Vapor Intrusion: A Georgia Regulatory Perspective Update

Presented to the Georgia Brownfield Association
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Introduction

- Views expressed in this presentation are those of the presenters and are not necessarily EPD or EPA policy
- Vapor intrusion (VI) is an exposure pathway that may be evaluated at regulated sites
- VI evaluations have become more common
  - Greater focus by EPA, state agencies, ASTM
  - Generally greater awareness among stakeholders

Introduction

- Not a lot of specifics in GA statutes and regulations regarding VI
  - Example: *"[t]he corrective action shall not allow…the accumulation of vapors in buildings or other structures which pose a threat to human health or the environment."* – Rules for Hazardous Site Response Section 391-3-19-.07(4)(c)
- Vapor intrusion evaluations have traditionally been handled on a site-specific basis
- Typically relied on guidance from EPA and others (e.g., ITRC)

EPD Vapor Intrusion Workgroup

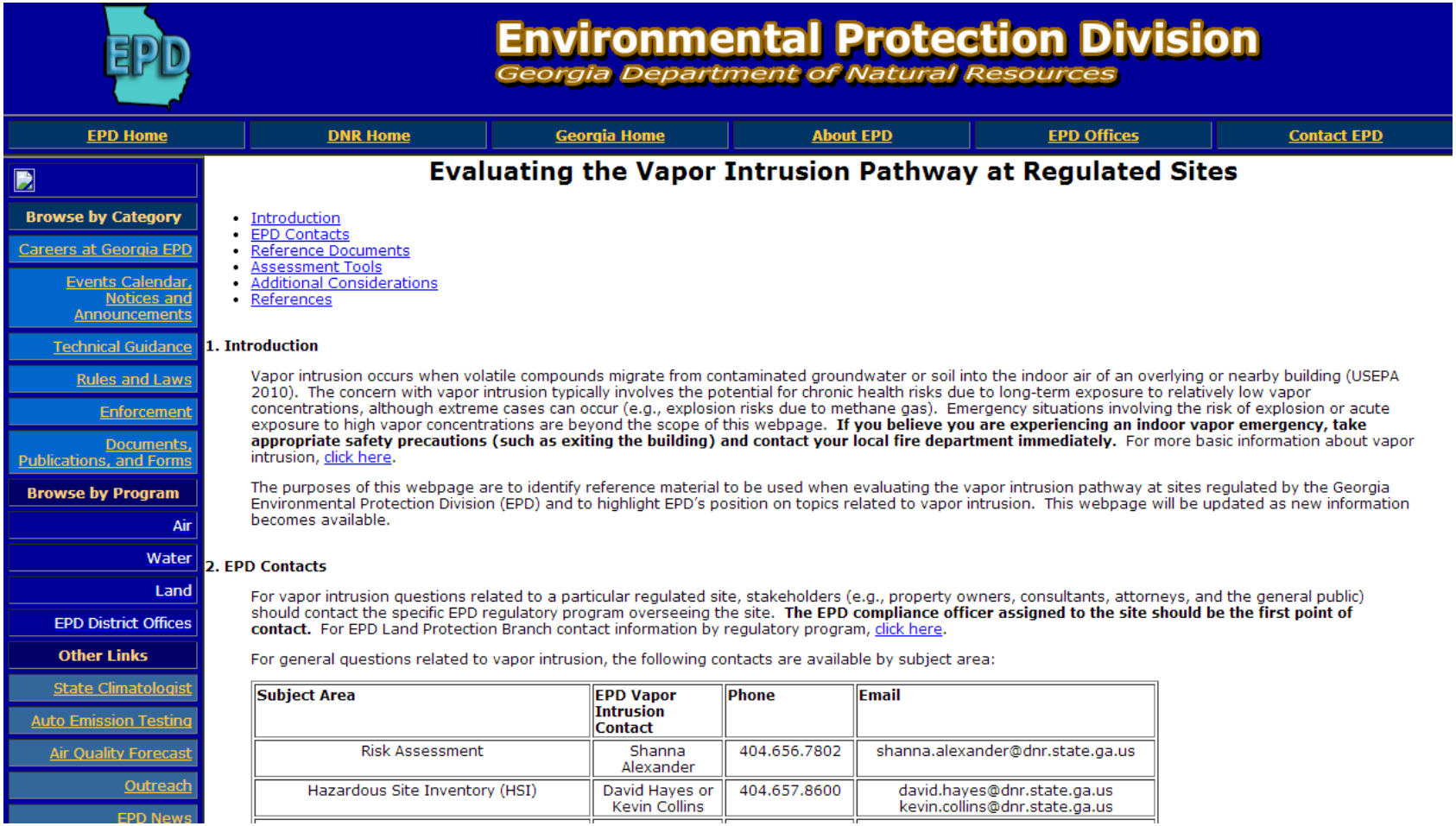
- Composed of people from various programs within the Land Protection Branch
  - Shanna Alexander (Risk Assessment)
  - Kevin Collins (HSI and VRP)
  - David Hayes (HSI and VRP)
  - Undine Johnson (UST)
  - Kent Pierce (Brownfields)
  - Amy Potter (DOD Facilities)

