The background of the slide is a solid blue color with a faint, large watermark of the United States Environmental Protection Agency (EPA) seal. The seal features a central sun and a leaf, surrounded by the text "ENVIRONMENTAL PROTECTION AGENCY" and "U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE".

***Human Health and
Ecological Risk
Assessment with Spatial
Analysis and Decision
Assistance (SADA)
Freeware***

Tom Purucker

Robert Stewart

Fred Dolislager

Human and Ecological Risk Functions

SADA implements EPA methods for conducting ecological and human health risk assessments

Calculation of site-specific preliminary remediation goals

Benchmark database for contaminant effects on ecological receptors

Exposure modeling for humans and over 20 other terrestrial species

Contains IRIS/HEAST toxicity databases for calculating risk from exposure

Contains EPA default exposure parameters for the risk models

Tabular screening and risk results

Point screens

Risk and dose mapping

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Sample Laboratory Data

PROJECT NAME	PROJECT #	SAMPLES	SAMPLE ID	DATE COLL	DATE RECD	ANALYZED	LAB #	ANALYTE	RESULT	POL	UNITS	METHOD
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Adrin	< 0.00005	5E-05	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	a-BHC	< 0.00005	5E-05	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	b-BHC	< 0.00005	5E-05	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	d-BHC	< 0.00005	5E-05	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	g-BHC Lindane	< 0.00005	5E-05	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	4,4'-DDE	< 0.00010	0.0001	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	4,4'-DDE	< 0.00010	0.0001	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	4,4'-DDT	< 0.00010	0.0001	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Dieldrin	< 0.00010	0.0001	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Endosulfan I	< 0.00005	5E-05	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Endosulfan II	< 0.00010	0.0001	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Endosulfan Sulfate	< 0.00010	0.0001	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Endrin	< 0.00010	0.0001	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Endrin Aldehyde	< 0.00010	0.0001	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Endrin Ketone	< 0.00010	0.0001	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Heptachlor	< 0.00005	5E-05	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Heptachlor Epoxide	< 0.00005	5E-05	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Methoxychlor	< 0.00010	0.0001	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	Toxaphene	< 0.00050	0.005	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	alpha-Chlordane	< 0.00005	5E-05	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/7/2002	02-A162603	gamma-Chlordane	< 0.00005	5E-05	mg/l	8081A
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/6/2002	02-A162603	Aroclor 1016	< 0.00050	0.0005	mg/l	8082
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/6/2002	02-A162603	Aroclor 1221	< 0.00100	0.001	mg/l	8082
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/6/2002	02-A162603	Aroclor 1232	< 0.00050	0.0005	mg/l	8082
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/6/2002	02-A162603	Aroclor 1242	< 0.00050	0.0005	mg/l	8082
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/6/2002	02-A162603	Aroclor 1248	< 0.00050	0.0005	mg/l	8082
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/6/2002	02-A162603	Aroclor 1254	< 0.00050	0.0005	mg/l	8082
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/6/2002	02-A162603	Aroclor 1260	< 0.00050	0.0005	mg/l	8082
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/5/2002	02-A162603	Arsenic	< 0.0050	0.005	mg/l	60109
I-401-640 SINKHOLE	4969 013	BWUO	HSSW1	10/1/2002	10/3/2002	10/5/2002	02-A162603	Barium	0.08	0.01	mg/l	60109

Or transport model output files



Data Formats

SADA can accept data in two formats: comma delimited files (csv) and Microsoft Access.

Requires the presence of certain fields in the data set.

- Easting

- Northing

- Depth

- Value

- Name

Can use other forms of information as well

- Media

- Detection

- Date

- CAS Number

Any other form of meta data can be imported as well. User can plot and retrieve this meta data during an analysis.

SADA recognizes soil, sediment, surfacewater, groundwater, air, biota, and background, and the “basic” media type. Basic is assigned to data that have no media type.

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Data!

Risk Assessments are data driven:

as quality and confidence in data increases, then so does the quality and confidence in risk estimates.

SADA offers reliable and effective data storage, visual analysis, and synthesis that can enhance risk assessments. But ultimately, the quality of the risk assessment is dependent upon the quality and quantity of the data.

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Scaleable interface

The screenshot shows a software interface with several key components labeled with arrows:

- Analysis Box**: Located at the top left, containing a toolbar with icons for various analysis functions.
- Data Type Box**: A dropdown menu showing 'Soil'.
- Data Name Box**: A dropdown menu showing 'Anthracene'.
- Labels Box**: A dropdown menu showing '(None)'.
- Layers Box**: A dropdown menu showing 'Z = 0'.
- Interviews**: A label pointing to the 'Plot my data' button.
- Steps Window**: A vertical panel on the left with a list of steps (1-9) and 'Back'/'Next' buttons.
- Parameters Window**: A central panel with 'Data Query' settings, including 'Interval' (5/25/1970 to 8/7/19), 'Duplicate Data' options, and 'Non Detects' options.
- Results Window**: A scatter plot titled 'Anthracene Sample Locations (Z = 0)' showing data points on a coordinate system with 'Easting' on the x-axis and 'Northing' on the y-axis. A color scale on the right ranges from 0.80 to 5.50.

