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The Revised Hazard Ranking System: Background Information

Office of Emergency and Remedial Response
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Quick Reference Fact Sheet

The U.S. Environmental Protection Agency (EPA) has revised the Hazard Ranking System (HRS) in response to the Superfund Amendments and Reauthorization Act of 1986 (SARA). The HRS is the scoring system EPA uses to assess the relative threat associated with the release or potential release of hazardous substances from a waste site. The HRS score is the primary criterion EPA uses to determine whether a site should be placed on the National Priorities List (NPL). The NPL identifies sites that warrant further investigation to determine if they pose risks to public health or the environment. Sites on the NPL are eligible for long-term "remedial action" financed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by SARA. SARA authorizes a "Hazardous Substances Superfund" totalling $8.5 billion over 5 years to pay costs not assumed by those responsible for problems at a site. The HRS uses data that can be collected relatively quickly and inexpensively, thus allowing most Superfund resources to be directed to remedial actions at sites on the NPL.

Summary of Revisions

The revised HRS retains the same cutoff score and basic approach as the original HIRS, while incorporating SARA requirements as well as improvements identified as necessary by EPA and the public. The revised HRS retains the ground water, surface water, and air pathways, drops the direct contact and fire/explosion pathways, and adds a fourth pathway, soil exposure.

Several key provisions of the revised HRS make it more comprehensive. They:

- Evaluate new exposure pathways or threats that assess direct contact of people with contaminated soils, and contamination of the aquatic food chain.
- Expand how toxicity is evaluated, considering not only acute health effects, but also carcinogenic and chronic noncarcinogenic effects.
- Increase the sensitive environments considered from just wetlands and endangered species to environments designated by various Federal and State agencies.
- Evaluate the potential for air to be contaminated and for contaminated ground water to enter surface water.

Other provisions make the revised HRS **more accurate.** They:

- Allow use of concentration data to determine the quantity of waste at a site.
- Assign higher scores when people are actually exposed to contamination than when they are potentially exposed.
- Assign higher scores to potentially exposed people and sensitive environments closest to a site, with scores decreasing as distance from a site increases.

The complexity and scope of the issues involved in revising the HRS required EPA to got widespread input. EPA sought information from a number of sources such as its Science Advisory Board and, on three occasions, requested public comment: before drafting the revisions, after proposing the revisions in the Federal Register, and after publishing a Field Test report describing how the revisions scored actual hazardous waste sites. These procedures generated over 2,500 comments (from approximately

145 commenters). The majority of the commenters believed that the revised HRS represented an improvement over the original HRS. Other commenters, however, believed that the data required were too extensive for a screening tool and raised numerous technical issues. EPA made significant changes based on these comments, as well as on the Field Test. The result is a revised HRS that is a practical and effective tool in identifying the nation's worst hazardous waste sites.

Sara Requirements

SARA required that EPA modify the HRS so that, "to the maximum extent feasible, [it] accurately assesses the relative degree of risk to human health and the environment posed by sites." Several specific requirements were spelled out.

Section 105 required EPA to:

- Assess human health risks associated with contamination or potential contamination of surface waters, either directly or as a result of run-off. This assessment should take into account the use of these waters for recreation and the potential migration of any contaminant through surface water to downstream sources of drinking water.
- Evaluate damage to natural resources that may affect the human food chain.
- Assess contamination or potential contamination of ambient air.

Section 118 required EPA to:

- Give a high priority to sites where contamination has resulted in the closing of drinking water wells, or has contaminated a principal drinking water supply.

Section 125 required EPA to:

- Revise the HRS to assure appropriate consideration of sites that contain substantial volumes of wastes described in Section 3001(b)(3)(A)(i) of the Solid Waste Disposal Act, also known as the Resource Conservation and Recovery Act (RCRA). These wastes include fly ash, bottom ash, slag, and waste from control of flue gas emissions, all generated primarily by combustion of coal or other fossil fuels. The assessment must consider:
  - Quantity, toxicity, and concentrations of hazardous constituents present in such wastes.
  - Extent of, and potential for, release of such constituents into the environment.
  - Degree of risk to human health and the environment posed by such constituents.

