

## SUMMARY - DOI GENERIC COST ESTIMATES TABLES AND RANGES

Costs shown in 2007 dollars\*

### Mine Remediation - Capping

Remedial Process	Generic RACER Model Cost Range	CHF Project-specific RACER Model Cost Range	Suggested Cost Range per Acre of Cap <sup>6</sup>
Studies/Design/Remedial Action	\$2.9 M (5 acres) to \$40.6 M (100 acres)	\$0.6 M (5 acres) to \$15.7 M (31 acres)	
O&M (30 years)	\$1.3 M (5 acres) to \$8.3 M (100 acres)	\$2.4 M (5 acres) to \$3.5 M (31 acres)	
<b>Total with O&amp;M</b>	<b>\$4.2 M (5 acres) to \$48.9 M (100 acres)</b>	<b>\$3.0 M (5 acres) to \$19.2 M (31 acres)</b>	<b>\$440,000 to \$880,000 per acre of cap</b>

### Landfill/Dump Remediation - Capping

Remedial Process	Generic RACER Model Cost Range	CHF Project-specific RACER Model Cost Range	Suggested Cost Range per Acre of Cap <sup>6</sup>
Studies/Design/Remedial Action	\$2.3 M (5 acres) to \$31.0 M (100 acres)	\$1.9 M (2 acres) to \$2.2 M (29 acres)	
O&M (30 years)	\$1.0 M (5 acres) to \$5.0 M (100 acres)	\$0.3 M (2 acres) to \$6.5 M (29 acres)	
<b>Total with O&amp;M</b>	<b>\$3.3 M (5 acres) to \$36.0 M (100 acres)</b>	<b>\$2.2 M (2 acres) to \$8.7 M (29 acres)</b>	<b>\$330,000 to \$1,100,000 per acre of cap</b>

### Industrial Remediation – Excavate/Demolish and Haul/Dispose

Remedial Process	Generic RACER Model Cost Range	CHF Project-specific RACER Model Cost Range	Suggested Cost Range per Acre <sup>6</sup>
Studies/Design/Remedial Action	Not computed due to unique nature of each site	\$0.2 M (0.5 acres to 0.6 acres)	
O&M (30 years)	Not computed due to unique nature of each site	\$0.4 M (0.5 acres to 0.6 acres)	
<b>Total with O&amp;M</b>	<b>Not computed due to unique nature of each site</b>	<b>\$0.6 M (0.5 acres to 0.6 acres)</b>	<b>\$990,000 to \$1,200,000 per acre</b>

### Agricultural Remediation – Excavate and Bioremediate

Remedial Process	Generic RACER Model Cost Range	CHF Project-specific RACER Model Cost Range	Suggested Cost Range per Acre <sup>6</sup>
Studies/Design/Remedial Action	Not computed due to unique nature of each site	\$0.4 M (0.6 acres) to \$2.2 M (3 acres)	
O&M (2 years)	Not computed due to unique nature of each site	\$0.1 M (0.6 acres) to \$0.2 M (3 acres)	
<b>Total with O&amp;M</b>	<b>Not computed due to unique nature of each site</b>	<b>\$0.6 M (0.6 acres) to \$2.4 M (3 acres)</b>	<b>\$770,000 to \$880,000 per acre</b>

#### Assumptions:

\*Costs shown are in 2007 dollars. (2007 dollars obtained by using model-generated 2003 dollar estimates plus a 10.4% inflation increase from 2003 to 2007; source of inflation increase is [http://www.adeg.state.ar.us/hazwaste/branch\\_programs/rcra\\_financial\\_assurance.htm](http://www.adeg.state.ar.us/hazwaste/branch_programs/rcra_financial_assurance.htm). Note: The Suggested Cost Range values were rounded to the nearest \$10,000.

1. The data on the Cost Summary tables:
  - a. Were obtained from generic (non site-specific) RACER model cost estimates, DOI CHF project-specific RACER estimates, and estimating expertise.
  - b. Are general in nature and are intended to represent typical response action scenarios.
  - c. Should be adjusted to reflect actual site conditions (if known).
  - d. Represents lowest level estimate (order of magnitude).
  - e. Reflects typical costs on DOI CHF sites.
2. Landfills and Dumps are combined due to similarities.
3. O&M represents 30 years of monitoring for mines and landfill/dump sites. On other sites, it is estimated that less monitoring may be allowed.
4. DOI CHF project-specific RACER cost estimates, used in compiling the Cost Summary tables, may not be indicative of other similar CHF sites.
5. Due to the unique nature of each site, RACER assumptions, cost estimates and data tables (with plotted charts) were not generated for industrial or agricultural type sites.
6. Suggested Cost Ranges per Acre were estimated from the plotted charts (attached).

## SUMMARY - DOI GENERIC COST ESTIMATES TABLES AND RANGES

Costs shown in 2005 dollars\*

### Mine Remediation - Capping

Remedial Process	Generic RACER Model Cost Range	CHF Project-specific RACER Model Cost Range	Suggested Cost Range per Acre of Cap <sup>6</sup>
Studies/Design/Remedial Action	\$2.7 M (5 acres) to \$38.7 M (100 acres)	\$0.5 M (5 acres) to \$14.9 M (31 acres)	
O&M (30 years)	\$1.3 M (5 acres) to \$7.9 M (100 acres)	\$2.3 M (5 acres) to \$3.4 M (31 acres)	
Total with O&M	\$4.0 M (5 acres) to \$46.6 M (100 acres)	\$2.8 M (5 acres) to \$18.3 M (31 acres)	<b>\$420,000 to \$840,000 per acre of cap</b>