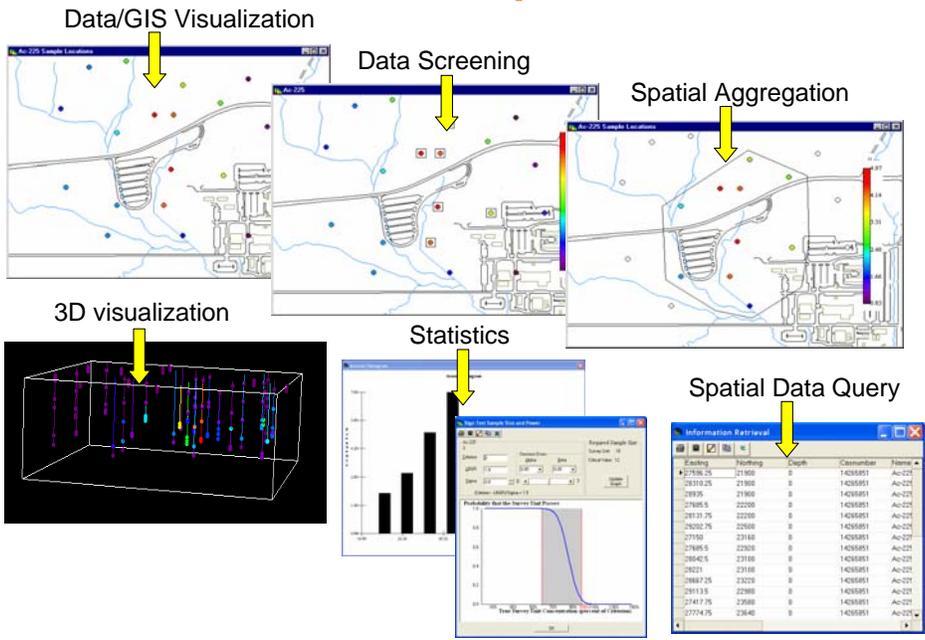
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Basic Data Exploration



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Classical Statistics

EPA DQO/DQA

Numerous univariate statistics

Non-parametric hypothesis testing

Power curve based sample sizes

Histograms and CDFs

The screenshot displays several Minitab windows for data analysis:

- Univariate Statistics:** Shows various statistical options like Detects, Range, Interquartile Range, UCL95, etc.
- One-Sided Sign Test:** Configured for a one-sided test with $\alpha = 0.05$ and $n = 120$.
- Ac-225 Sample Locations(0 <- Z < 10):** A window for comparing two data sets: 'Soil' and 'Background'.
- Sign Test Sample Size and Power:** A window for determining sample size based on a decision error rate and a power curve graph.
- Wilcoxon Rank-Sum Test:** Shows the results of a non-parametric test, including a table of data points and test statistics.

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Human Health Risk

- SADA implements EPA methods for conducting human health risk assessments
- Calculation of site-specific preliminary remediation goals
- Exposure modeling for humans for five different land use scenarios
- Contains IRIS/HEAST toxicity databases for calculating risk from exposure
- Contains EPA default exposure parameters for the risk models
- Tabular screening and risk results
- Point screens
- Risk and dose mapping

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SADA Human Health Functionality

Setting Up Human Health

Viewing Scenario Parameters

Viewing Toxicological Parameters

Changing Target Risk/Hazard Index

Setting Screening and Exposure Statistics

PRG Tables

PRG Screen Tables

Risk Tables

Spatial PRG Screens

Point Risk Maps

Rematching a Single Contaminant

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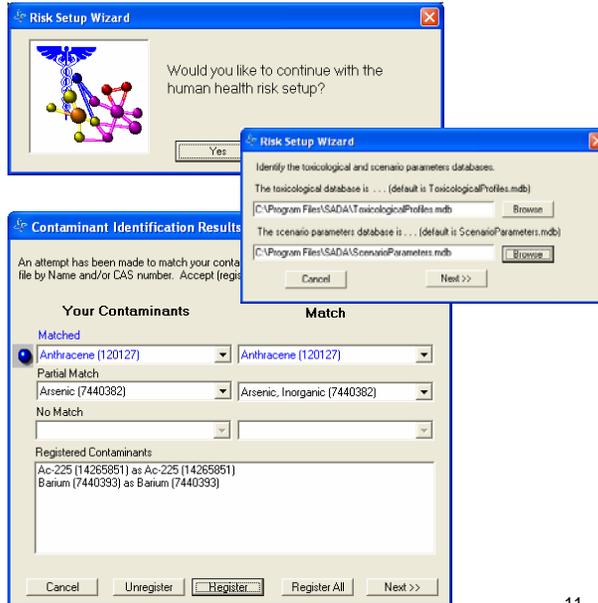
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Setup Human Health

After a SADA file is created

Imports toxicity and exposure data to the SADA file

Link contaminants in toxicity file to those in SADA file



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Human Health Risk Inputs

Media Data: Soil, Sediment, Surface Water, Groundwater

Exposure Scenarios: Residential, Industrial, Recreational, Agricultural, Excavation

Exposure Pathways: Ingestion, Inhalation, Dermal Contact, Food Chain (Beef, Milk, and Vegetable Ingestion)

IRIS and HEAST Toxicity Databases for Carcinogenic and Noncarcinogenic Effects

Physical Parameters for Modeling: Bioaccumulation Factors, Volatilization, Particulate Emission Factors, Permeability Constants, Absorption Factors, Saturation Coefficients, etc.