EPD Vapor Intrusion Workgroup

- Goals
  - Promote discussion among EPD programs that may deal with VI at sites
  - Promote consistency when evaluating VI
  - Promote the use of current information and methods when evaluating VI
  - Recommend information for posting on EPD website to assist stakeholders

EPD VI Webpage

www.gaepd.org/Documents/vaporintrusion



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Evaluating the Vapor Intrusion Pathway at Regulated Sites

- Introduction
- EPD Contacts
- Reference Documents
- Assessment Tools
- Additional Considerations
- References

1. Introduction

Vapor intrusion occurs when volatile compounds migrate from contaminated groundwater or soil into the indoor air of an overlying or nearby building (USEPA 2010). The concern with vapor intrusion typically involves the potential for chronic health risks due to long-term exposure to relatively low vapor concentrations, although extreme cases can occur (e.g., explosion risks due to methane gas). Emergency situations involving the risk of explosion or acute exposure to high vapor concentrations are beyond the scope of this webpage. **If you believe you are experiencing an indoor vapor emergency, take appropriate safety precautions (such as exiting the building) and contact your local fire department immediately.** For more basic information about vapor intrusion, click here.

The purposes of this webpage are to identify reference material to be used when evaluating the vapor intrusion pathway at sites regulated by the Georgia Environmental Protection Division (EPD) and to highlight EPD's position on topics related to vapor intrusion. This webpage will be updated as new information becomes available.

2. EPD Contacts

For vapor intrusion questions related to a particular regulated site, stakeholders (e.g., property owners, consultants, attorneys, and the general public) should contact the specific EPD regulatory program overseeing the site. **The EPD compliance officer assigned to the site should be the first point of contact.** For EPD Land Protection Branch contact information by regulatory program, click here.

For general questions related to vapor intrusion, the following contacts are available by subject area:

Subject Area	EPD Vapor Intrusion Contact	Phone	Email
Risk Assessment	Shanna Alexander	404.656.7802	shanna.alexander@dnr.state.ga.us
Hazardous Site Inventory (HSI)	David Hayes or Kevin Collins	404.657.8600	david.hayes@dnr.state.ga.us kevin.collins@dnr.state.ga.us

2013 External Review Draft of EPA OSWER Final VI Guidance

- Reflects knowledge gained since 2002
- “Multiple lines of evidence” approach
  - General idea: VI pathway is complex, more supporting evidence = more confident decisions
  - Importance of particular lines depends on site-specific factors
  - Not a new concept (e.g., ITRC 2007)
- Attenuation factor updates

Multiple Lines of Evidence: Examples

- Site history / source information
- Site geology / hydrology information
- Building construction
- Groundwater data
- Soil gas data
- Sub-slab data
- Indoor air data
- Outdoor air data
- Comparison of media concentrations (e.g., groundwater) to screening levels
- Preferential pathway assessment
- Tracer data
- Pressure data
- Mathematical modeling
- Data trends

Attenuation Factor (AF)

- Quantifies reduction in vapor concentration from source to indoor air
- $AF = C_{indoor} / C_{source}$
  - C_{indoor} = vapor concentration in indoor air
  - C_{source} = vapor concentration at source
- Used to calculate media screening levels (e.g., $C_{sub\text{-}slab} = C_{indoor} / AF_{sub\text{-}slab}$)
- Lower AF = more attenuation = higher screening levels
- Can calculate AF using empirical data (e.g., paired indoor air and sub-slab data) or mathematical modeling

EPA Attenuation Factor Updates: Default

media	2002 Draft	2013 Draft
	AF	AF
sub-slab	0.1	0.03
external soil gas	0.1 (<5 ft below foundation) 0.01 (>5 ft below foundation)	0.03 (near-source)
groundwater	0.001	0.001

