Inventory Development for the West Valley Probabilistic Performance Assessment (PPA) Model

WVDP Quarterly Public Meeting

November 2018

NEPTUNE AND COMPANY

Purpose

- Define inventory to be used as input to the West Valley PPA Model from existing data sources
  - Radiological and chemical wastes, other contamination, and residuals
- Structured parallel to the PPA Model
  - Waste Management Areas (12) – each may have zero, one, or multiple Facilities; zero to many Decision Units per WMA
  - Facility (34) – a modeling construct; each has its own contaminant transport and risk exposure calculations
  - Decision Unit (428) – each Decision Unit (DU) needs to have an inventory assigned
    - Inventory is assigned at the WMA and/or Facility level for those having no DUs; additional residual inventory is assigned to each Facility

WMAs

WMA 11 and 12 not shown.

Facilities

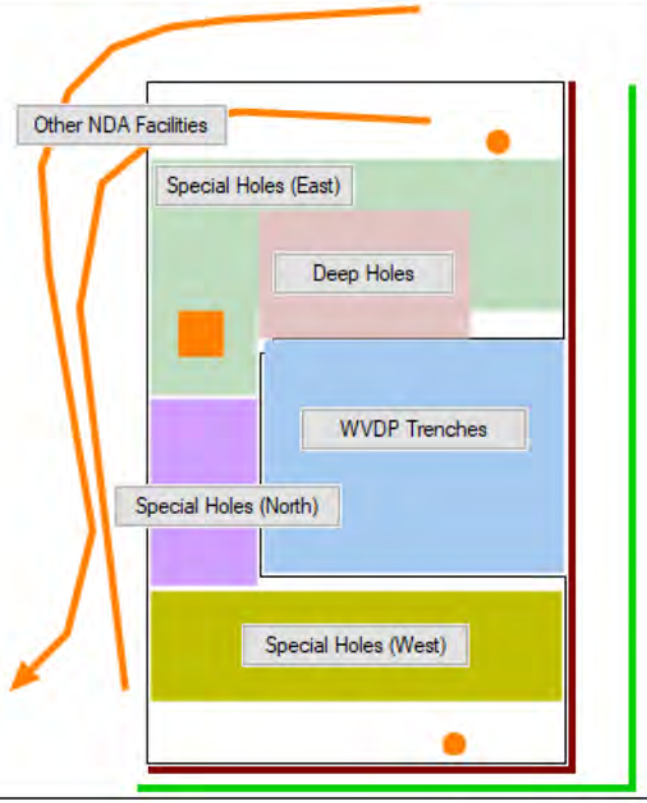
Selection of WMA 7 Closure Options

Instructions
- Select the closure option to be modeled using the drop-down box.
- For the Close-in-Place option, additional engineered controls may be selected, and individual Decision Units may be

Select closure options:

Close-In-Place (with engineered cover)