The screenshot displays the 'Set Human Health Exposure Parameters' software interface. It includes several key sections:

- Exposure Parameters - Soil:** A table with columns for Residential, Industrial, Recreational, Excavation, and Agricultural. Rows include Exposure frequency, Adult exposure duration, Child exposure duration, Adult soil ingestion rate, Child soil ingestion rate, Fraction ingested, Inhalation rate, Adult surface area, Adherence factor, Gamma exposure factor, and Gamma shielding factor.
- General:** Fields for Body weight (Adult: 70, Child: 15 kg) and Lifetime (70 years).
- Mass loading factors:** Residential (0.26) and Agricultural (0.26) values.
- Milk-food chain pathway (Dairy cattle):** Residential and Agricultural options.
- Beef for...:** Parameters for Fraction, Quantity, and Value.
- Parameter Calculation Settings:** A dialog box with checkboxes for 'Maximum Value', 'Maximum Detected Value', and 'VCLM'.
- Set Human Health Contaminant Physical Parameters:** A window for setting parameters like Soil Factor (PF), Soil Factor (PF), Soil Factor (PF), etc.

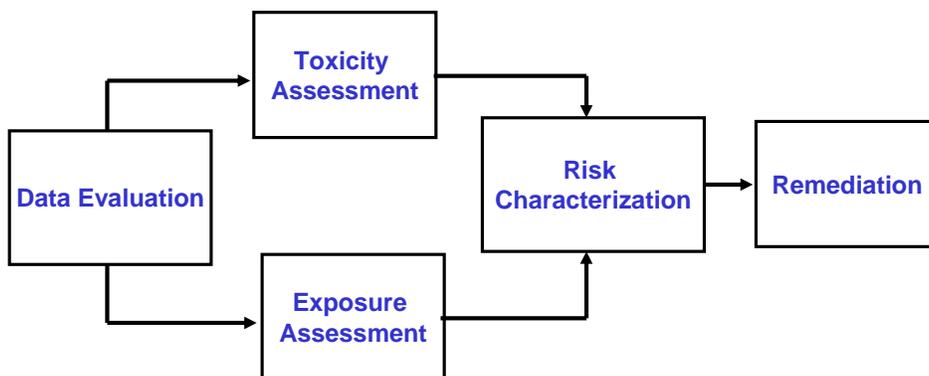
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Standard Steps of a Risk Assessment



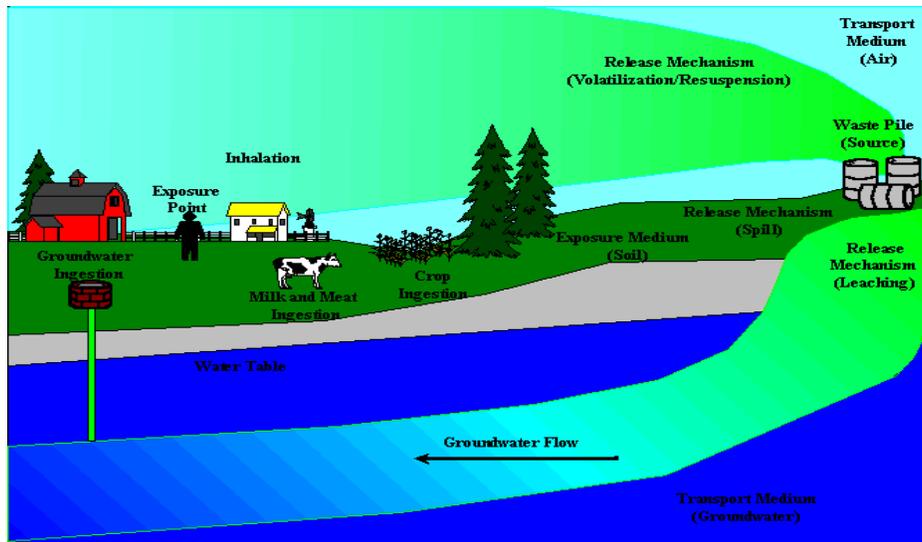
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Risk Assessment- Exposure



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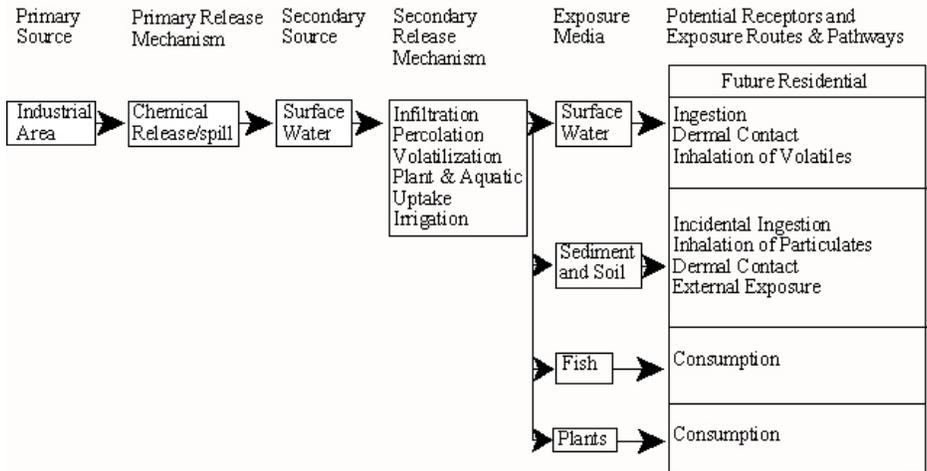