### Landfill/Dump Remediation - Capping

Remedial Process	Generic RACER Model Cost Range	CHF Project-specific RACER Model Cost Range	Suggested Cost Range per Acre of Cap <sup>6</sup>
Studies/Design/Remedial Action	\$2.2 M (5 acres) to \$29.5 M (100 acres)	\$1.8 M (2 acres) to \$2.1 M (29 acres)	
O&M (30 years)	\$1.0 M (5 acres) to \$4.7 M (100 acres)	\$0.3 M (2 acres) to \$6.2 M (29 acres)	
Total with O&M	\$3.2 M (5 acres) to \$34.3 M (100 acres)	\$2.1 M (2 acres) to \$8.3 M (29 acres)	<b>\$320,000 to \$1,050,000 per acre of cap</b>

### Industrial Remediation – Excavate/Demolish and Haul/Dispose

Remedial Process	Generic RACER Model Cost Range	CHF Project-specific RACER Model Cost Range	Suggested Cost Range per Acre <sup>6</sup>
Studies/Design/Remedial Action	Not computed due to unique nature of each site	\$0.18 M (0.5 acres to 0.6 acres)	
O&M (30 years)	Not computed due to unique nature of each site	\$0.41 M (0.5 acres to 0.6 acres)	
Total with O&M	Not computed due to unique nature of each site	\$0.59 M (0.5 acres to 0.6 acres)	<b>\$950,000 to \$1,160,000 per acre</b>

### Agricultural Remediation – Excavate and Bioremediate

Remedial Process	Generic RACER Model Cost Range	CHF Project-specific RACER Model Cost Range	Suggested Cost Range per Acre <sup>6</sup>
Studies/Design/Remedial Action	Not computed due to unique nature of each site	\$0.4 M (0.6 acres) to \$2.1 M (3 acres)	
O&M (2 years)	Not computed due to unique nature of each site	\$0.1 M (0.6 acres) to \$0.2 M (3 acres)	
Total with O&M	Not computed due to unique nature of each site	\$0.5 M (0.6 acres) to \$2.3 M (3 acres)	<b>\$736,000 to \$840,000 per acre</b>

#### Assumptions:

\*Costs shown are in 2005 dollars. (2005 dollars obtained by using model-generated 2003 dollar estimates plus a 5.1% inflation increase from January 2003 to January 2005; source of inflation increase is [http://www.oregonstate.edu/dept/pol\\_sci/fac/sahr/sahr.htm](http://www.oregonstate.edu/dept/pol_sci/fac/sahr/sahr.htm). (Note: The Suggested Cost Range values were rounded to the nearest \$10,000).

1. The data on the Cost Summary tables:
  - a. Were obtained from generic (non site-specific) RACER model cost estimates, DOI CHF project-specific RACER estimates, and estimating expertise.
  - b. Are general in nature and are intended to represent typical response action scenarios.
  - c. Should be adjusted to reflect actual site conditions (if known).
  - d. Represents lowest level estimate (order of magnitude).
  - e. Reflects typical costs on DOI CHF sites.
2. Landfills and Dumps are combined due to similarities.
3. O&M represents 30 years of monitoring for mines and landfill/dump sites. On other sites, it is estimated that less monitoring may be allowed.
4. DOI CHF project-specific RACER cost estimates, used in compiling the Cost Summary tables, may not be indicative of other similar CHF sites.
5. Due to the unique nature of each site, RACER assumptions, cost estimates and data tables (with plotted charts) were not generated for industrial or agricultural type sites.
6. Suggested Cost Ranges per Acre were estimated from the plotted charts (attached).

## SUMMARY - DOI CHF GENERIC COST ESTIMATES TABLES AND RANGES

(Costs shown are in 2003 dollars)

### *Mine Remediation - Capping*

Remedial Process	RACER Cost Range	DOI CHF Historical Budget Cost Range	Suggested Cost Range per Acre of Cap
Studies/Design/Remedial Action	\$2.6 M (5 acres) to \$36.8 M (100 acres)	\$0.5 M (5 acres) to \$14.2 M (31 acres)	
O&M (30 years)	\$1.2 M (5 acres) to \$7.5 M (100 acres)	\$2.2 M (5 acres) to \$3.2 M (31 acres)	
Total with O&M	\$3.8 M (5 acres) to \$44.3 M (100 acres)	\$2.7 M (5 acres) to \$17.4 M (31 acres)	<b>\$400,000 to \$800,000 per acre of cap</b>

### *Landfill/Dump Remediation - Capping*

Remedial Process	RACER Cost Range	DOI CHF Historical Budget Cost Range	Suggested Cost Range per Acre of Cap
Studies/Design/Remedial Action	\$2.1 M (5 acres) to \$28.1 M (100 acres)	\$1.7 M (2 acres) to \$2.0 M (29 acres)	
O&M (30 years)	\$0.9 M (5 acres) to \$4.5 M (100 acres)	\$0.3 M (2 acres) to \$5.9 M (29 acres)	
Total with O&M	\$3.0 M (5 acres) to \$32.6 M (100 acres)	\$2.0 M (2 acres) to \$7.9 M (29 acres)	<b>\$300,000 to \$1,000,000 per acre of cap</b>