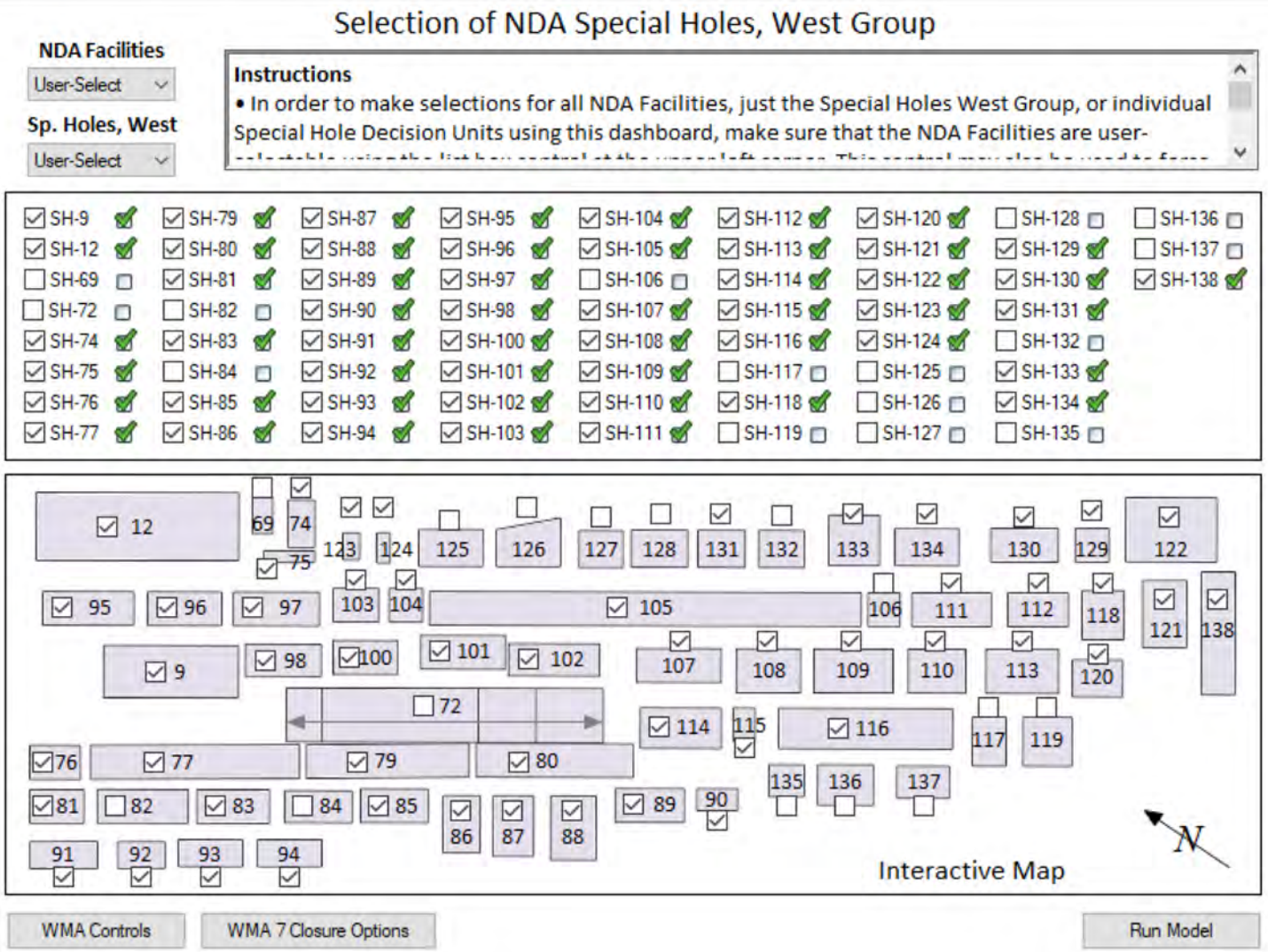
- No Action: All contamination remains in place. The existing geomembrane coverand slurry wall remain in place.
  - existing slurry wall
- Close-in-Place: Some or all contamination remains in place, as selected on the NDA Decision Units dashboards. The Close-in-Place cover would be constructed, and additional engineered controls may also be selected.
  - ☑ Upgradient French drain
  - ☐ Grout Interceptor Trench
  - ☑ Grout Decision Units > 6 m (20 ft)
- Complete removal: All NDA Holes, Trenches, and associated contamination are removed from WMA 7, and are replaced with clean backfill and a simple soil cover. Residual contamination remains in the ULT below the excavation.



WMA Controls

Run Model

Decision Units



Primary Data Sources

- SDA – URS 2002
- NDA – URS 2000
- WTF – WVNS 2005 (tanks 8D-1 and 8D-2), WVES 2008 (tank 8D-3) and CH2MHill 2012 (tank 8D-4)
- Residual contamination inventory source data is the WVDP Environmental Monitoring Program
  - Residual contamination: in the PPA Model, this is contamination that would remain after Decision Units are removed, under removal scenarios.

Chemical Species List

- Risk-based screening based on toxicity and mass – Are chemical risks potentially important relative to radiological risks?
- Human health-based chemical Regional Screening Levels (RSLs) plus ecological lowest observed adverse effect levels (L-ESLs) are compared to Radiological Soil Screening Levels (radSSLs)
- Radiological risk is generally at least 100 times chemical risk
- 4 species carried through to modeling:
  - Chromium
  - Mercury
  - Thallium
  - Uranium (chemical effects) – Radiological activity generated in PPA Model runs will be converted to uranium mass equivalent for assessment

Radiological Species List

- Master list of radionuclides (143)
- Ensure progeny are included; adding those not reported (153)
- Screening process defines species to carry through to contaminant transport modeling (66)
  - Short $T_{1/2}$ cutoff – 5 years, except Po-210, Rn-222, Th-228, Pu-236
  - Long $T_{1/2}$ cutoff - 1.5E10 years (9 nuclides)
  - Low inventory screen – Si-32, Nb-92, Tc-98, Pt-193, Bi-208
- Dose/risk modeling includes short-lived progeny of long-lived species after contaminant transport

Radiological Species List

Green cell indicates a species is present in the EIS (18)