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Exposure- Conceptual Site Model

Site Conceptual Model For site A



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Risk Characterization

Risk Characterization

Risk Characterization incorporates the outcomes of the previous activities (Data Evaluation, Exposure Assessment, and Toxicity Assessment) and calculates the risk or hazard resulting from potential exposure to chemicals via the pathways and routes of exposure determined appropriate for a site.

Calculate risks by media and land-use

- Quantify risk for each chemical
- Quantify risks from multiple chemicals
- Combine risks across exposure pathways
- Assess uncertainty

Identify chemicals, media, and land-uses of concern and support development of cleanup goals

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We have now selected the data to be used in the risk assessment (through screening); we have selected the exposure routes and pathways (in the exposure assessment); and we have selected the appropriate toxicity values.

All of this previous information will now be used in the risk characterization step.

We are now ready to perform the forward calculations of the risk and hazard equations. Please note that the PRG determinations have been backwards (extrapolating from a set risk or hazard levels BACK to a “safe” or “acceptable” residual concentration level for a specific medium [groundwater or soil]).

In the forward calculations, we will determine the risk from each of the chemicals within each pathway. The RAIS does not calculate the total risk or hazard values in the forward direction (needed in the backward direction, though).

As appropriate, you can then sum the risks from the different chemicals within each pathway and across the pathways to determine pathway and scenario total risk and hazard values.

Note: EPA’s default assumption is one of additivity for risk and hazard values. However, there are chemicals that act together in non-additive manners, I.e. synergistic or antagonistic (PICK SOME GOOD EXAMPLES FOR EACH).

For more help, you can look at the online tutorial.

Human Health Risk Outputs

PRG Calculation

Forward Risk

Risk Based Screening Results: Target risk = 0.0001...

Pathways:
 Ingestion Dermal Fish Beef All
 Inhalation External Vegetables Dairy

Name	CAS	Ingestion	Inhalation	All
Ac-225	14265851	5.6E+2	1.5E+5	
Arsenic, Inoi	7440382	4.3E+1	7.4E+4	

PRG Screens

Screening Results: Target risk = 0.0001/Target ...

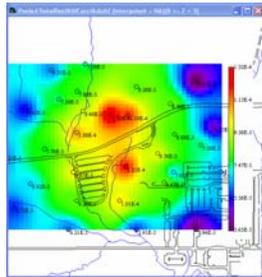
Pathways:
 Ingestion Dermal Fish Beef All
 Inhalation External Vegetables Dairy

Name	CAS	Ingestion	Vegetables	All
Ac-225	14265851	Yes	Yes	
Arsenic, Inoi	7440382	Yes	Yes	

Human Health Risk Results

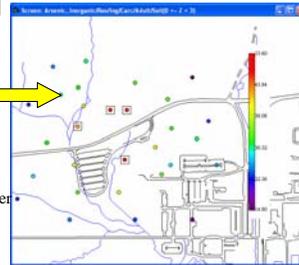
Pathways:
 Ingestion Dermal Fish Beef All
 Inhalation External Vegetables Dairy

Name	CAS	Ingestion	Inhalation	External	All
Ac-225	14265851	5.5E-7	2.E-9	5.5E-7	1.1E-6
Arsenic, Inoi	7440382	1.8E-5	1.E-8	1.8E-5	1.8E-5
Total		1.8E-5	1.2E-8	5.5E-7	1.9E-5



Risk Based Spatial Screens

Risk Mapping



Residential, Industrial, Agricultural, Recreational, Worker
 Ingestion, Inhalation, Dermal, External, Food Chain
 Soil, Sediment, Surfacewater, Groundwater
 Packaged with Editable Scenario Parameters
 Packaged with IRIS and HEAST Database

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Exposure Statistics

Default values are maximum detected value for screening calculations and lesser of the maximum detected value and the UCL95 for exposure calculations.