### *Industrial Remediation – Excavate/Demolish and Haul/Dispose*

Remedial Process	RACER Cost Range	DOI CHF Historical Budget Cost Range	Suggested Cost Range per Acre
Studies/Design/Remedial Action	Not computed due to unique nature of each site	\$0.17 M (0.5 acres to 0.6 acres)	
O&M (30 years)	Not computed due to unique nature of each site	\$0.39 M (0.5 acres to 0.6 acres)	
Total with O&M	Not computed due to unique nature of each site	\$0.56 M (0.5 acres to 0.6 acres)	<b>\$900,000 to \$1,100,000 per acre</b>

### *Agricultural Remediation – Excavate and Bioremediate*

Remedial Process	RACER Cost Range	DOI CHF Historical Budget Cost Range	Suggested Cost Range per Acre
Studies/Design/Remedial Action	Not computed due to unique nature of each site	\$0.4 M (0.6 acres) to \$2.0 M (3 acres)	
O&M (2 years)	Not computed due to unique nature of each site	\$0.1 M (0.6 acres) to \$0.2 M (3 acres)	
Total with O&M	Not computed due to unique nature of each site	\$0.5 M (0.6 acres) to \$2.2 M (3 acres)	<b>\$700,000 to \$800,000 per acre</b>

#### Assumptions:

1. Escalation is not factored into these costs. All costs shown are in 2003 dollars (Note: The Suggested Cost Range values were rounded to the nearest \$100,000).
2. The data on the Cost Summary tables:
  - a. Will be continually updated as actual costs/data are compiled.
  - b. Was obtained from DOI CHF budget estimates, RACER estimates and estimating expertise.
  - c. Is general in nature and is intended to represent typical scenarios.
  - d. Should be adjusted to reflect actual site conditions (if known).
  - e. Represents lowest level estimate (order of magnitude).
  - f. Reflects typical costs on DOI CHF sites, which are believed to be less than superfund sites.
3. Landfills and Dumps are combined due to similarities.
4. O&M represents 30 years of monitoring for mines and landfill/dump sites. On other sites, it is estimated that lesser monitoring over 30-year period may be required.
5. DOI CHF budget estimates, used in compiling the Cost Summary tables, may not be indicative of other similar CHF sites.
6. Due to the unique nature of each site, RACER assumptions, cost estimates and data tables (with plotted charts) were not generated for industrial or agricultural type sites.

## Mines

(Cost shown in 2003 dollars)

### DOI CHF Project-specific RACER Cost Estimates

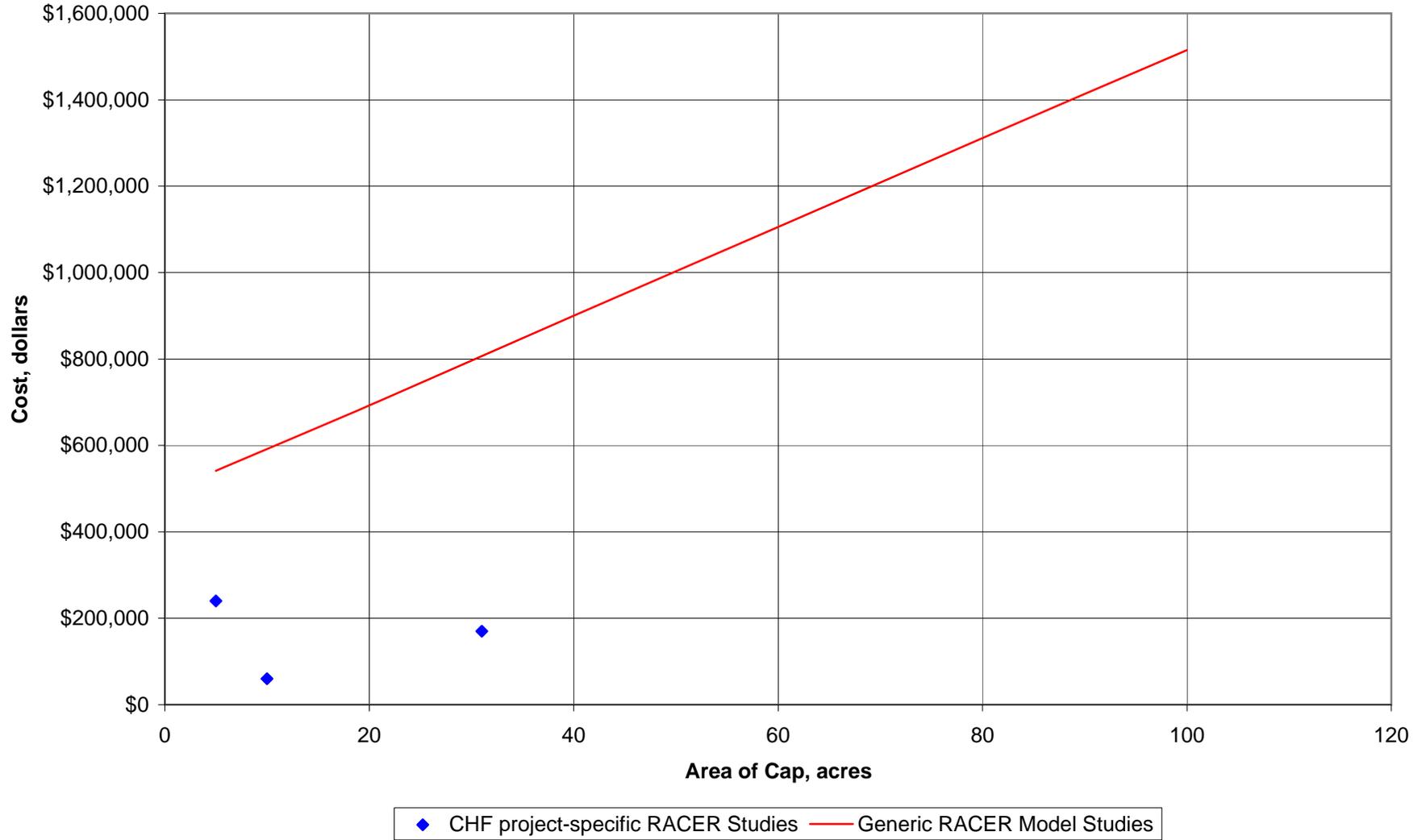
Description	Area (Acres of cap)	Studies (eg, RI/FS)	Remediation (RD + RA)	Total for Studies and Remediation	O&M/year	O&M for 30 Years*
BLM Mill Site (1)	5	\$240,000	\$290,000	\$530,000	\$74,000	\$2,220,000
BLM Millsites (2)	10	\$60,000	\$2,400,000	\$2,460,000	\$42,000	\$1,260,000
NPS Mine (1)	31	\$170,000	\$14,000,000	\$14,170,000	\$105,000	\$3,150,000

