration pathway, a source area containing radioactive substances has been flooded at a time that radioactive substances were present and one or more radioactive substances were in contact with the flood waters.

• Analysis of radionuclide concentrations in samples appropriate to the pathway (that is, ground water, soil, air, surface water, benthic, or sediment samples):

- -For radionuclides that occur naturally and for radionuclides that are ubjouttous in the environment:
 - --Measured concentration (in units of activity, for example, pCi per kologram (pCi/kg), pCi per liter (pCi/1), pCi per cubic meter (pCi/ m²) of a given radionuclide in the sample are at a level that:
 - ---Equals or exceeds a value 2 standard deviations above the mean site-specific background concentration for that

ulide in that type of uple, er ande file up

- en the upper-limit out o surge of regional present concerned 1
- » for that specific successful to the specific of the specific sector of the sector of the specific sector of the
- earph. Inne parties of the increase must be attributable to the alte to establish the observed selecce (or observed al. and
- For the self appearse patterny only. Ant and fan ar correso. Automatical flor Automatical present at the summer motorial 2 feat or lass of cover motorial pla, pail) in a
- nes made sedlenschides without phone background concentrations -Net a - 51 -
- n fin weite of Manualist in essented essententine (in unite of eccledy) of a given redevective in a sample equals or extended for excepte quantitative limit for the excepte productive limit for the specific redistorchies in that type of media and is efficientiate to the
- e, if de solicentes statis quite e associ des link, bet lo statis u ple quant nero can also be efficiented to a ar more neighboring eiten. A a generoud concentration of th 4.0 ion of the it also equal or ther 2 standard and a value of destations abore the press announceptes of the realized -. castalisted by these seighboring alone at 3 times in bothground
- tion, whichever is inver------n Kest at he e
 - net be established -E the comple analysis was performed under the BPA Capture Laboratory Program, use the BPA context-required another limit (CRQL) in ince of the sample particular limit in addining on oh ilian ano for abou **rva**ľ
 - 2 A و ما ما 20 The complex conjucts is to performed under the UPA Content Laborary Property use the detection last in place of the energy
- quantitation back. -Per the coll expresses patternay only. the uniformatide trans also be present at the mathete or correct by 2 feet or lass of error material flor emargin, and to astablish chearved combinities.

Commo multiplies measurements (oppli-eatly to observed contamination for the soil expenses pathway);

- -The ge
- The gamme indication expresses sets, as managed in informations per hour (eff./fec) using a current functioner hold 1 mater above the ground exclose (or 1 mater curry from an aboveground second, cyanto or exceeds 2 times the observed to be a current or times the ant beld nd explace (or 1 senerei, openie er enter ste-specific background militäre experier tele. pound genues

-Bone portion of the increase must be alleftuitable to the ate to establish observed contamination. The passmo-emitting radiancilides do not have to be which 2 fact of the surface of the

Per the these migration polyways, if an observed release can be established for the settemy (or equifar or waterched, as appropriate), assign the polyway (or equifar in waterched) as observed release factor rules of 500 and proceed to socilon 7.2. If an observed release cannot be established, attended to be the solution of the solution. m an observed release factor value of 0 nd proceed to section 7.1.2.

The process of second 7.12. For the self expanse pathway, if observed instantianties can be established, assign the instantion of exposure factor for resident spalation a value of 500 if there is an area of erved contamic eties is one or more n listed in section 5.1; evaluate the aparties and an expensive factor for manby spaleties as specified in section 5.2.1; and record to section 7.3. If observed ation cannot be established, do not

ovaluate the soil exposure po thway. At allos containing mixed redioactive and other hexerdous substances, evaluate observed release (or observed contentioning in this section and for other dous substances as described in ms 2 through 6.