H-3	Nb-93m	Pm-146	Ac-227	U-238	Am-242m
Be-10	Nb-94	Sm-146	Th228	Np-236	Am-243
C-14	Mo-93	Sm-151	Th-229	Np-237	Cm-243
Cl-36	Tc-99	Eu-152	Th-230	Pu-236	Cm-244
Co-60	Pd-107	Eu-154	Th-232	Pu-238	Cm-245
Ni-59	Ag-108m	Ho-166m	Pa-231	Pu-239	Cm-246
Ni-63	Cd-113m	Pb-210	U-232	Pu-240	Cm-247
Se-79	Sn-126	Po-210	U-233	Pu-241	Cm-248
Kr-85	I-129	Rn-222	U-234	Pu-242	Cf-249
Sr-90	Cs-135	Ra-226	U-235	Pu-244	Cf-250
Zr-93	Cs-137	Ra-228	U-236	Am-241	Cf-251

Sources of Uncertainty

- Multiple, sometimes conflicting inventories
- Inherent uncertainty of ~50 year old documentation
- No records of quality assurance checks
- Dose rate measurement methods/instrumentation
- Dose-to-curie conversion
- Profile assignment
- Profile development
- Volume per container/shipment
- Actual disposal location within NDA/SDA

SDA Burial Log

Shipment Number	Customer	Date Received	H & S Rep.	Cubic Feet	Date Buried	Location Buried	Container Type	Curies Per Load	Curies Total acc.	Remarks SNM, Special handling, Decontamination
E-7030	National Lead Company	5-23-67	L.W.	352 90	5-23-67	C+5 565	D	.000	114,726.956	No special handling.
E-7031	NFS	5-23-67	L.W.	154 35	5-23-67	C 570	cdb	.0255	114,726.956	
E-7032	U.S. AEC	5-23-67	L.W.	107 05	5-23-67	C-10 570	D	.000	114,726.956	
E-7033	Nuclear Waste Handling	5-24-67	L.W.	3 00	5-24-67	C-15 570	cdb	.003	114,726.959	
E-7034	McCormack's	5-24-67	L.W.	488 00		D-10 55	C & D	1.585	114,728.544	
E-7035	McCormack's	5-25-67	L.W.	368 00		D+5 60	C & S	.146	114,728.690	
E-7036	Long Island Nuclear	5-25-67	L.W.	102 90	5-25-67	C+15 575	D	.091	114,728.781	
E-7037	Niagara Chemical	5-26-67	L.W.	22 00	5-26-67	C-10 580	cdb	.000	114,728.781	
E-7038	NFS	5-26-67	L.W.	271 72	5-26-67	C 585	cdb	.0363	114,728.781	
E-7039	Isotopes, Inc.	April - May	L.W.	44,305 00		C 560 to 660	none	3.800	114,732.581	Special handling Decontamination
E-7040	Martin-Marietta	5-29-67	L.W.	448 35	5-29-67	C+10 590	D	.100	114,732.681	
E-7041	NFS	5-29-67	L.W.	290 64	5-29-67	C-15 590	D & cdb	.000	114,732.681	
E-7042	NFS	5-31-67	L.W.	73 50	5-29-67	C-5 600	cdb	.000	114,732.681	
E-7043	National Lead	5-31-67	L.W.	294 00	5-31-67	C+5 600	S	.000	114,732.681	
F-7001	Westinghouse-Bettis	6-1-67	L.W.	698 25	6-1-67	C 605	D	74.970	114,807.651	No special handling
F-7002	NFS	6-1-67	L.W.	29 40	6-1-67	C-10 625	D	.000	114,807.651	Special handling
F-7003	Westinghouse-Bettis	6-2-67	L.W.	311 19	6-2-67	D-10 55	S	401.110	115,208.761	No special handling.
F-7004	Westinghouse-Bettis	6-2-67	L.W.	307 40	6-2-67	D-15 65	S	533.000	115,741.761	No special handling
F-7005	[illegible]	6-2-67	L.W.	36 75	6-2-67	C-15 630	D	5.000	115,746.761	No special handling.
F-7006	NFS	6-3-67	L.W.	330 75	6-3-67	C+15 610	cdb + D	.001	115,746.761	No special handling
F-7007	NFS	6-5-67	L.W.	305 36	6-5-67	C+10 615	D + cdb	.010	115,746.761	No special handling