\* Note: For BLM Mill Site (1), O&M is for only 5 years total.

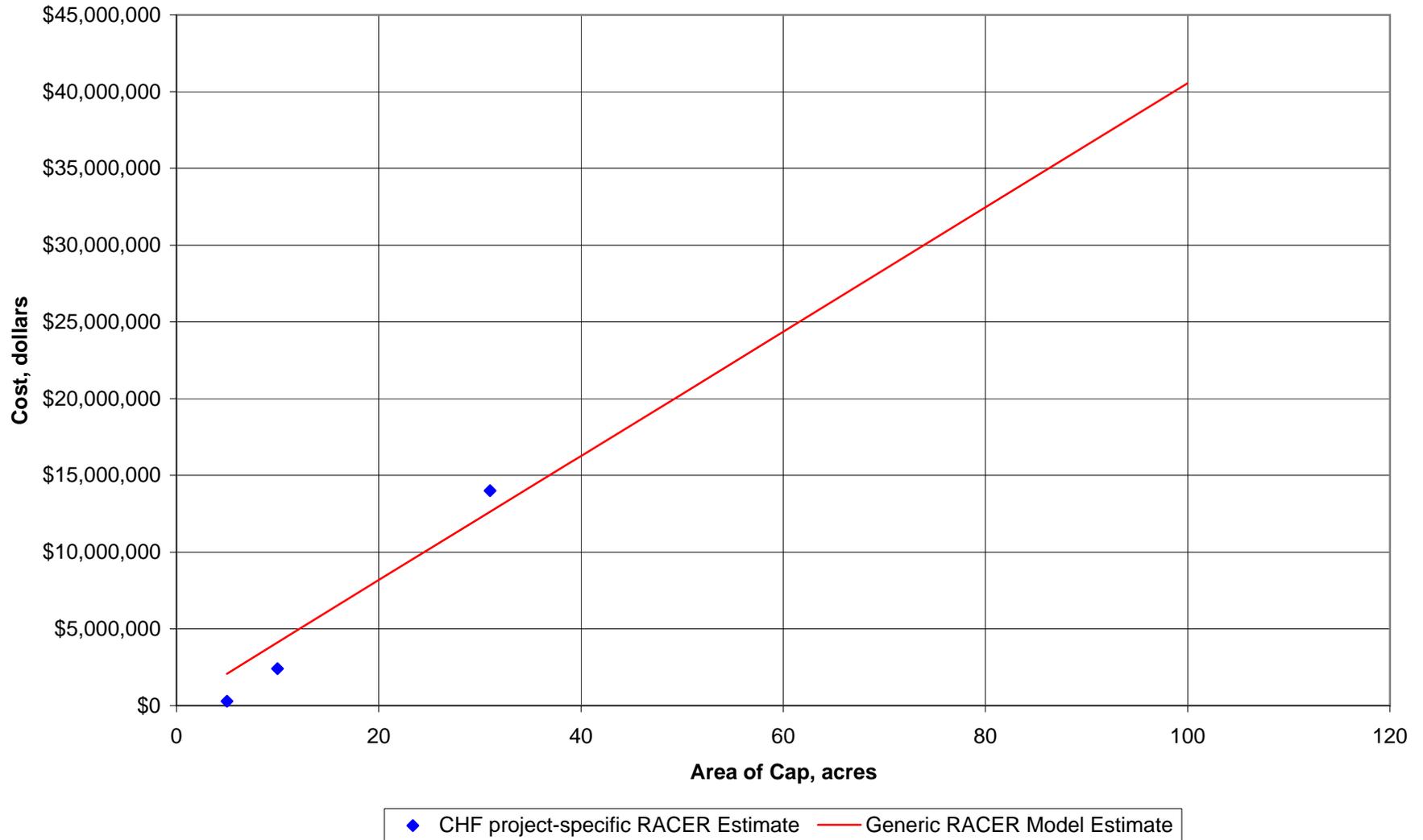
### Generic RACER Model Cost Estimates

Area (Acres of cap)	Studies (eg, RI/FS)	Remediation (RD + RA)	Total for Studies and Remediation	Size Reduction Factor	Factored Total	O&M/year	O&M for 30 Years
5	\$500,000	\$2,100,000	\$2,600,000	0.00%	\$2,600,000	\$40,000	\$1,200,000
20	\$700,000	\$8,200,000	\$8,900,000	2.50%	\$8,700,000	\$70,000	\$2,100,000
40	\$900,000	\$16,300,000	\$17,200,000	5.00%	\$16,300,000	\$120,000	\$3,600,000
60	\$1,100,000	\$24,400,000	\$25,500,000	7.50%	\$23,600,000	\$160,000	\$4,800,000
80	\$1,300,000	\$32,500,000	\$33,800,000	10.00%	\$30,400,000	\$210,000	\$6,300,000
100	\$1,500,000	\$40,600,000	\$42,100,000	12.50%	\$36,800,000	\$250,000	\$7,500,000