Per die tesen migration palloways, if an Norred selece can be established based on Marmalisanciides ar other hazardeus count managements or other accurates substances, or both, ansign the policy (or appling or watershell) an observed release faster value of 300 and precord to section 7.2. If an observed valuese cannot be established boatd on either radionacticles or other no substances, assign as observed incorvoine of 0 and proceed to ana fact -8711

Per the coll exposure pathway, if abserved contamination can be established based on other radianuclides or other herardous versat interestation or versat attactions substances, or both, assign the likelihood of experime factor for resident papulation a verse of 500 ff there is an area of observed Valids of now 2 travers is an arrow or observe contamination in one or more locations is in section 5.1; evaluate the likelihood of exponence factor for searby population on specified in section 5.2.1; and proceed to excitin 7.2. If observed contamination co na listed esclies 7.2. If electroid contamination cannot be established based on either radiosuclides er henerdous enbetances, de apt er að

er other hemeridese explosionces, co my: evaluate the soil expensive pathway. 7.1.2 Poten. V to release. For the three mignetics pathways, evaluate potential to release for sites containing radiomedicies in the same measure as opecified for sites ass for mean under as opecified for sites taking other besardous substances. Base evaluation on the physical and chamical formacildes, not on their ية عد properties or the second level of radioactivity.

containing mixed radio show substances. cush **For sites contain** ictive and ther hannedous substances, evaluate stantial to release considering radiosuchide ad other basardous substances together. Brainste potential to selence for each nigration pathway as specified in sections 3. 4. or 6. as appropriate. 7.3 Waste characteristics. For radioactive

non, evaluate the human toxicity factor, the acception texicity factor, the surface water persistence factor, and the basardous weste quantity factor as specific in the following sections. Evaluate all other waste characteristic factors as specified in ----m 2 through 4.

7.2.1 Human tanicity. Per sufficientive substances, evaluate the bound tanicity factor as epacified balance, not as epacified in section 2.4.1.1.

Assign business testicity factor values to ones sufficientiaties available to the pathway used on quantizative dess suspanse irometers for cancer siells as follows: • Booleste redissacilides only on the basis 20

- avanues redisancides only on the basis of curchequicity and assign all radiancilies to weight of oxidence entropy A.

 Assign a human tendelty factor value from Table 7-2 to each redistincted based on its aloge factor (also referred to as cancer potency factor).

- Per each sulicancilde, use the higher of the slope factors for inholation and ingestion to aissign the factor value.
 If only one slope factor is available for the subisaucible, use it to assign the texicity factor value. funcicity factor we
- testicity secure verse. If no shape factor is available for the subsequelists, averge that radiosectide a taxicity factor value of 0 and use other subsequelistss for which a slope factor is available to evaluate the

pathway.

pathway. • If all inclumediates available to a particular-pathway are assigned a horner backetly factor value of 0 (that is, no slope factur is ovailable for all the milisoucides), use a default horner twickly factor value for all and/soucides available to the pathway. At also containing mixed relicacitive and other hornedistic quarter, where the twickly factor separately for the relicacitive and other hornedison substances and assign each a separate testicity factor value. This applies expendies of whether the relicacitive and other hornedison substances are physically measured, combined chamically. applies segmediese of whether the reflexitiv and other housedness substances are physically separated, combined chanically, or simply mixed together. Assign toxicity factor values to the andiametides as specific above and to the other housedness substance

veille or another homentees another and a second se

and 4.2.4), easign an econystem texticity for value to radioanclishs follows or combined chemically arratmed with other hazardow ad l substances) using the same slope factors and

rocedures specified for the human toxicity procedures specified for the manner warner factor in section 7.2.1, except: use a default of 100, not 1,000, if all radionuclides eligible to be evaluated for ecceystem toxicity receive an ecosystem toxicity factor value of 0.

TABLE 7-2 .--- TOXICITY FACTOR VALUES FOR RADIONUCLIDES

Cancer slope factor * (SF) (pCl)-1	Assigned value		
3×10 ⁻¹¹ ≤8F	10,000 1,000		
SF<3×10 ⁻¹⁸ SF not available for the radionuclide	100		

*Radionuclide slope factors are estimates of age-averaged, individual lifetime total excess cancer risk per ploccurie of radionuclide inhaled or ingested.