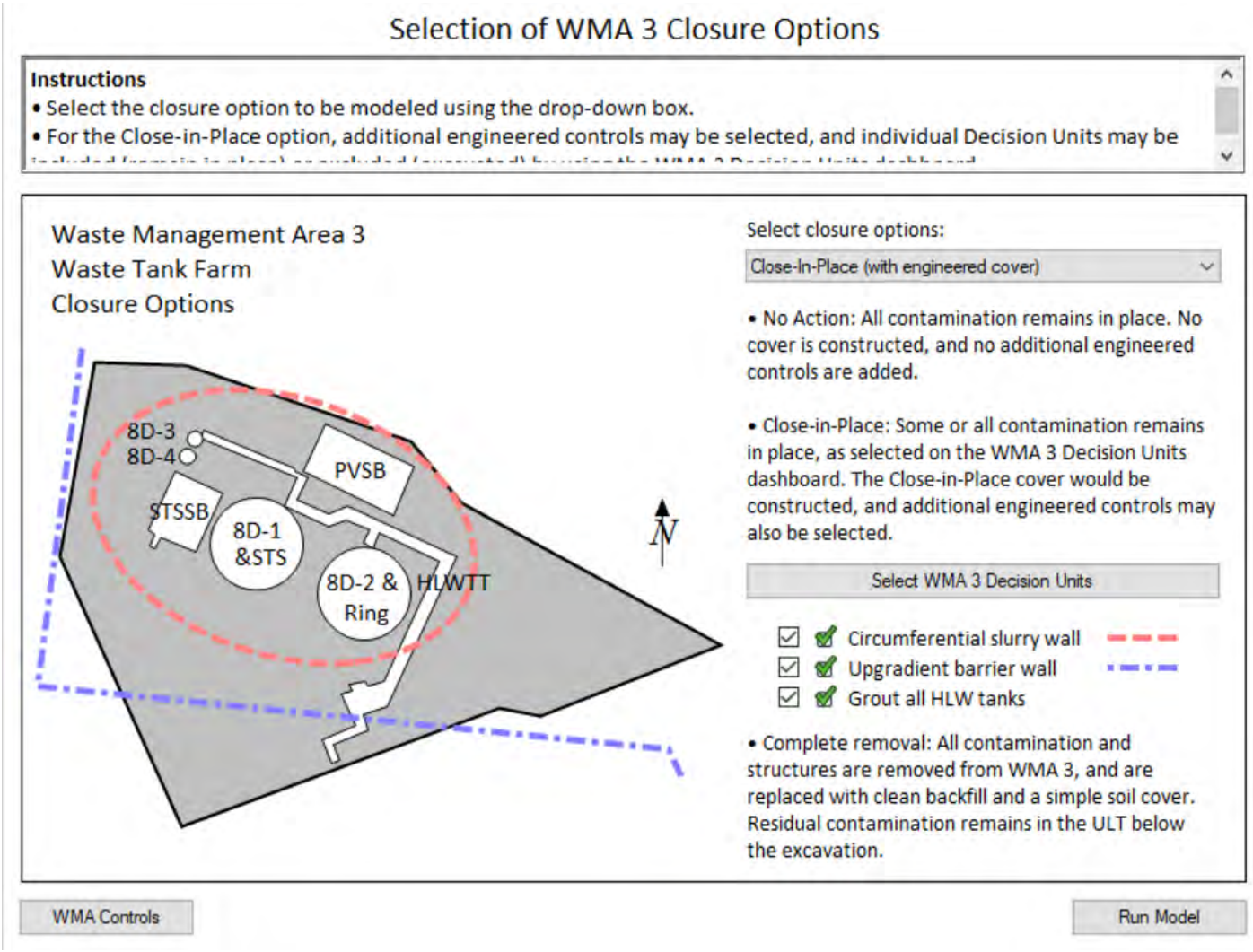
WMA 1

- Main Plant Process Building
- All structures and subsurface soil assumed to be removed during Phase 1 decommissioning
- 1 PPA Model Facility
- No Decision Units
- Inventory consists of residual contamination below the excavation
  - Extrapolate from geoprobe investigations
  - Using Phase 1 Decommissioning Plan (DP) subsurface soil cleanup goals as upper bound, since these will drive excavation limits during Phase 1

WMA 2

- Former LLRW Treatment Facilities
- 2 PPA Model Facilities
  - WMA 2 northwest of groundwater barrier wall
    - 2 Decision Units
      - North Plateau Groundwater Plume (NPGP)
      - Permeable Treatment Wall
    - Additional inventory of residual contamination
  - WMA 2 southeast of groundwater barrier wall
    - No Decision Units – all excavated
    - Inventory consists of residual contamination, based on geoprobe investigations and Phase 1 DP subsurface soil cleanup goals

WMA 3 – Waste Tank Farm



WMA 4

- Construction & Demolition Debris Landfill
- 1 PPA Model Facility
  - 1 Decision Unit
    - Construction & Demolition Debris Landfill (CDDL) and North Plateau Groundwater Plume within CDDL footprint
  - Residual contamination, including NPGP outside CDDL footprint

WMA 5

- Waste Storage Area
- Structures, concrete floor slabs, and foundations removed with Phase 1 decommissioning
- 1 PPA Model Facility
- No Decision Units
- Inventory consists of residual contamination, including NPGP