EPA Attenuation Factor Updates: Semi-Site-Specific

media	2002 Draft		
	AF	factors	source
external soil gas	approx. 0.002 – 0.0002	soil type, depth	J & E Model
groundwater	approx. 0.001 – 0.0001	soil type, depth	J & E Model
media	2013 Draft		
	AF	factor	source
external soil gas	0.03	---	empirical database
groundwater	0.0005	fine soil type	empirical database

Upcoming Documents

- EPA OSWER Final VI Guidance
  - Additional supporting documents
- EPA OUST VI Guidance
  - Petroleum vapor intrusion at UST sites
- ITRC Petroleum VI Guidance
  - Expected in October 2014
  - Accompanying internet-based training
  - Releases from USTs and other sources

What can I do right now if VI is a concern?

- Consult with the EPD site compliance officer
- Develop a conceptual site model for VI
- Support decision-making with recent reference material (e.g., see EPD VI webpage)
- Use assessment tools
  - Vapor Intrusion Screening Level (VISL) Calculator
  - Johnson and Ettinger Model
- Consider remediation of the vapor source
- Consider vapor mitigating design with new construction

Conceptual Site Model for VI

- Examples of important elements
  - Nature and extent of vapor sources
  - Data trends (e.g., groundwater concentrations increasing, stable, or decreasing)
  - Soil lithology
  - Depth to groundwater and flow direction
  - Building use (e.g., residential) and construction information
  - Preferential pathways
- Geologic cross-sections are helpful for visualizing
- CSM is needed to evaluate if screening levels or modeling are applicable

Application of EPA VISL Calculator in Vapor Intrusion Evaluations

Overview

- To focus site-specific vapor intrusion evaluations on specific sources, constituents of potential concern, and/or background locations
- VISL calculator replaces the screening level tables in the back of the 2002 Draft VI Guidance (i.e., Tables 2a, 2b and 2c)
- Based on the generic CSM for vapor intrusion described in the 2002 Draft VI Guidance

Key Items

- Conservative values designed for screening purposes only
- Determined using the recommended approaches in existing guidance and based on current understanding of the VI pathway
- VISLs for groundwater and soil gas calculated from the target indoor air concentrations using empirically-based conservative generic AFs
- Non-residential Exposure Time Interval now factored into calculation (e.g., 8 hours/day for commercial workers vs. 24 hours for residents)

Key Items (Cont'd)

- Based on default exposure parameters and factors that represent EPA's Reasonable Maximum Exposure (RME) conditions for long-term chronic exposures
- Incorporates the latest toxicity factors and chemical-specific parameter values in the Regional Screening Levels Tables (updates semi-annually)
- Incorporates ADAF methodology based on EPA's *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens* (EPA 2005)
- Based on inhalation exposure dose model from EPA RAGS, Part F Inhalation Risk Assessment (EPA 2009)

Site-Specific Criteria for the VISL Calculator

- Exposure scenario (residential or commercial)
- Target Risk for carcinogens = 1E-5 (HSRA, Brownfields sites, VRP)
- Target Hazard Quotient = 1
- Groundwater temperature