At sites containing mixed radioactive and other hazardous substances, evaluate the ecceystem toxicity factor separately for the radioactive and other hazardous substances and assign each a separate acceptem toxicity factor value. This applies regardless of whether the radioactive and othe hazardous substances are physically separated, combined chemically, or simply mixed together. Assign ecosystem toxicity factor values to the radionuclides as specified above and to the other hazardous substances as specified in sections 4.1.4.2.1.1 and 4.2.4.2.1.1. If all radionuclides available to a particular pathway are assigned an ecceystem toxicity factor value of 0, use a default ecceystem toxicity factor value of 100 for all these radionuclides even if nonradioactive hazardous substances nonrealization of the pathway are assigned ecosystem toxicity factor values greater than 0. Similarly, if all nonredioactive bazardous substances available to the pathway are assigned an ecception toxicity factor value of 0, use a default ecception toxicity factor value of 100 for all these nonradioactive hazardous substances even if radionuclides available to the pathway are assigned ecceystem toxicity factor values greater than 'n.

7.2.3 Persistence. For radionuclides. evaluate the surface water persistence factor based solely on half-life; do not include sorption to sediments in the evaluation as is done for nonradioactive hexardous substances. Assign a persistence factor value from Table 4-10 (section 4.1.2.2.1.2) to each radionuclide based on half-life (t₁/2) calculated as follows:

$$\frac{1}{\frac{1+1}{r}}$$

where

r=Radioactive half-life

v = Volatilization half-life If the volatilization half-life cannot be estimated for a radionuclide from available

data, delete it from the equation. Select the portion of Table 4-10 to use in assigning the persistence factor value as specified in section 4.1.2.2.1.2.

At sites containing mixed radioactive and other hazardous substances, evaluate the persistence factor separately for each radionuclide and for each nonradioactive hazardous substance, even if the available data indicate that they are combined chemically. Assign a persistence factor value to each radionuclide as specified in this ction and to each nonredioactive hazardous substance as specified in section 4.1.2.2.1.2. When combined chemically, assign a single persistence factor value based on the higher of the two values assigned (individually) to the radioactive and nonradioactive components.

7.2.4 Selection of substance potentially using greatest hazard. For each migration pathway (threat, aquifer, or watershed, as appropriate), select the radioactive substance radioactive hexardous substance that potentially poses the greatest hazard based on its toxicity factor value, combined with the applicable mobility, persistence, and/or bioaccumulation (or ecosystem bioaccumulation) potential factor values. Combine these factor values as specified in sections 2, 3, 4, and 6. For the soil exposure pathway, base the selection on the toxicity factor alone (see sections 2 and 5).

7.2.5 Hazardous waste quantity. To calculate the hazardous waste quantity factor value for sites containing radioactive substances, evaluate source hazardous waste quantity (see section 2.4.2.1) using only the following two measures in the following hierarchy (these measures are consistent with Tiers A and B for nonredioactive hazardous substances in sections 2.4.2.1.1 and 24.2.1.2):

· Radionuclide constituent quantity (Tier **A)**,

• Radionuclide wastestream quantity (Tier

B). 7.2.5.1 Source hazardous waste quantity for radionuclides. For each migration pathway, assign a source hazardous waste quantity value to each source having a containment factor value greater than 0 for the pathway being evaluated. For the soil exposure pathway, assign a source hazardous waste quantity value to each area of observed contamination, as applicable to the threat being evaluated: Allocate hazardous substances and hazardous wastestreams to specific sources (or areas of observed containination) as specified in section 2.4.2. 7.2.5.1.1 Radionuclide constituent

quantity (Tier A). Evaluate radionucitde constituent quantity for each source (or area of observed contamination) based on the activity content of the radionuclide allocated to the source (or area of observed contamination) as follow

· Estimate the net activity content (in curies) for the source (or area of observed contamination) based on:

-Manifests, or -Either of the following equations, as applicable:

where:

- N=Estimated net activity content (in curies) for the source (or area of observed contamination).
- V=Total volume of material {in cubic yards) in a source (or area of observed contamination) containing radionuclides.
- AC_i=Activity concentration above the respective background concentration (in pCi/g) for each radiozuclide i allocated to the source (or area of observed contamination).
- n=Number of radioauclides allocated to the source (or ares of observed contamination) above the respective background concentrations.