WMA 6

- Central Project Premises
- With the exception of the rail spur, all structures, concrete floor slabs, and foundations removed with Phase 1 decommissioning
- 1 PPA Model Facility
- 1 Decision Unit
  - Rail spur (portion within WMA 6)
- Inventory consists of residual contamination

WMA 7 –
Dissolver Burial
in NDA SH-9

WMA 7 – NDA

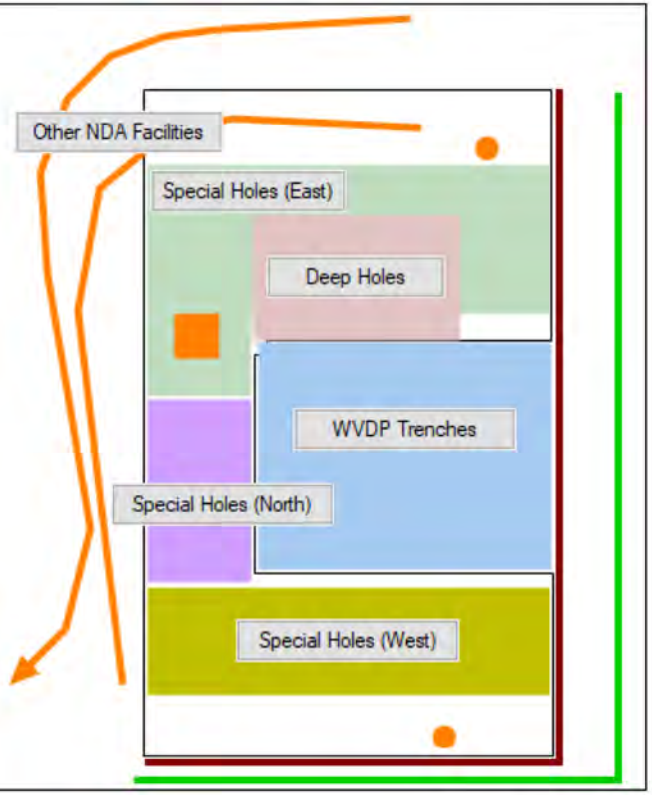
Selection of WMA 7 Closure Options

Instructions
- Select the closure option to be modeled using the drop-down box.
- For the Close-in-Place option, additional engineered controls may be selected, and individual Decision Units may be

Select closure options:

Close-In-Place (with engineered cover)

- No Action: All contamination remains in place. The existing geomembrane coverand slurry wall remain in place.
  - existing slurry wall
- Close-in-Place: Some or all contamination remains in place, as selected on the NDA Decision Units dashboards. The Close-in-Place cover would be constructed, and additional engineered controls may also be selected.
  - ☑ Upgradient French drain
  - ☐ Grout Interceptor Trench
  - ☑ Grout Decision Units > 6 m (20 ft)
- Complete removal: All NDA Holes, Trenches, and associated contamination are removed from WMA 7, and are replaced with clean backfill and a simple soil cover. Residual contamination remains in the ULT below the excavation.