Groundwater Temperature Map

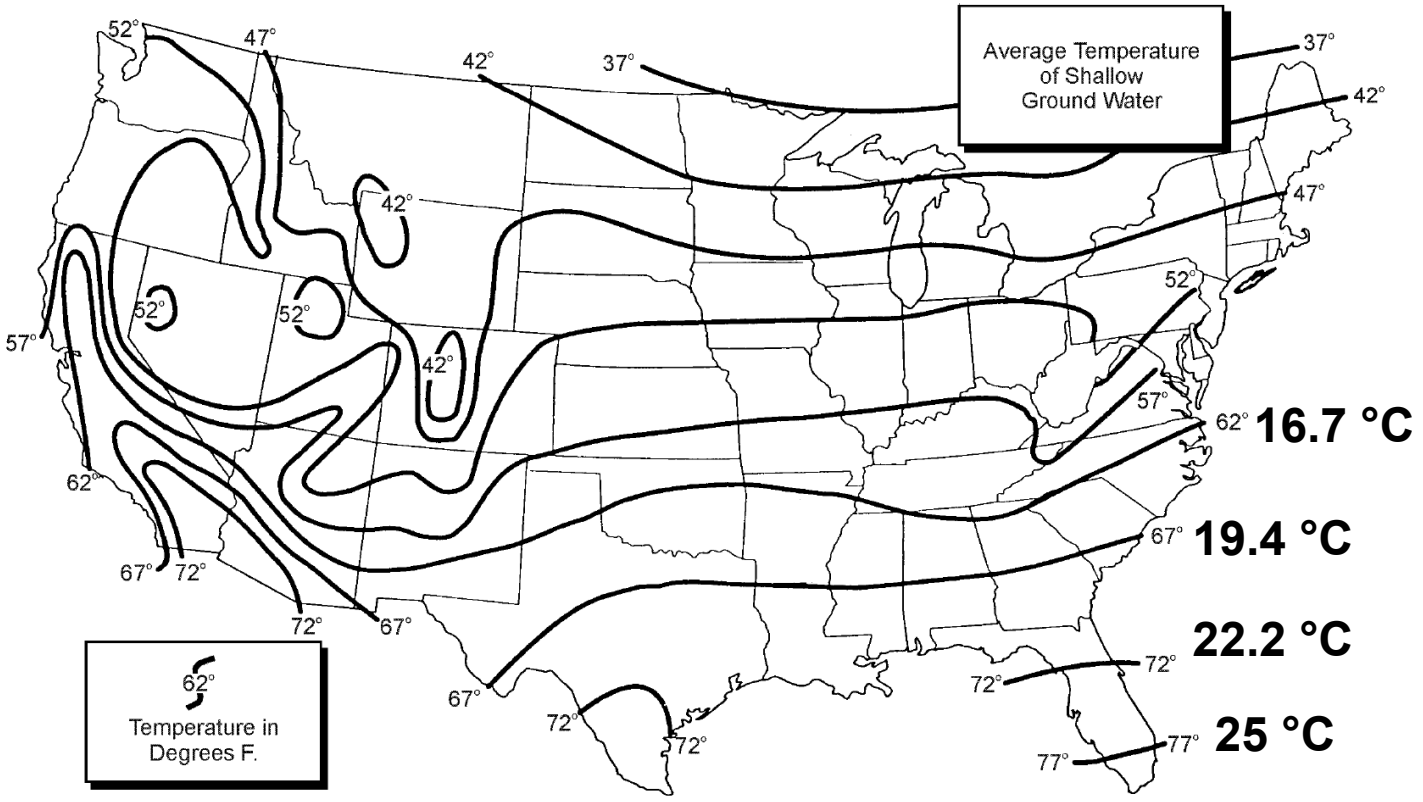
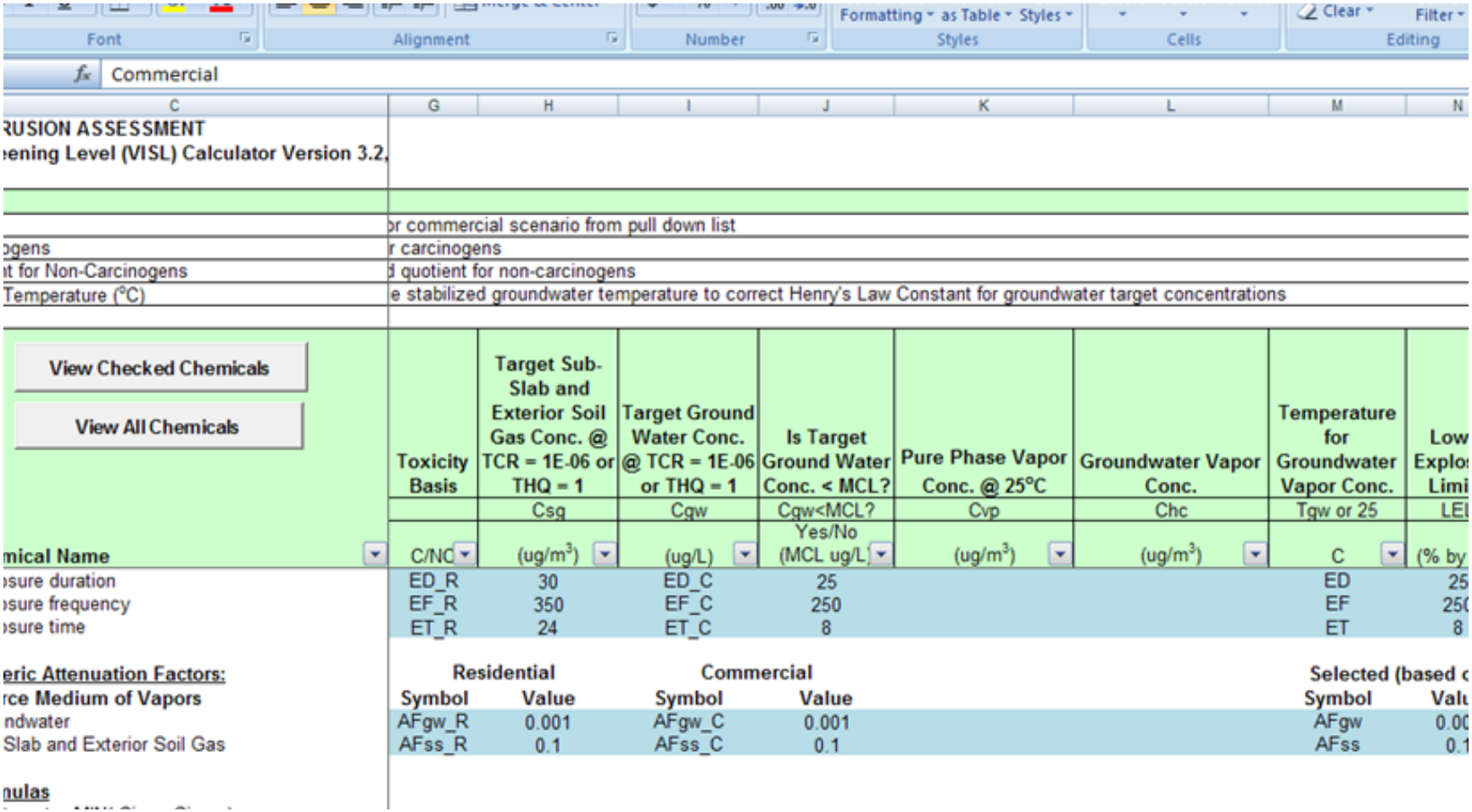