N=3.8×10-4V E AG

where

- N=Estimated net activity content (in curies) for the source (or area of observed contamination).
- V-Total volume of material (in sallons) in a source (or area of observed contamination)
- containing radionuclides AC_Activity concentration above the respective background concentration (in pCi/1) for each radionuclide i allocated to the source (or area of observed contamination). n=Number of radionuclides
- allocated to the source (or bevrsedo lo sera contamination) above the respective background concentrations.
- -Estimate volume for the source (or volume for the area of observed contamination) based on records or measurements.
- For the soil exposure pathway, in estimating the volume for areas of observed contamination, do not include more than the first 2 feet of depth, except: for those types of areas of observed contamination listed in Tier C of Table 5-2 (section 5.1.2.2), include the entire depth, not just that within 2 feet of the surface.

· Convert from curies of radionuclides to equivalent pounds of nonradioactive hazardous substances by multiplying the activity estimate for the source (or area of observed contamination) by 1,000.

 Assign this resulting product as the radionuclide constituent quantity value for the source (or area of observed contamination).

If the radionuclide constituent quantity for the source (or area of observed

contendenties) to adoptately determined (that is, the total activity of all radiosuclides in the source and missions from the source for in the source and subsars from the source (or in the area of observed contamination) is known or is estimated with mesonable is estimated with presentite rej, do not evaluate the radios d, and y account in partice d, and y account in partice windly a value of 0 and tap 7.2.5.1.2 Educ . 72512 h terneliste compliment quantity is not quality determined, aquips the searce (or a of charaved contemination) a value for elanovel conto title conto title conto radionacitie constituent quantity based o the oraphibic data and passati to section need on 72512

72512 Andianatich septetreen quantity (Ter B) Desirate sufferencies weatersam quantity for the source (or area of choorved contamination) based on the activity content of sufferentiably vertexteen Incated to the source (or case of observed minutestics) as follows: • Betwate the total values (in cubic **CR**

ide or in gallepe) of vesteriosane thinks rules with a located to the nce (or area of observed contamination Divide the volume in cubic yords by

6.55 (or the volume is gallous by 120) to convert to the activity contant expressed turns of equivalent possils of association at expression a abet .

contentionited). 725.1.3 Colombatton of source homorizes where quantify value for redisanchides. Select the higher of the values assigned to the source for area of observed existenciation) senace for even of observed sentencienties, for sufficientials constituent quantity and sufficientials wavestations quantity. Assign this value so the conste humanium wave quantity value for the senace (or area of observed contampositiva). Do not reveal to the summer human

runnet latager. 7252 Coloniation of h 5.2 Coloridation of homorologic sease by factor value for scatteringicides. Sum much benerators wants quantity values and to all country for arous of observed interstant) for the pathway being untertant sound this sum to the passast ter then t. pr. croupt if the sum is greater then 0. nor them 1. sound it to 1. Deced-on this e, select a b 8 10 20 cter value for this pothway from Table 2-4 m 2423).

ler a stignation lessachile contr lessachily datas n pailway. If the address quantity is subset (see sectors) a72511) er all sources for all partiens of sources and decreas surgeining other a sources) action). rall country per an provide action, income remaining other a removal action, sign the value from Table 2-4 on the madeus wants quantity factor value for the above, If the radianceful countinent for one income countries of actions of re sources for one or more portions of as a subsecto sumaining after a renova-h, assign a factor value as follows: o), assign a fa

• If any maps a mener value as numeric • If any maps for that migration polyway is subject to Lovel I or Lovel II concentration (see section 7.5), assign ables the value from Table 5-6 or a value of 100, whichever is greater, as the hazardous waste quantity factor value for that pathway.