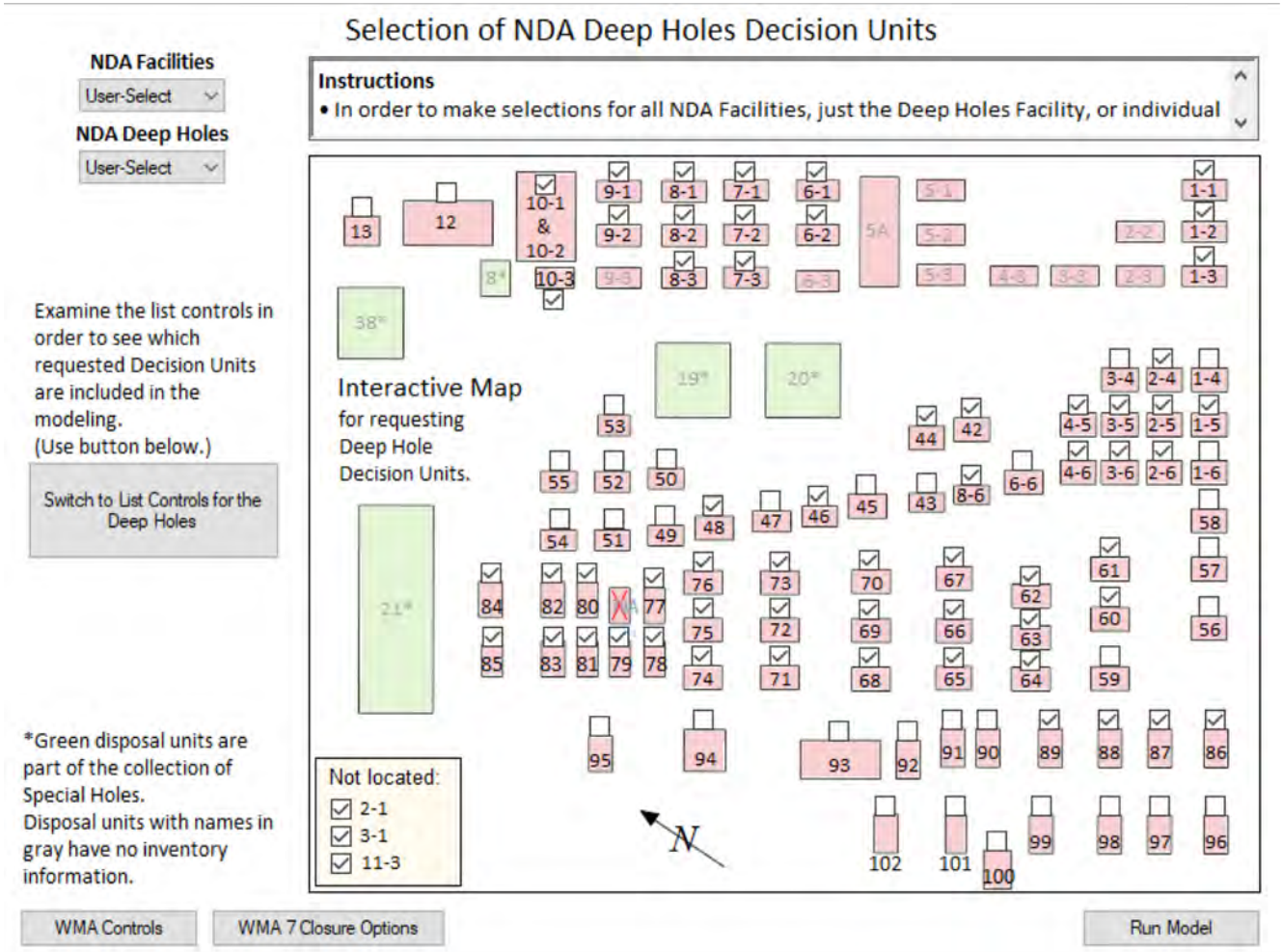


WMA Controls

Run Model

WMA 7

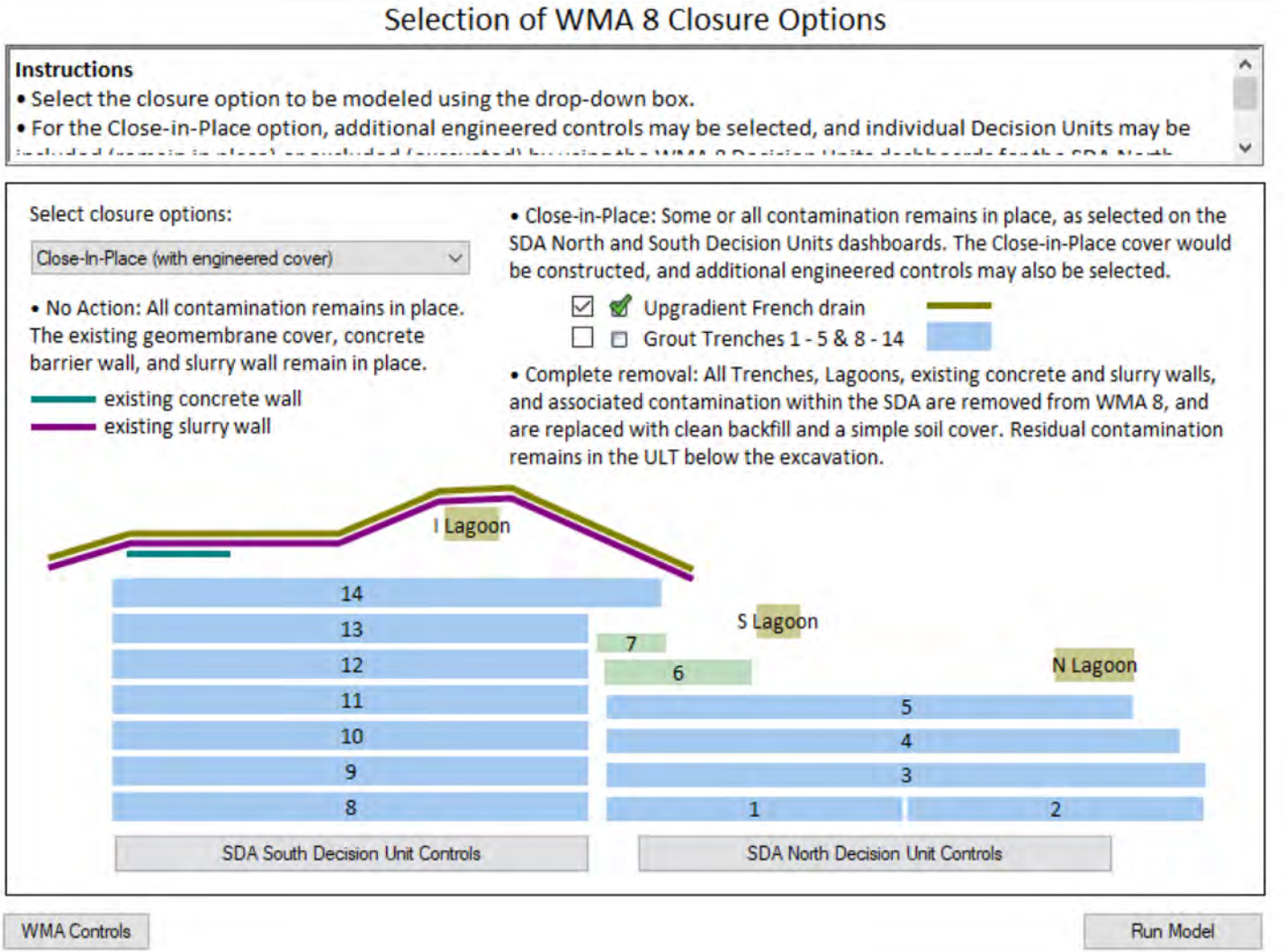
NFS Deep Holes




WMA 8 – SDA
Figure II-2 from
ECS, 2016

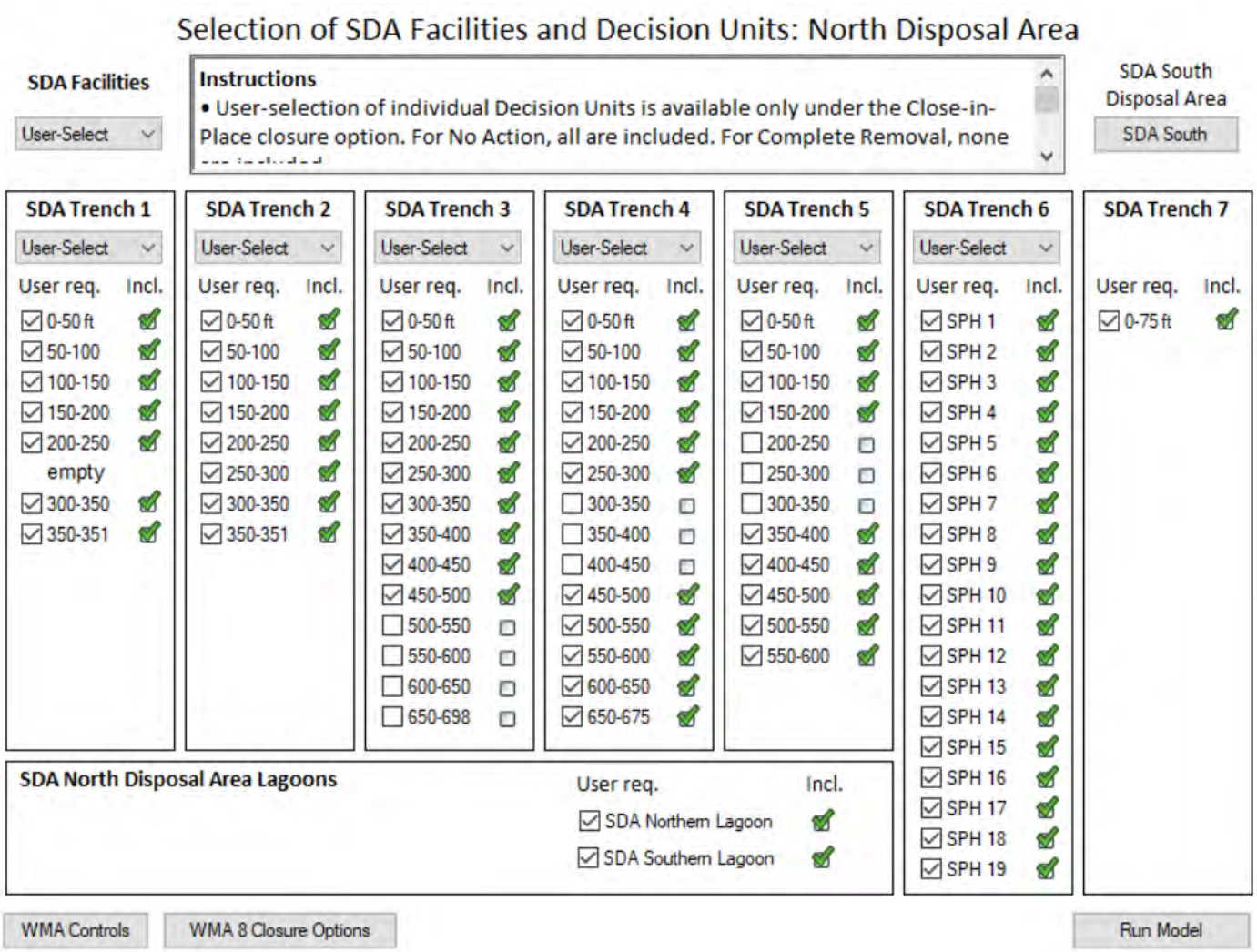
WMA 8

SDA


Selection of WMA 8 Closure Options
Instructions
• Select the closure option to be modeled using the drop-down box.
• For the Close-in-Place option, additional engineered controls may be selected, and individual Decision Units may be
Select closure options:
Close-In-Place (with engineered cover)
• No Action: All contamination remains in place. The existing geomembrane cover, concrete barrier wall, and slurry wall remain in place.
existing concrete wall
existing slurry wall
• Close-in-Place: Some or all contamination remains in place, as selected on the SDA North and South Decision Units dashboards. The Close-in-Place cover would be constructed, and additional engineered controls may also be selected.