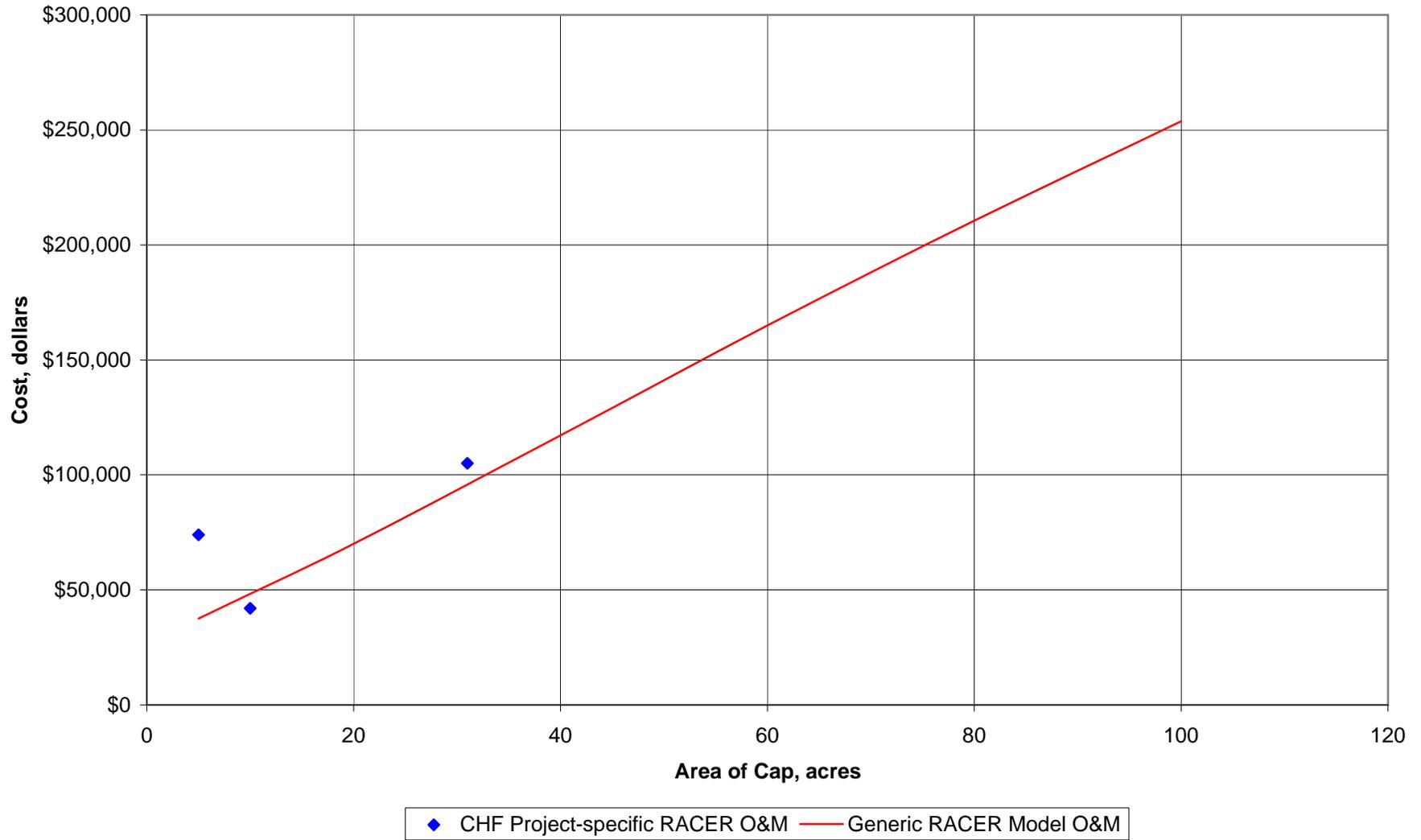
**RACER Cost Estimates for Mine Studies vs Area of Cap**  
(Cost shown in 2003 dollars)