User can change the approach:

Maximum Value: the maximum concentration, detected or nondetected, for normal or lognormal distribution

Maximum Detected Value: the maximum detected concentration for normal or lognormal distribution

UCL95: the 95% upper confidence limit on the mean for normal or lognormal distribution

Mean: the average concentration over all values for normal or lognormal distribution

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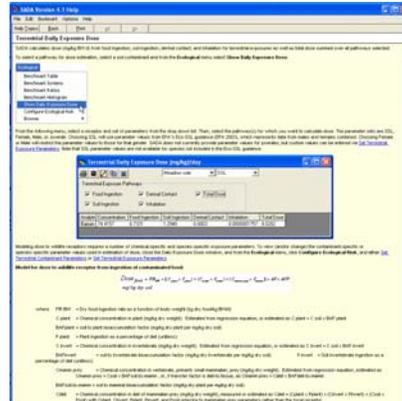
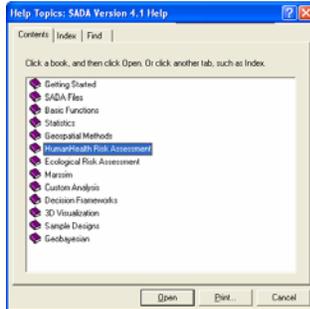


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Help File and Users' Manual

Extensive documentation of human health methods and parameters in SADA help file



320 page user guide available from:

http://www.tiem.utk.edu/~sada/SADA_4_1_Usersguide.pdf

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Current limitations for Human Health Risk

ProUCL95 (confidence limits, automatic distribution testing)

Additional tox info, target organs

RAGS Part D reporting format

Screening PRGs as benchmarks

Air, dermal modifications

Uncertainty analysis

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Ecological Capabilities in SADA

- SADA implements EPA methods for conducting ecological risk assessments
- Benchmark database for contaminant effects on ecological receptors
- Exposure modeling for over 20 other terrestrial species
- Contains EPA default exposure parameters for the risk models where available
- Tabular screening and risk results
- Point screens
- Risk and dose mapping

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Ecological Functionality

Setting Up Ecological Risk
Ecological Risk Assessment Procedure
Setting Physical Parameters
Description of Ecological Benchmark Database
Histograms of Benchmark Values
Tables of Benchmark Values
Setting Screening and Exposure Statistics
Area Result Tables (Screens, Ratios)
Map Result Values (Screens, Ratios)
Rematching a Single Contaminant
Checking Ecological Version
Terrestrial Dose Modeling

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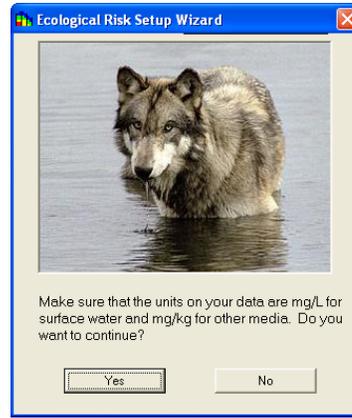


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Setup Ecological Risk

- Identify source benchmarks database
- Match contaminants in data to benchmark contaminants
- Adds ecological information to SADA file



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Hazard v. Risk Assessment

Ecological Hazard Assessment- a comparison of an environmental concentration to an estimated toxic threshold for a particular contaminant

- most common method for examining effects of chemicals in environment
- comparison of environmental exposure concentration to a toxic threshold (benchmark)
- iterative (or tiered) implementation
- number of toxicity data sets for soil, sediment, and surface water available for screening

Ecological Risk Assessment- explicitly attempts to estimate the probability and magnitude of the effects of exposure to contamination

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Benchmark Screening

Media-specific concentration benchmarks

Choice of statistics (max, percentile, UCL95, etc.)

Hierarchy of media-specific benchmarks for screening

Spatial and tabular display of ratios

Derivation of Benchmarks:

Toxicity testing (acute or chronic)

-regression of concentration-response data

-hypothesis testing

Extrapolation from another benchmark

Simulation of an assessment endpoint

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Ecological Benchmark Screening

Suitable for screening ERAs

Compilation of ecological benchmarks for surface water (14), soil (11), sediment (17), and biota (8)

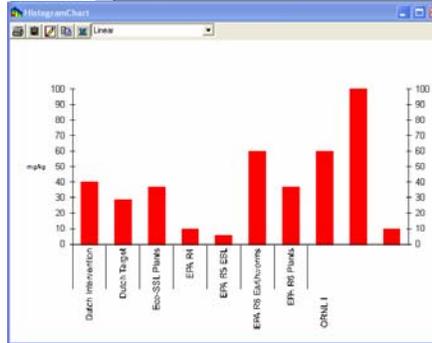
Benchmarks a function of environmental variables where appropriate

Choice of statistics (max, percentile, UCL95, etc.)

Hierarchy of media-specific benchmarks for screening

Spatial and tabular display of ratios

Analyte	EPA Region 4 Chronic	NWQSC Chronic	Tier 1 SAV	CV Aquatic Plants	LC50 Fish	EC
Chloride	0.000019	0.000002	4.4			
Tetrahydrocannabinol			0.2	669	2.46	0.2
Carbon Dioxide	0.53		0.02		5.72	1
Tetrahydrocannabinol (TCF)			0.44		5.76	0.2
Arsenic	0.19			2.32	1.12	2
Zinc	0.11	0.11		0.03	0.05	0.0