• If some of the targets for that pathway is subject to Level 1 or Level II concentrations, gs a factor value as follows:

-if there has been no removed action, assign either the value from Table 3-6 or a value of 10, whichever is greater. as the house as waste quantity factor value for that pathway. If there has been a super-

- nee has been a semoval action: Internine values from Table 3-8 with and without consideration of --D e removal action.
- -If the value that would be assigned from Table 2-6 without consideration of the removal ac would be 300 or greater, assign other the value from Table 3-6 with consideration of the remov tion of the removal action action or a value of 100, which and the second of the second of the second s
- quantity factor reasons pathway. -If the value that would be assigned from Table 2-8 without consideration of the reasonal action into them 100, easign a would be less than 100, easign a value of 10 as the heaterdays was matily factor value for the dags waste

For the soil exposure pathway, if the discussion constituent quantity is sately determined for all sense of read contamination, anoign the rail m Table 3-6 as the hazardous weats tily fester value. If the redistancible constituent quantity is not adequately determined for one or more areas of observed contamination, assign either the value from Table 2-6 or a value of 18, whichever is in, as the Lanardous waste quantity -

7253 Calculation of Lanardown wante santily factor value for situs containin ined sedioactive and other hospitus ining . nors. For each source (or area of vad contamination) can taking seloud active and other laserdous substances. beerved can calculate two source heartdown whole quantity values—one based on redison as qualified in sections 7.2.5.1 through 7.2.5.1.3 and the other based on the adjouctive hazardous subs reflective hazardous substances as cilled in sections 24.2.1 through 24.2.1.5 hat is, data usine each value as if the othe (the is, managing out value as it for our other to the second type of substance was not present). Sum the two values to determine a combined source hezardous waste quantity value for the source (or area of observed contantianties). Do not re-ad this value to the nonrest integer.

Use this umbined source bezardous wes quantity value to calculate the haracdeus waste quantity factor value for the packway as specified in section 2.4.2.2, except if either the henerdous constituent quantity or the radiancilde constituent quantity, or both, are not adequately determined for one or ses sources (or one or more portions of cos or releases remaining after a removal action) or for one or more areas of observed contamination, as applicable, assign the value from Table 3-6 or the default value licable for the pathway, whichever is nor, as the bazardous waste quantity apple. presitier, as the bazardous waste quantity factor value for the pathway. 7.3 Torgets. For redisortive substances.

sie the targets factor c>'egory as

epocified in section 2.5 and excitent 3 throug 9, except: existing Lovel 3 and Lovel 3 concentrations at sampling locations as

concentrations at sampling herations an specified in sections 7.3.3 and 7.3.2. For all polynoys (and threats), use it some target distance limits for sites containing redisantive substances as in specified in sections 3 flowigh 6 for site containing momention of the substances reducting momention threats and reductions. At sites containing mixed ita), une the exhetnesses. At class containing mixed tudiostility and other handees subst include all exercise for earns of observed contemization) at the one in identifying the applicable targets for the polynamy. 7.3.1 Lovel of contemination of a

7.3.3 Level of contemporer or a sampling location. Determine whether Level I or Lovel II concentrations apply at a compling location (and thus to the esteciated targets) as falls

Solect the banchmarks from section 7.3.2 applicable to the pothway (or thread) being evaluated.

 Compare the concentrations of radianuclides in the sample (or comparable samples) to their banchmark concentrations for the pathway (or threat) as specified in which the pathway (or threat) as specified in a for the pointery or throat) as specified in section 7.1.2. These comparable samples as specified in section 2.5.1. • Determine which level applies based on

 Determine If areas of the redirections eligible to be evaluated for the simpling location have an applicable banchmark, areign Lovel II to the actual contamination at that excepting la to be

ecours contention at that compling location for the pathway (or thread). • In making the comparison, consider on these complex, and only these sufficientials in the complex, and only the collection for an observed subsets for observed contention of the collection for an ved selecce (or one path uneg, enci variantering for the patiency, except tieres complex from equatic human field chain experience may chook or used for the human field chain threat of the surface we patience as constituted in contracts. y as specified in sections 41.3.3 and 4233