Original HRS

The original HRS used a structured value analysis approach to scoring site. This approach assigned numerical values to factors that relate to or indicate risk based on conditions at the site. The factors were grouped into three categories -- observed release/route characteristics, waste characteristics, and targets -- and were combined to obtain category scores. Each category had a maximum value, as did each component factor.

The category scores in the original HIRS were then multiplied together within each of the migration pathways (ground water, surface water, and air) and normalized to obtain a pathway score. Finally, the scores for the three pathways (gw, sw, a) were combined using a root-mean-square approach. The final HRS score was the square root of the sum of the squares of the pathway scores divided by a factor, 1.73, which put all final scores on a scale of 0-100.

$$HRS = \frac{\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}}{1.73}$$

If all migration pathway scores were low, the HRS score was low. However, the HRS score could be relatively high even if only one pathway score was high. This was an important requirement for HRS scoring because some extremely dangerous sites pose threats through only one migration pathway. For example, buried leaking drums of hazardous

substances could contaminate drinking water wells but -- if the drums were deep enough and the substances not very volatile -- not surface water or air.

Revised HRS

A number of major changes from the original HRS involve more than one of the four pathways. They are summarized before the individual pathways are discussed.

Structure. The revised HRS retains the three migration pathways. An EPA analysis of remedial actions at NPL sites indicates that some significant risks from direct contact may not have been completely addressed by removal actions, and these risks should be of concern in determining priorities for remedial action. Therefore, a fourth pathway, soil exposure (named onsite exposure in the proposed revisions), is now included in the total site score. The pathway assesses direct human exposure to hazardous substances or contaminated soil. The direct contact and fire/explosion pathways have been deleted.

The essential structural features of the revised HRS generally remain the same as those of the original HRS - that is, relative risks continue to be evaluated using pathways, three factor categories (likelihood of release, waste characteristics, and targets), and factors -- and the score is calculated similarly.

$$HRS = \sqrt{\frac{S_{gw}^2 + S_{sw}^2 + S_a^2 + S_x^2}{4}}$$

Every factor has been revised or is new in the revised HRS. A few factors have been eliminated, either because they did not discriminate among sites or because they were replaced by more accurate measures.

Key changes were made in the waste characteristics factor category; the hazardous waste quantity factor is now multiplied by toxicity and other factors, instead of being added as they were in the original HRS. This is one of several changes that make the revised HRS more consistent with risk assessment principles.

Observed Release. The original HRS scored an observed release if the measured concentration of the hazardous substance was significantly above the background level and if that concentration could reasonably be attributed to the site. EPA is retaining this approach to scoring observed releases in all four pathways but has incorporated criteria for determining when a release is significantly above background.

Hazardous Waste Quantity. Hazardous wastes, in addition to including hazardous substances, almost always include nontoxic substances. When the original HRS was developed, EPA judged that the cost during initial investigations (preliminary assessments and site inspections) of reliably determining the amount of hazardous constituents within the hazardous waste was prohibitive and, in some cases, not feasible. Therefore, the original HRS used the total quantity of waste containing hazardous substances (as defined in CERCLA Section 101), excluding any wastes that were contained so that they could not migrate.

The revised HRS uses a tiered approach to determine the hazardous waste quantity factor. Hazardous constituent concentration data, mass of Waste as deposited, volume, or surface area of the source can be used. This approach provides the flexibility to use the best data available.

Toxicity. Toxicity, a factor in the waste characteristics category for all four pathways, is intended to represent the relative potential of a substance to cause adverse health effects.