Upgradient French drain
Grout Trenches 1 - 5 & 8 - 14
• Complete removal: All Trenches, Lagoons, existing concrete and slurry walls, and associated contamination within the SDA are removed from WMA 8, and are replaced with clean backfill and a simple soil cover. Residual contamination remains in the ULT below the excavation.
I Lagoon
S Lagoon
N Lagoon
14
13
12
11
10
9
8
7
6
5
4
3
1
2
SDA South Decision Unit Controls
SDA North Decision Unit Controls
WMA Controls
Run Model

WMA 8

SDA North



WMA 9

- Radwaste Treatment System Drum Cell
- Structures, concrete pads, and foundations removed with Phase 1 decommissioning
- 1 PPA Model Facility
- No Decision Units
- Inventory consists of residual contamination

WMA 10

- Support and Services Area
- New Warehouse, concrete pads, and foundations removed with Phase 1 decommissioning; meteorological tower, security gatehouse, security fence remain
- 1 PPA Model Facility
- No Decision Units
- Inventory consists of residual contamination

Next Steps

- Draft distributions under internal review
- Agency and independent expert review
- Next QPM:
  - Distribution development process and results

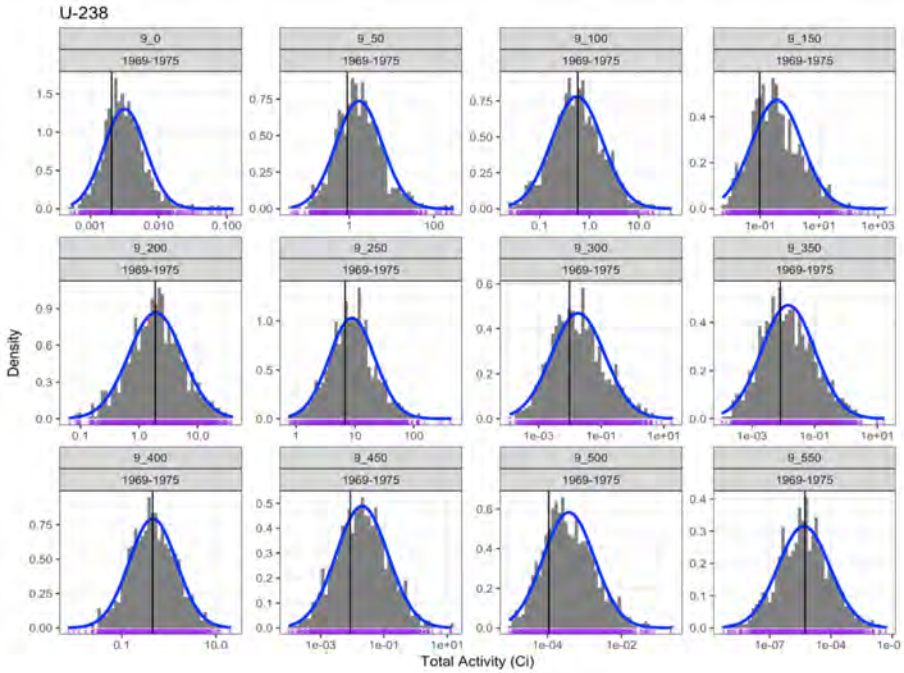


Figure A 12. Histograms displaying total inventory draws for ^{238}U by trench interval and time period 1969–1975 in Trench 9, on the logarithmic base 10 scale. The parametric curves display the lognormal distributions fit to the draws by maximum likelihood. The black vertical line indicates the variable concentration method estimate (URS 2002; Wild 2000).