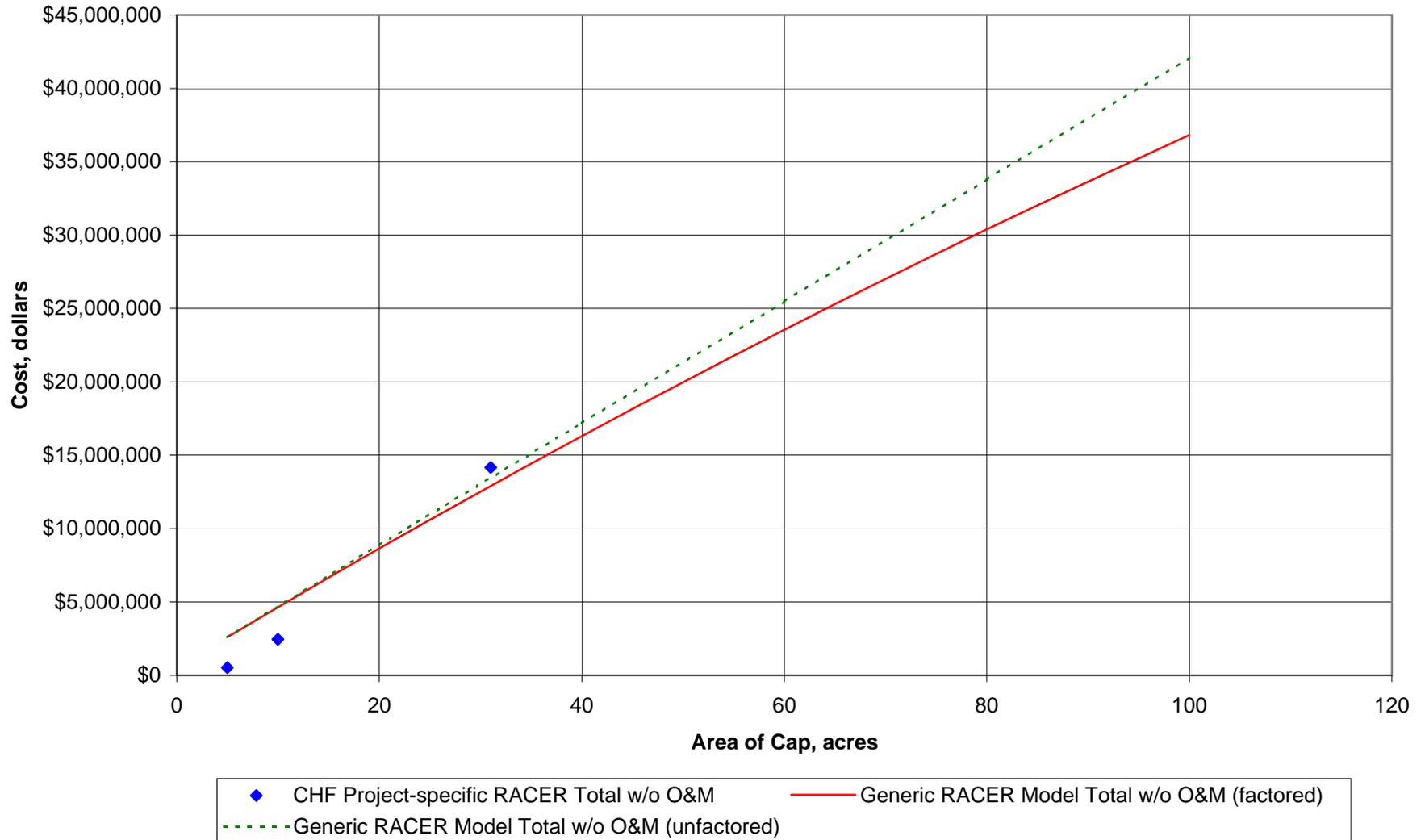
**RACER Cost Estimates for Mine Remediations (Design and Action) vs Area of Cap**  
(Cost shown in 2003 dollars)



### RACER Cost Estimates for Mine O&M per Year vs Area of Cap (Cost shown in 2003 dollars)



### RACER Cost Estimates for Mines (Total w/o O&M) vs Area of Cap (Cost shown in 2003 dollars)



## Landfills & Dumps

(Cost shown in 2003 dollars)

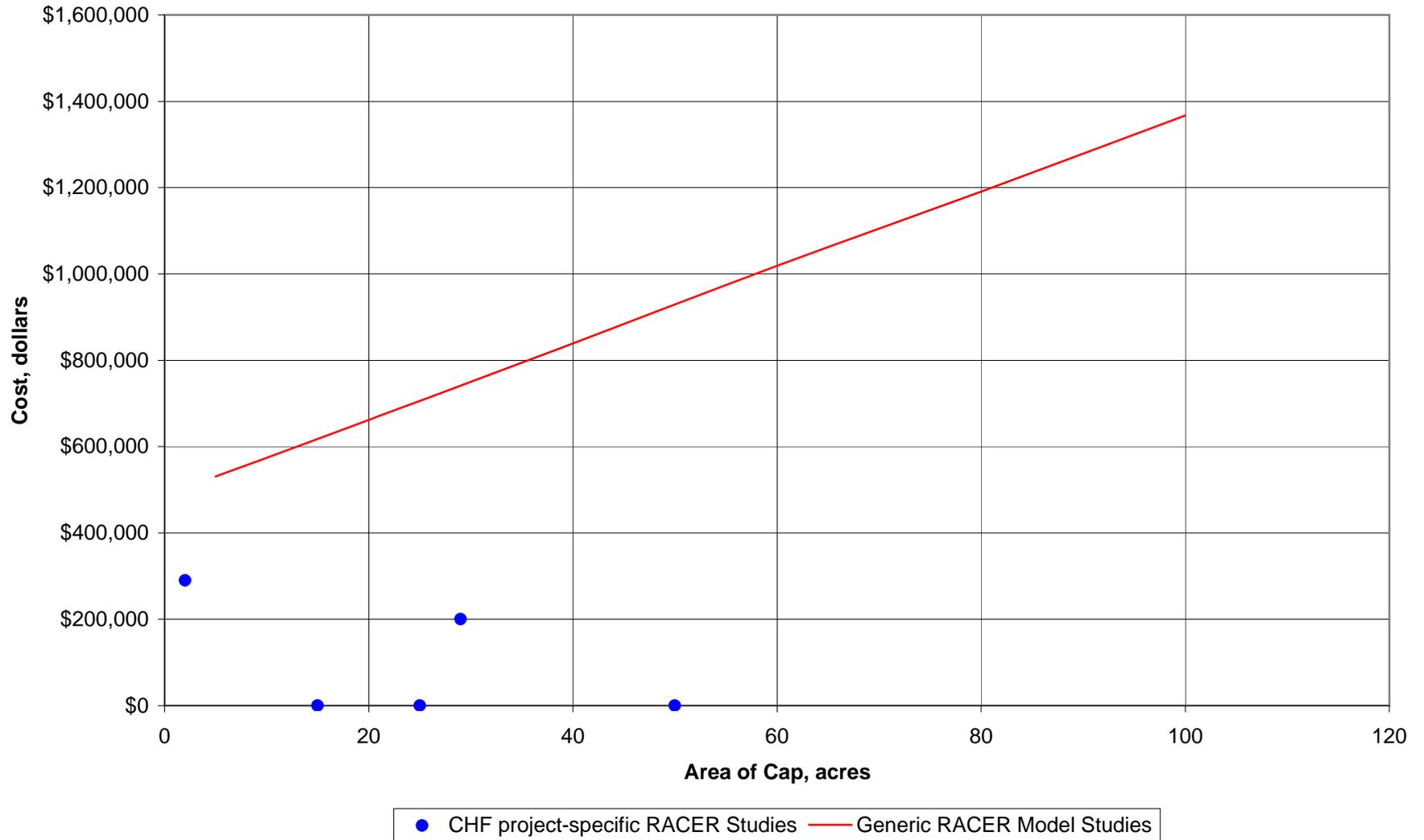
### DOI CHF Project-specific RACER Cost Estimates