The original HRS assigned a toxicity factor value from 0 to 3 based on the toxicity ratings developed by N.I. Sax or the National Fire Protection Association rating scheme. Both ratings primarily emphasized acute toxicity of a substance. However, EPA's experience has been that adverse health effects at hazardous waste sites may result from carcinogenic and chronic noncarcinogenic. exposures as well as acute exposures.

The revised HRS evaluates three measures of toxicity in a tiered approach that uses acute data only when the other data are not available. The three measures are:

- Cancer risks based on two factors that

EPA's Carcinogen Assessment Group has developed for a variety of substances:

- Cancer potency factors (also referred to as slope factors) derived from experimental animals or human epidemiologic data, if available.
- Qualitative weight-of-evidence – that is, the overall strength of the data indicating potential carcinogenicity.

- Noncancer effects of chronic exposure, based on verified Reference Doses (RfDs), the estimated amount of a substance to which the human population (including sensitive subgroups) can be exposed on a daily basis over a lifetime without an appreciable risk of harmful noncancer effects. RfDs undergo a formal EPA-wide review and verification.
- Acute toxicity, based on the LD_{50} or LC_{50} (lethal dose or lethal concentration at which 50 percent of experimental animals exposed die).

Targets (People and Sensitive Environments). In the original HRS, the people actually exposed to contamination did not count more than those potentially exposed, nor was the level of exposure considered. To assess risks more accurately, the revised HRS gives greater weight to actual exposures by.

- Adding factors to the ground water, surface water, and air pathways reflecting risks to the nearest exposed individual -- that is, the person who is closest to the site and so is expected to be exposed to the highest concentration of contaminants.
- Giving greater weight to people whose drinking water is contaminated (or, for the soil exposure pathway, people living, working, or going to school on contaminated soil). The evaluation of exposed target populations in both the ground water and surface water pathways includes a weighting factor based on the Federal primary drinking water standards, or some other health-based benchmark if no standard exists.
- Giving greater weight in the surface water pathway to actual contamination of the aquatic human food chain.

Where no actual exposure has been documented, the people potentially exposed are distance weighted in the ground water and air pathways and dilution weighted in the surface water pathway.

The revised HRS also replaces the use factor of the original HRS with a more comprehensive resources factor that considers recreational and other uses in the ground water, surface water, and air pathways.

Environmental Threats. In developing the original HRS, EPA decided, given the need to set priorities for the spending of limited monies, to place greater weight on sites that posed threats to public health rather than to the environment. EPA's experience since then, however, suggested that a number of sites posing a serious threat to the environment were not scoring high enough to be on the NPL, and that some of the most serious threats dearly warrant remedial action. Therefore, the revised HRS gives greater weight than the original HRS to impacts on sensitive environments (wetlands, for example) in the surface water and air pathways. Sensitive environments are also considered in the soil exposure pathway. Relative risks to human health, however, are still weighted more heavily than sensitive environments. In addition, the revised HRS expands significantly the types of sensitive environments evaluated at a site.

Radionuclides. The revised HRS includes a special section (Section 7) on scoring radionuclides that allows for a parallel evaluation of radionuclides.

Ground Water Migration Pathway

The ground water migration pathway in both the original and revised HRS (Figure 1) evaluates the Likelihood that hazardous substances at a site or facility will migrate through the ground below and contaminate aquifers (underground formations holding usable amounts of water) and any drinking water wells that draw on those aquifers.

The revised HRS ground water pathway has the same general structure as in the original HRS. However, every factor has been revised. The most significant revision assigns weights to the target population based on distance from the site to account for dilution in the aquifer. In addition, the area (target distance limit) in which drinking water wells are considered has been expanded. A new factor, travel time, has been added to the potential-to-release calculations. In the waste characteristics category, the mobility of each hazardous substance

is considered, rather than persistence as in the original HRS.

The original HRS did not consider the direction of ground water flow in determining which populations or environments could be affected by the migration of hazardous substances at the site. The targets category gave equal weight to the entire population drawing water within 3 miles of the site.