7.3.2 Comparison to beachments. Use the following mode specific bunchmasks (expressed in activity units, for example, pCi/) for water, pCi/log for cell and for equatic I see verse, pc2/vg ser own add we append beenen food chain argunisms, and pCI/m² for eir) for unking the comparisons for the indicated pathway (or theor);
 Maximum Contaminant Levels (MCLs)---

construction Continuing Levels (M ground water migration pothway and drinking water threat in surface water migration pathway

suigration patienery. • Urmium ME Tailinge Rediction Control Act (UMTRCA) standards—coll exposure pethway only.

 Screening concentration for cancer corresponding to that concentration that corresponds to the 10⁻⁴ individual concer risk corresponds to the 20⁻⁴ individual concer risk for inhelation exposures (or migration pothway) or for and exposures (ground water migration pathway: delaking water or human food chain threats in surface water migration pethway; and sell exposure pothway).

-For the soil exposure pollowey, inch two accounting conclustrations for cancer—one for legestion of surface metasials and one for external adiation exponence from genera-miting radionaciides in surface astatiole.

Select the benchmark(s) applicable to the pathway (or threat) being evaluated. Compare the concentration of each radionuclide from the sampling location to its benchmark concentration(s) for that pathway (or threat). Use only those samples and only those radioaclides in the sample that meet the criteria for an observed release (or observed contamination) for the pathway. except: tissue samples from aquatic human food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of any epplicable radionuclide from any sample equals or exceeds its benchmark concentration, consider the sampling location to be subject to Level I sampung socation to be subject to Level I concentrations for that pathway (or threat). If more than one benchmark applies to the radionuclide, assign Level I if the radionuclide concentration equals or exceeds the lowest applicable benchmark concentration. In addition for the act of concentration. In addition, for the soil exposure pathway, assign Level I concentrations at the sampling location if measured gamma radiation exposure rates equal or exceed 2 times the background level (see section 7.1.1). If no radionuclide individually equals or

exceeds its benchmark concentration, but

more than one radionuclide either meets the criteria for an observed release (or observed contamination) for the sample or is eligible to be evaluated for a tissue sample (see sections 4.1.3.3 and 4.2.3.3), calculate a value for index I for these radionuclides as specified in ection 2.5.2. If I equals or exceeds 1, assign Level I to the sampling location. If I is less than 1. assign Level II.

At sites containing mixed radioactive and other hazardous substances, establish the level of contamination for each sampling location considering radioactive substances and nouradioactive hazardous substances separately. Compare the concentration of each radionuclide and each nouradioactive hazardous substance from the sampling location to its respective benchmark concentration(s). Use only those samples and only those substances in the sample that meet the criteria for an observed release (or observed contamination) for the pathway except tissue samples from aquatic human food chain organisms may be used as specified in sections 4.1.3.3 and 4.2.3.3. If the concentration of one or more applicable radionuclides or other hazardous substances from any sample equals or exceeds its benchmark concentration, consider the

sampling location to be subject to Level I concentrations. If more than one benchmark applies to a radionuclide or other hazardous substance, assign Level I if the concentration of the radionuclide or other hazardous substance equals or exceeds its lowest applicable benchmark concentration.

If no radionuclide or other hazardous substance individually exceed a benchmark concentration, but more than one radionuclide or other hazardous substance either meets the criteris for an observed release (or observed contamination) for the sample or is eligible to be evaluated for a tissue sample, calculate an index I for both types of substances as specified in section 2.5.2. Sum the index I values for the two types of substances. If the value, individually or combined, equals or exceeds 1, assign Level I to the sample location. If it is less than 1, calculate an index] for the nonradioactive hazardous substances as specified in section 2.5.2. If | equals or exceeds 1, assign Level I to the sampling location. If J is less than 1, assign Level II.

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