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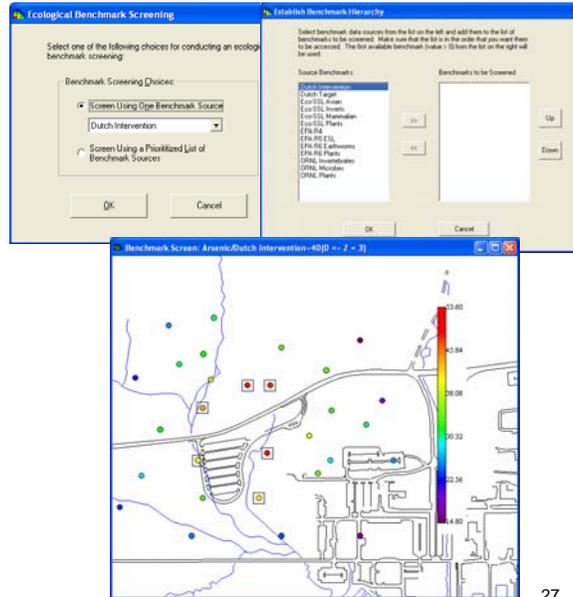
Building a scientific foundation for sound environmental decisions

Map Result Screens and Ratios

Screens concentration
against benchmarks at
each sample location

Places a box around
locations that exceed
benchmark

Can use one benchmark
source or establish a
site-specific hierarchy



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SADA Terrestrial Dose Modeling

SADA calculates dose (mg/kg BW d) from food ingestion, soil ingestion, dermal contact, and inhalation for terrestrial exposures as well as total dose summed over all pathways selected.

SSL, Female, Male, or Juvenile

Number of different species

Use a polygon to identify home range

Select species/sex

Click exposure pathways

Returns dose in mg/kg/day for each exposure pathway



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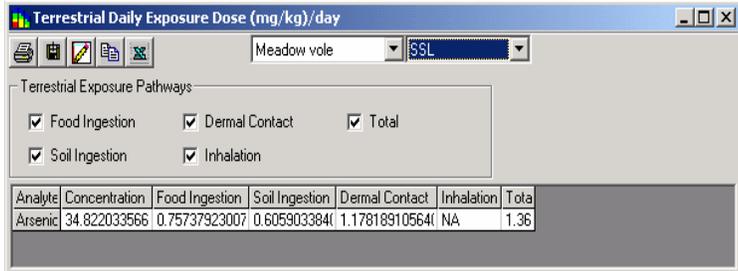
Calculate Exposure for Home Range

Use a polygon to identify home range

Select species/sex

Click exposure pathways

Returns dose in mg/kg/day for each exposure pathway



Ecological

- Benchmark Table
- Benchmark Screens
- Benchmark Ratios
- Benchmark Histogram
- Show Daily Exposure Dose
- Configure Ecological Risk
- Browse

Analyte	Concentration	Food Ingestion	Soil Ingestion	Dermal Contact	Inhalation	Total
Arsenic	34.822033566	0.75737923007	0.6059033841	1.178189105641	NA	1.36

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SADA Ecological Risk Needs

Additional benchmarks

Radionuclide benchmarks and dose
assessment methods

Terrestrial movement and habitat
models

Eco PRG tables/calculations

Aquatic dose models

Uncertainty for dose assessment

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Spatially Explicit Ecological RA

Use spatial distribution of contamination
with dynamic movement models that also
incorporate:

- Habitat quality
- Foraging behavior
- Ecological interactions

Number of movement models available in
the literature

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Terrestrial Movement Models (in development)

Terrestrial Dose Calculation

Select a species and a set of exposure assumptions for terrestrial dose calculation.

Receptor

Species: Red-tailed hawk

Exposure Type: SSL

Check the exposure pathways that are to be summed for terrestrial exposure.

Exposure Pathways

Movement Models

Select Movement Model Type

Movement Models

4-Square

5-Square

8-Square

9-Square

Daily range (radius)

Use Habitat Suitability Index Data

Home Range Limited

Home range size (radius)

Number of time steps (days)

Number of simulations

OK

Dose Histogram for 4-Square: Red-tailed hawk (SSL) - Arsenic

Statistic	Value
Simulations	1000
Time Steps	90
Grid Resolution	1
Mean	0.0165
Geometric Mean	0.0164
Median	0.0161
Standard Deviation	0.002
Variance	0.00003912
Coefficient of Variance	0.1191
Minimum	0.014
Maximum	0.0252
Range	0.0112
InterQ Range	0.0027
Skewness	0.0028
Kurtosis	-2.9961
UCL 95	0.0166
Geometric UCL 95	0.0165
Dose Units	(mg/kg/day)

Percentiles	Value
0 %	0.014
10 %	0.0162
20 %	0.0166
25 %	0.017
30 %	0.0172
40 %	0.0177
50 %	0.0181
60 %	0.0186
70 %	0.0193
75 %	0.0197
80 %	0.0201
90 %	0.0214
95 %	0.0222
100 %	0.0252

Simulations = 1000, # Time Steps = 90, Feed Ingestion (OI) Soil Ingestion (DI)

OK

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Spatial Risk Assessment

Conventional Risk Assessment Limitations

Typically regulatory exposure assessment guidance recommends a summary statistic for the exposure concentration

Spatial information is lost when a summary statistic is used in the RA- exposure is assumed to be continuous in space and time

Often this lost info not recovered in the rest of the assessment/remediation process

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Spatial Risk Assessment

Reasons for incorporating spatial statistics into risk assessment

Maximize the use of limited resources

Efficiently collect data

Retain collected spatial info in the risk assessment

Use all types of available data, including expert judgment

To more adequately characterize the exposure distribution

Extrapolate from known data to cover data gaps

Account for spatial processes related to exposure

Better understand uncertainties in the exposure assessment

Efficient (selective) determination of areas in need of remediation

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Selective Remediation

Process that achieves a local- and/or site-specific concentration level while minimizing cleanup volume.