After evaluating several options for considering ground water or contaminant flow direction, EPA decided to retain the original system, based on cost and technical considerations. Accurately determining local flow within the target distance would require considerable expenditure of time and public funds, which EPA believes is justified only at the nation's highest priority sites -- that is, those already on the NPL However, where there is known contamination, the populations are weighted higher than those only potentially exposed. Thus, the revised FIRS indirectly considers direction of substance migration by assigning weights to people drinking water contaminated either above or below health-based benchmarks and by using the nearest exposed individual factor.

Likelihood of Release. The potential-to-release to ground water is comparable to the route characteristics/containment portion of the original HRS. EPA has made a number of changes in how potential releases are scored. In the original HRS, values for depth to aquifer, net precipitation, permeability, and physical state were added, then multiplied by the value of a fifth factor, containment. The revised HRS uses four factors:

- Containment, which measures the means

Figure 1

Groundwater Migration Pathway

Original HRS

Likelihood of Release	x	Waste Characteristics	x	Targets
Observed Release or Route Characteristics Depth to Aquifer of Concern Net Precipitation Permeability of Unsaturated Zone Physical State Containment		Toxicity/Persistence Hazardous Waste Quantity		Groundwater Use Distance to Nearest Well/ Population Served

Revised 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 Hazardous Waste Quantity		Nearest Well Population Resources Wellhead Protection Area

taken at a site to minimize or prevent releases of contaminants into ground water.

- Net precipitation, which indicates the amount of water available to infiltrate into ground water.

- Depth to aquifer, which provides a measure of the time required for a contaminant to reach the underlying aquifer.

- Travel time, which measures the potential of geologic materials to slow the migration of contaminants to aquifers.

The potential to release is the sum of the values of the first three factors multiplied by the value for containment.

Waste Characteristics. The waste characteristics category of the original HRS included toxicity/persistence and hazardous waste quantity factors. The method used to evaluate persistence, however, was based on biodegradability and was generally not applicable to ground water. In addition to the changes in waste quantity and toxicity, the revised HRS replaces persistence with a mobility factor reflecting the rate at which a substance migrates. Combining mobility with the revised toxicity factor allows for discrimination among highly toxic substances that migrate at very different rates.

Targets. The targets category reflects the population potentially at risk from an actual or potential release of hazardous substances from the site to an aquifer. The revised HRS expands the target distance limit from 3 to 4 miles. Within that limit, four factors (instead of two) are considered: nearest well, population, resources, and Wellhead Protection Area.

The nearest well is a new factor in the targets category and is evaluated by measuring the distance to the nearest drinking water well. In the original HRS, the person using the nearest well was considered in a matrix with population. The two are now separate factors.

The second factor, population, indicates the number of people actually or potentially at risk from exposure to hazardous substances in drinking water wells. In the original HRS, all the people who drank water from wells within 3 miles of the site were counted equally. The total population was then combined in a matrix with distance to the nearest well to assign a single value. The revised HRS separates these factors to more clearly reflect individual risks and resource value/population risk. Population served is the sum of three groups:

- People exposed to contamination above health-based benchmarks -- for example, Federal drinking water standards.

- People exposed to contamination not above health-based benchmarks but significantly above background.

- People potentially exposed, weighted for distance.

The resources factor, a more comprehensive measure, has replaced the ground water use factor in the original HRS.

The presence of a Wellhead Protection Area, as designated under Section 1428 of the Safe Drinking Water Act, is a new factor in the targets category score. This revision addresses SARA Section 118, which requires a high priority for sites affecting principal drinking water supplies. Wellhead Protection Areas are defined as areas around a welt or well field supplying a public water system through which potentially harmful contaminants are likely to move toward and reach the welt or well field.