Figure 1. Average Shallow Ground Water Temperatures in the United States

(Adapted from EPA 2001)

Generic AFs in VISL Calculator



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fx Commercial

RUSION ASSESSMENT
ening Level (VISL) Calculator Version 3.2.

or commercial scenario from pull down list
ogens
r carcinogens
t for Non-Carcinogens
d quotient for non-carcinogens
Temperature (°C)
e stabilized groundwater temperature to correct Henry's Law Constant for groundwater target concentrations

View Checked Chemicals
View All Chemicals

mical Name	Toxicity Basis	Target Sub-Slab and Exterior Soil Gas Conc. @ TCR = 1E-06 or THQ = 1	Target Ground Water Conc. @ TCR = 1E-06 or THQ = 1	Is Target Ground Water Conc. < MCL?	Pure Phase Vapor Conc. @ 25°C	Groundwater Vapor Conc.	Temperature for Groundwater Vapor Conc.	Low Explo Limi
		Csg	Cgw	Cgw<MCL?	Cvp	Chc	Tgw or 25	LEL
	C/NC	(ug/m^3)	(ug/L)	Yes/No (MCL ug/L	(ug/m^3)	(ug/m^3)	C	(% by
osure duration	ED_R	30	ED_C	25			ED	25
osure frequency	EF_R	350	EF_C	250			EF	250
osure time	ET_R	24	ET_C	8			ET	8

eric Attenuation Factors:	Residential		Commercial		Selected (based c	
rce Medium of Vapors	Symbol	Value	Symbol	Value	Symbol	Valu
ndwater	AFgw_R	0.001	AFgw_C	0.001	AFgw	0.00
Slab and Exterior Soil Gas	AFss_R	0.1	AFss_C	0.1	AFss	0.1

nulas

Impact of AF and Temperature on Groundwater VISL

Substance	Groundwater Screening Levels (Commercial) (ug/L)			
	AF = 0.001 25 °C	AF = 0.001 20 °C	AF = 0.0005 25 °C	AF = 0.0005 20 °C
PCE	240	320	480	640
TCE	22	28	44	55

Notes:

- Table is provided as an example only (these are not necessarily approved screening levels)
- Screening levels calculated using VISL Calculator Ver. 3.2 Nov. 2013
- Commercial exposure assumptions
- Cancer Risk = 1E-5
- Hazard Quotient = 1
- AF = attenuation factor
- PCE = tetrachloroethene
- TCE = trichloroethene

Other Considerations

- Toxicity of compounds:
  - TCE updated toxicity factors
- Consider cumulative risk for multiple chemicals

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Questions or Comments

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