Implementation requires:

- data
- spatial interpolation model
- decision-maker cleanup criteria
- spatial scale inputs

Results in a spatially explicit remedial design

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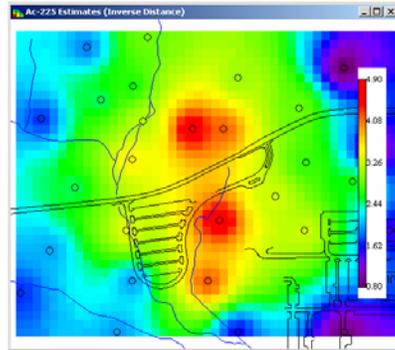
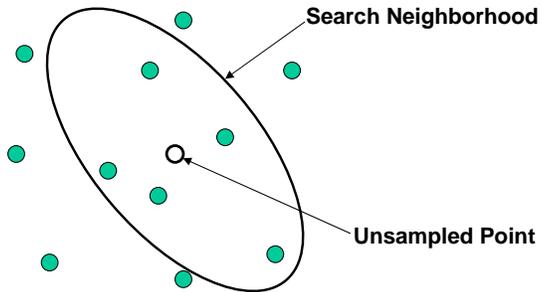
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Spatial Estimation

The estimated value V_0 at all unsampled grid locations is estimated as a weighted average of nearby values.

$$V_0 = \sum_{i=1}^N w_i V_i$$



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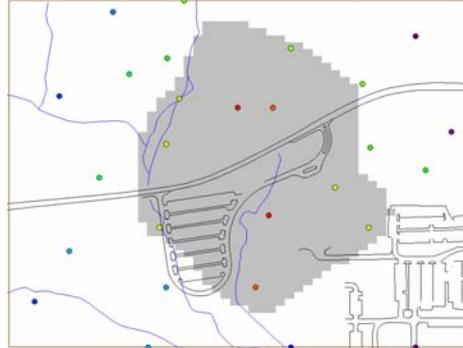
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Determining Areas of Concern

Map of interpolated concentration values can be compared to ecological or human health risk criteria to develop areas of concern

SADA reports area or volume of exceedance and coordinates or areal extent



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SADA web site

<http://www.tiem.utk.edu/~sada/>

Or just google “SADA” to freely download program and documentation.



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Questions?

Comments?

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Case Studies and Additional Slides

Marino Brothers Scrap Yard, Rochester Borough, Pennsylvania

- http://www.frtr.gov/decisionsupport/PDF/FIELDS_SADACaseStudy_8-22-05.pdf
- http://www.kvvm.hu/szakmai/karmentes/egyeb/us_epa/22_Marino_Brothers_CS.pdf

Navy TCE Plume, Lemoore Naval Air Station, Lemoore, California

- http://www.kvvm.hu/szakmai/karmentes/egyeb/us_epa/14_Navy_TCE_Plume_Case_Study.pdf

Small Arms Range, Tacoma, Washington

- http://www.kvvm.hu/szakmai/karmentes/egyeb/us_epa/18_Rifle_Range_Case_Study.pdf

Barker Chemical Company, Inglis, Florida

- http://www.frtr.gov/decisionsupport/PDF/SADA_Case_Study_053907Barker.pdf
- manuscript in review- Environmental Modeling and Assessment

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Use of SADA Software at David Witherspoon Inc. 901 Site

Fred Dolislager
The University of TN
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Use of SADA Software at David Witherspoon Inc. 901 Site

- ◆ Spatial Analysis and Decision Assistance (SADA) software was used as the primary risk assessment/spatial assessment tool
- ◆ Operations at the site resulted in widespread radionuclide and other hazardous substances
- ◆ Shut down in 1993
- ◆ Contaminated Soil, Sediment, Groundwater and Surface Water
- ◆ 10.5 acre site

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Brief site description

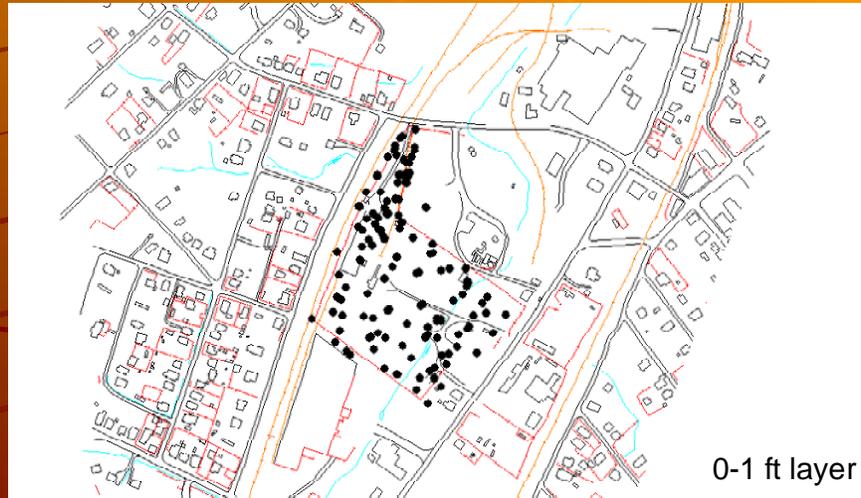
Use of SADA Software at David Witherspoon Inc. 901 Site