Surface Water Migration Pathway

The surface water migration pathway in both the original and revised HRS (Figure 2) evaluates the likelihood that runoff containing hazardous substances from a site can move through surface water and affect people or the environment. The revised HRS differs from the original HRS in several ways. The revised HRS:

- Replaces route characteristics with two potential-to-release components -- overland flow/flood and ground water to surface water. If both components are scored, the pathway score is the higher of the two scores.

- Divides the surface water pathway into three subpathways representing threats to drinking water, the human food chain, and the environment. The surface water migration pathway score is the sum of the scores of the three subpathways. This change in structure provides a relatively simple way to account for the different substances and targets that may be important for the different types of potential exposure in the subpathways.

Figure 2

Surface Water Migration Pathway

Original HRS

Likelihood of Release x **Waste Characteristics** x **Targets**

Observed Release
or
Route Characteristics
Facility Slope/Intervening Terrain
1-Year, 24-Hour Rainfall
Distance to Nearest Surface Water
Physical State
Containment

Toxicity/Persistence
Hazardous Waste Quantity

Surface Water Use
Distance to Sensitive Environment
Population Served/Distance to Nearest Intake Downstream

Revised HRS

Likelihood of Release:

Overland/Flood Component

Observed Release
or
Potential to Release

By Overland Flow:
Containment
Runoff
Distance to Surface Water

By Flood:
Containment
Flood Frequency

or

Ground Water to Surface Water Component

Observed Release
or
Potential to Release

Containment
Net Precipitation
Depth to Aquifer
Travel Time

x

Drinking Water Threat

Waste Characteristics x **Targets**

Toxicity/Persistence/Mobility*
Hazardous Waste Quantity

Nearest Intake Population
Resources

+

Human Food Chain Threat

x **Waste Characteristics** x **Targets**

Toxicity/Persistence/Bioaccumulation/Mobility*
Hazardous Waste Quantity

Food Chain Individual Population

+

Environmental Threat

x **Waste Characteristics** x **Targets**

Ecosystem Toxicity/Mobility*/Persistence/Bioaccumulation
Hazardous Waste Quantity

Sensitive Environments

*Mobility applicable only to Ground Water to Surface Water Component.

- Extends the distance to the targets at risk from the probable point where hazardous substances enter the surface water to a point 15 miles from the source (versus 3 miles downstream of the farthest observed contamination, or 1 mile in static water, in the original HRS). The target values are modified by dilution weighting -- that is a lower value is assigned to a larger body of water because the substance is more diluted.

Drinking Water Threat. The drinking water threat in the revised HRS retains the waste quantity and toxicity/persistence factors of the original HRS but evaluates them differently. Persistence is no longer based solely on biodegradation but on four additional decay processes (hydrolysis, photolysis, volatilization, and free-radical oxidation). For each hazardous substance in (or likely to be in) surface water, a persistence value is assigned that reflects the time the substance remains in the surface water. The substance with the highest toxicity/persistence value is used, along with the hazardous waste quantity, in calculating the waste characteristics score.

The drinking water targets category in the revised HRS retains the use and population factors of the original HRS but substantially modifies them. Instead of the four uses in the original HRS use factor, with only the highest assigned a value, two uses (drinking water and other uses) are assigned values, providing a better evaluation of the risk to the resource. The distance to a surface water intake in the original HRS has been replaced with a nearest intake factor that is evaluated separately and is based on dilution at the nearest intake. As in the revised ground water pathway, the population served is evaluated in three groups based on actual and potential exposure. The population potentially exposed is weighted based on dilution.

Human Food Chain Threat. SARA Section 105(a)(8)(A) requires EPA, in revising the HRS, to consider the effects of hazardous waste sites on the human food chain. In developing the revisions, EPA determined that the most significant, measurable food chain risks involved contamination of the aquatic food chain. Therefore, the revised surface water migration pathway includes evaluation of the human food chain based on potential or observed contamination of aquatic food chain organisms.