Description	Area (Acres of cap)	Studies (eg, RI/FS)	Remediation (RD + RA)	Total for Studies and Remediation	O&M/year	O&M for 30 Years
BLM Landfill (1)	2	\$290,000	\$1,400,000	\$1,690,000	\$11,500	\$345,000
FWS Landfill (1)	15	Completed	\$4,700,000	\$4,700,000	\$60,000	\$1,800,000
BLM Landfill (1)	25	Completed	\$2,700,000	\$2,700,000	\$66,000	\$1,980,000
NPS landfill (1)	29	\$200,000	\$1,750,000	\$1,950,000	\$195,000	\$5,850,000
NPS Landfill (2)	50	Completed	\$10,500,000	\$10,500,000	\$7,600	\$228,000

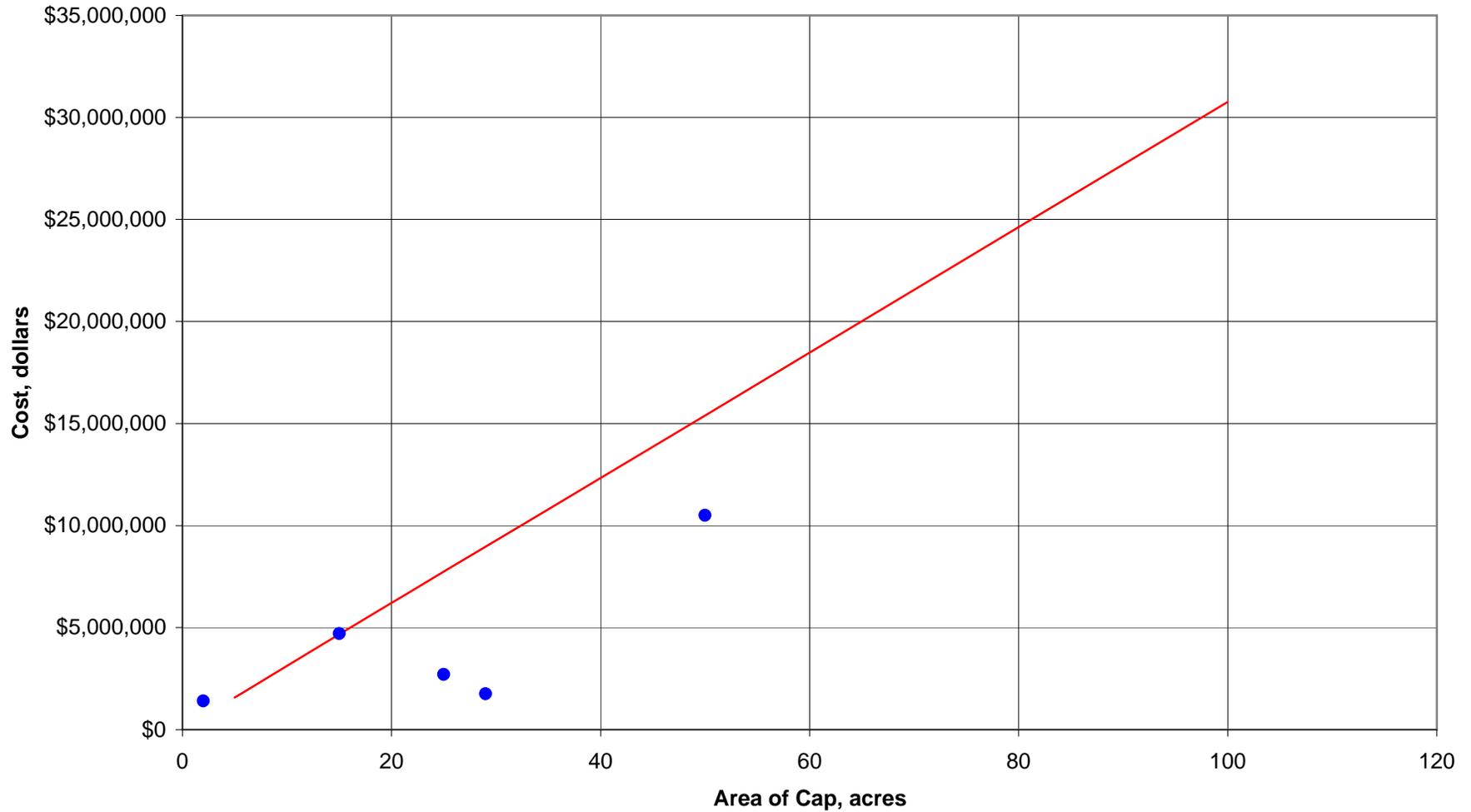
### Generic RACER Model Cost Estimates

Area (Acres of cap)	Studies (eg, RI/FS)	Remediation (RD + RA)	Total for Studies and Remediation	Size Reduction Factor	Factored Total	O&M/year	O&M for 30 Years