- ◆ Visualization
- ◆ Geospatial Analysis
- ◆ Statistical Analysis
- ◆ Human Health Risk
- ◆ Ecological Risk
- ◆ Cost/Benefit Analysis
- ◆ Sample Design
- ◆ Decision Analysis
- ◆ Site Characterization
- ◆ Data Aggregation
- ◆ Risk Assessment
- ◆ 3-D Risk Modeling
- ◆ Removal Volumes
- ◆ Decision Analysis
- ◆ Sample Design
- ◆ Data Screening

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On left things SADA can do. On right Things we used SADA for.

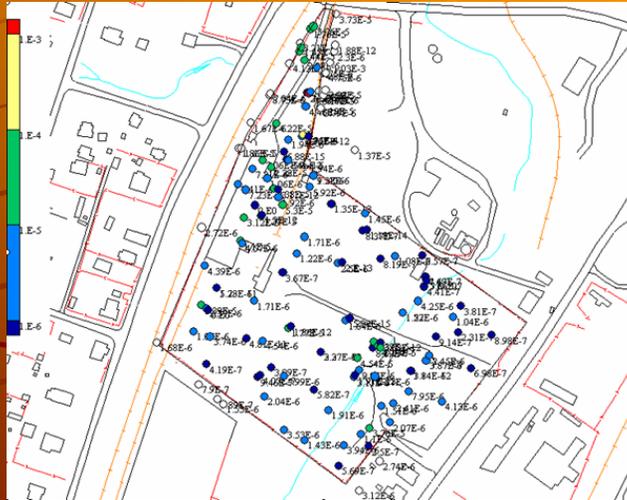
Use of SADA Software at David Witherspoon Inc. 901 Site



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A picture of all soil borings.

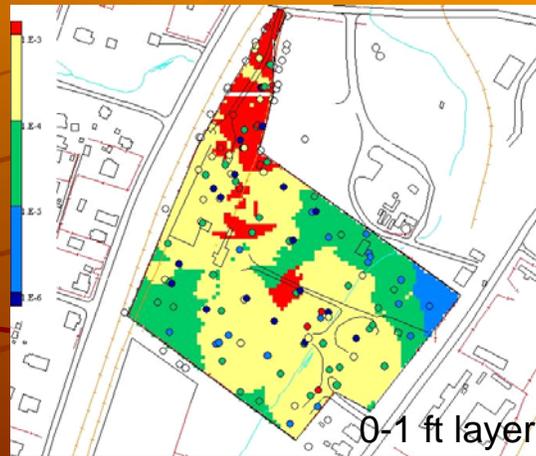
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Point risk map of surface soil

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Contoured risk. (each contaminant modeled separately).

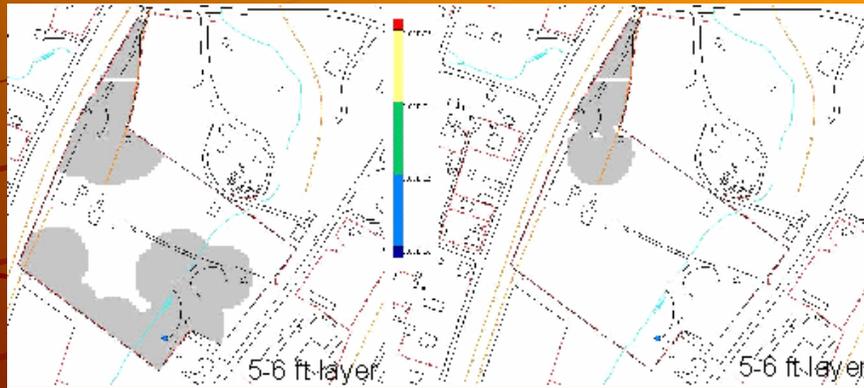
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Where to dig to meet risk goal. Remove 1 ft on whole site and then determine various depths

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Block scale on left. Site scale on right. Notice no actual data points.

Use of SADA Software at David Witherspoon Inc. 901 Site

- ✦ Tools in SADA that were useful
 - Overburden
 - Benching Angles
 - Selection of Interpolation Models
 - Volume Calculations
 - Reproducibility for changes at meetings
 - Auto documentation
 - Dynamics of Risk Library
 - Site Scale versus Block Scale

Use of SADA Software at David Witherspoon Inc. 901 Site



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Predicted excavation depth was right on. Notice the color change. Foundry sand

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Note the slag. Not predicted well at all. 15 ft deep trench.

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Candora rd.

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Back to Candora rd

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Top to bottom

Questions?

Comments?

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please complete our online feedback form.

Thank You

[Links to Additional Resources](#)

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