In evaluating waste characteristics (and targets as well), a single hazardous substance is selected, on the basis of bioaccumulation potential, toxicity, and persistence, from among those known to be present at the site and available to the surface water migration pathway. Persistence is determined based on the same five decay processes as in the drinking water threat.

The targets category reflects the threat to people from consumption of fish and shellfish taken from the surface water migration pathway. Fishery use -- for example, commercial, subsistence, or sport fishing--is evaluated to give an estimate of resource value. Population is calculated by estimating food chain products harvested from the contaminated surface water. Population is the sum of actual and potential contamination, and is determined based on bioaccumulation and annual production of each fishery in the surface water migration pathway.

Environmental Threat. In the surface water pathway of the original HRS, sensitive environments were assigned a value in the targets category on the basis of distance to a particular type of sensitive environment -- wetlands, for example. The revised HRS places more emphasis on environmental damage and expands the types of environments considered. Ecosystem toxicity is determined using EPA chronic water quality criteria for the protection of aquatic life (or other measures if the criteria are not available). Ecosystem persistence is evaluated as it is for the drinking water subpathway. The sensitive environments targets are weighted into groups based on ecologically-based benchmarks where sensitive environments are contaminated; otherwise, dilution factors are applied.

Soil Exposure Pathway

The soil exposure pathway (Figure 3) evaluates the potential threats posed by direct, physical contact with hazardous wastes or contaminated soil. It is similar to the direct contact pathway, which was scored in the original HRS but was not used to determine if a site should be on the NPL. The revised HRS evaluates the threat by looking at two groups potentially at risk -- those living on property with hazardous wastes or contaminated soils and those living nearby with access to the property. The resident population is evaluated based only on presence of contamination within the site boundary and within 200 feet of the boundary. The resident population is not evaluated on release potential, as in the other pathways, because contaminants do not have to migrate offsite for exposure to occur. Five targets are evaluated in the resident population:

- Resident individual -- a person living on, or

Figure 3

Soil Exposure Pathway (Revised HRS Only)

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

going to school or day care on, contaminated property.

- Resident population – people living on or going to school or day care on contaminated property.
- Workers – people working on contaminated property.
- Resources – contaminated property used for commerce, agriculture, silviculture, livestock production, or livestock grazing.
- Terrestrial sensitive environments on contaminated property – aquatic environments are considered in the surface water migration pathway.

The nearby population is evaluated on the basis of:

- Attractiveness/accessibility and area of contamination, which evaluate the likelihood of exposure.
- Population within a 1-mile travel distance of the site.
- Nearby Individual.

Air Migration Pathway

The air migration pathway of the revised HRS (Figure 4) has the same three categories as the original HRS, but each is revised. The original air pathway was evaluated only if an observed release of hazardous substances could be documented. As required by SARA Section 105(a)(8)(A), the revised HRS considers characteristics of the site to assess the potential for release if none has been documented. The likelihood of release is determined, as well as how many people and sensitive environments could be exposed to hazardous substances carried in the air and the inherent hazard associated with potential exposures. The potential to release by gases and particulates is evaluated separately based on:

- Containment, which assesses the ability of natural or constructed barriers to inhibit the escape of hazardous substances from a source.

- Source type -- for example, containers (including tanks), contaminated soil (including land treatment), fire sites, landfills, surface impoundments, and waste piles.

- Migration potential, which reflects the relative tendency of hazardous substances contained in a source to migrate.

In addition to the changes to waste quantity and toxicity in the waste characteristics category discussed earlier, the reactivity and compatibility factors in the original HRS have been deleted because they have proved not to be applicable to the vast majority of NPL sites; mobility has been added. All hazardous substances at a site are evaluated for gas mobility. Particulate mobility is evaluated based on the local climate. The two values are combined in a matrix to determine the mobility factor.

In the revised HRS, the three target factors in the original HRS -- land use, population within a 4-mile radius, and distance to a sensitive environment -- have been modified, and a factor has been added to reflect the risk to the nearest individual. The 4-mile limit for population in the original HRS has been retained, the limit for sensitive environments evaluated has been extended from 2 to 4 miles. In both cases, distance weighting factors are used to represent the reduced concentrations farther away from the site.

Figure 4

Air Migration Pathway

Original HRS

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

Revised HRS

Likelihood of Release	x	Waste Characteristics	x	Targets
Observed Release or Potential to Release Gas Gas Containment Gas Source Type Gas Migration Potential Particulate Particulate Containment Particulate Source Type Particulate Migration Potential		Toxicity/Mobility Hazardous Waste Quantity		Resources Population Within 4-Mile Radius Nearest Individual Sensitive Environments

Additional Considerations

In the preamble to the proposed revisions to the HRS, EPA requested comment on two issues:

- The cutoff score for proposing sites for the NPL.
- The policy of scoring sites based on current conditions.

Cutoff Score. EPA chose an HRS score of 28.50 as a cutoff for placing sites on the NPL because it yielded an initial NPL of at least 400 sites as suggested by CERCLA, not because EPA had determined that 28.50 represented a threshold of unacceptable risks. Believing that the current cutoff score has been a useful management tool, EPA proposed that the cutoff score for the revised HRS be functionally equivalent to the original cutoff. However, EPA wanted to evaluate the practical effects of keeping the cutoff score at 28.50 -- that is, will that score continue to provide an appropriate set of priorities for management purposes. EPA examined several approaches for defining "equivalent to 28.50". These approaches included:

- A statistical analysis to determine what revised HRS score best corresponds to 28.50 on the original HRS.
- A determination of the percentage of potential sites in CERCLIS (EPA's inventory of potential hazardous waste sites) that score above 28-50 on the original NPL and the setting of a cutoff that yields the same percentage.
- An identification of risk levels that on the average correspond to an original HRS score of 28.50 and a determination of what revised HRS score best corresponds to that risk level.

Based on an analysis of 110 test sites, scored with both the original and revised HRS, EPA has decided not to change the cutoff score at this time because the analysis did not point to a single number as the appropriate cutoff. The field test data show that few sites score in the range of 25 to 30 with the revised HRS. EPA believes that this range may represent a true breakpoint in the distribution of site scores and that the sites scoring above the range of 25-30 are clearly the types of sites that should be captured with a screening tool.

Because the HRS is intended to be a screening tool, EPA has never attached significance to the cutoff score as an indicator of a specific level of risk froma site, nor has EPA intended to imply that "risky" and "nonrisky" sites can be precisely distinguished. Nevertheless, the cutoff score has been a successful screening tool that has allowed EPA to set priorities and to move forward with studying and, where appropriate, to clean up hazardous waste sites. The vast majority of sites scoring above 28.50 in the past have been shown to present risks.

Scoring on the Basis of Current Conditions. Under the original HRS, EPA generally scored the three migration pathways based on the conditions at the site before, any response action had been taken, rather than based on current conditions at the site. In revising the HRS, EPA decided that it may be appropriate to evaluate sites based on current conditions and to consider prior responses in calculating an HRS score.

The policy of evaluating sites based on current conditions raised concerns that it might:

- Encourage private parties to only take action sufficient to lower the score so the site would not be placed on the NPL
- Discourage public agencies from taking early actions that could lower the score, thus preventing the site from being on the NPL and therefore eligible for Superfund monies.

EPA examined two approaches to incorporate current site conditions in the HRS score. Under either approach, EPA would only consider actions prior to a site inspection, which provides most of the data used to score a site. Because response action at sites may be an ongoing process, it would be burden-some to recalculate scores continually to reflect such actions. The two approaches were:

- Consideration of current conditions for certain pathways or factors where appropriate.
- Consideration of current conditions routinely, but identification of situations where initial conditions more accurately reflect risks.

EPA decided to consider response actions prior to a site inspection because it will provide increased incentives for rapid response.