5	\$500,000	\$1,600,000	\$2,100,000	0.00%	\$2,100,000	\$30,000	\$900,000
20	\$700,000	\$6,200,000	\$6,900,000	2.50%	\$6,700,000	\$50,000	\$1,500,000
40	\$800,000	\$12,300,000	\$13,100,000	5.00%	\$12,500,000	\$70,000	\$2,100,000
60	\$1,000,000	\$18,500,000	\$19,500,000	7.50%	\$18,000,000	\$100,000	\$3,000,000
80	\$1,200,000	\$24,600,000	\$25,800,000	10.00%	\$23,200,000	\$120,000	\$3,600,000
100	\$1,400,000	\$30,800,000	\$32,200,000	12.50%	\$28,100,000	\$150,000	\$4,500,000

**RACER Cost Estimates for Landfill/Dump Studies vs Area of Cap**  
(Cost shown in 2003 dollars)

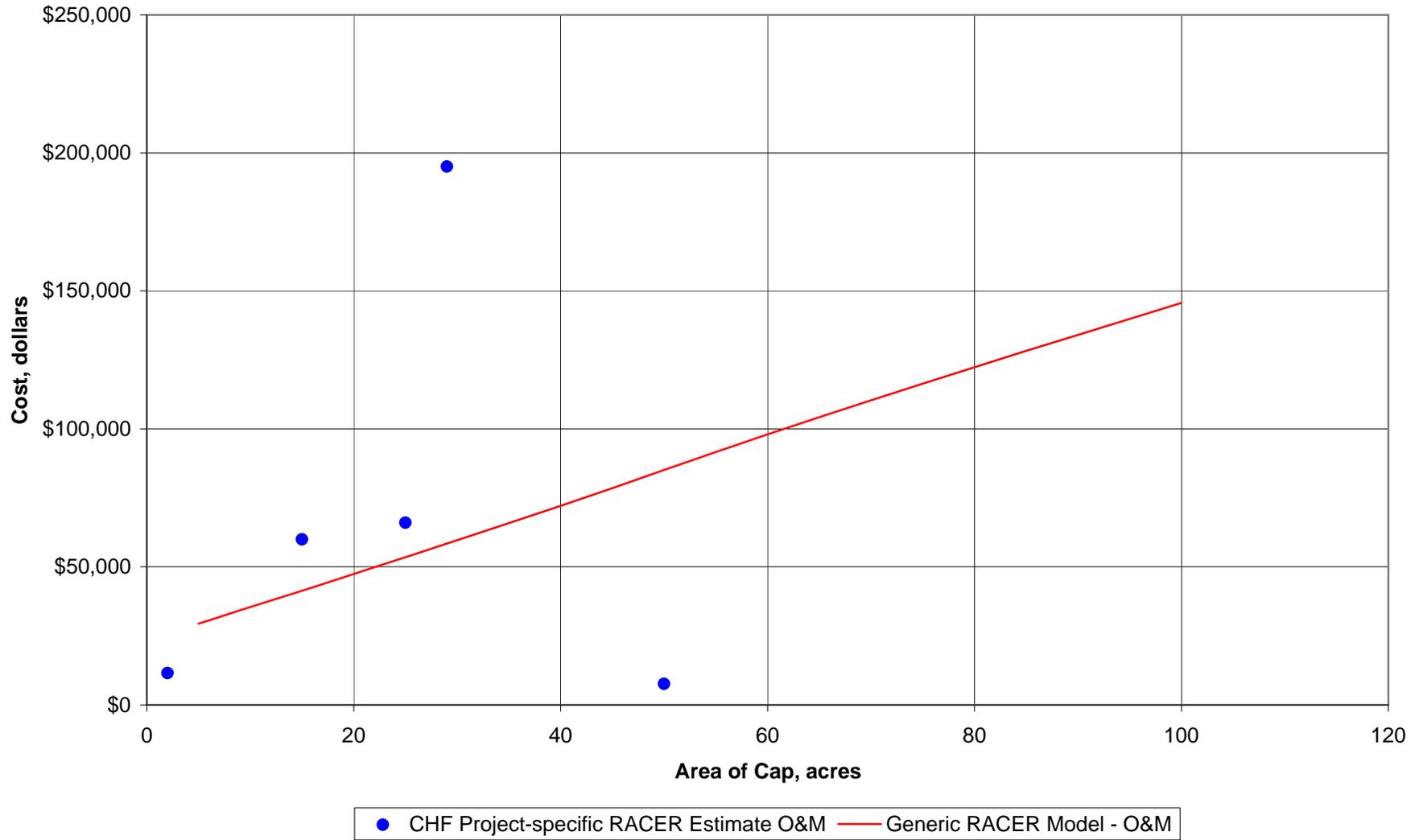


**RACER Cost Estimates for Landfill Remediation (Design and Action) vs Area of Cap**  
(Cost shown in 2003 dollars)

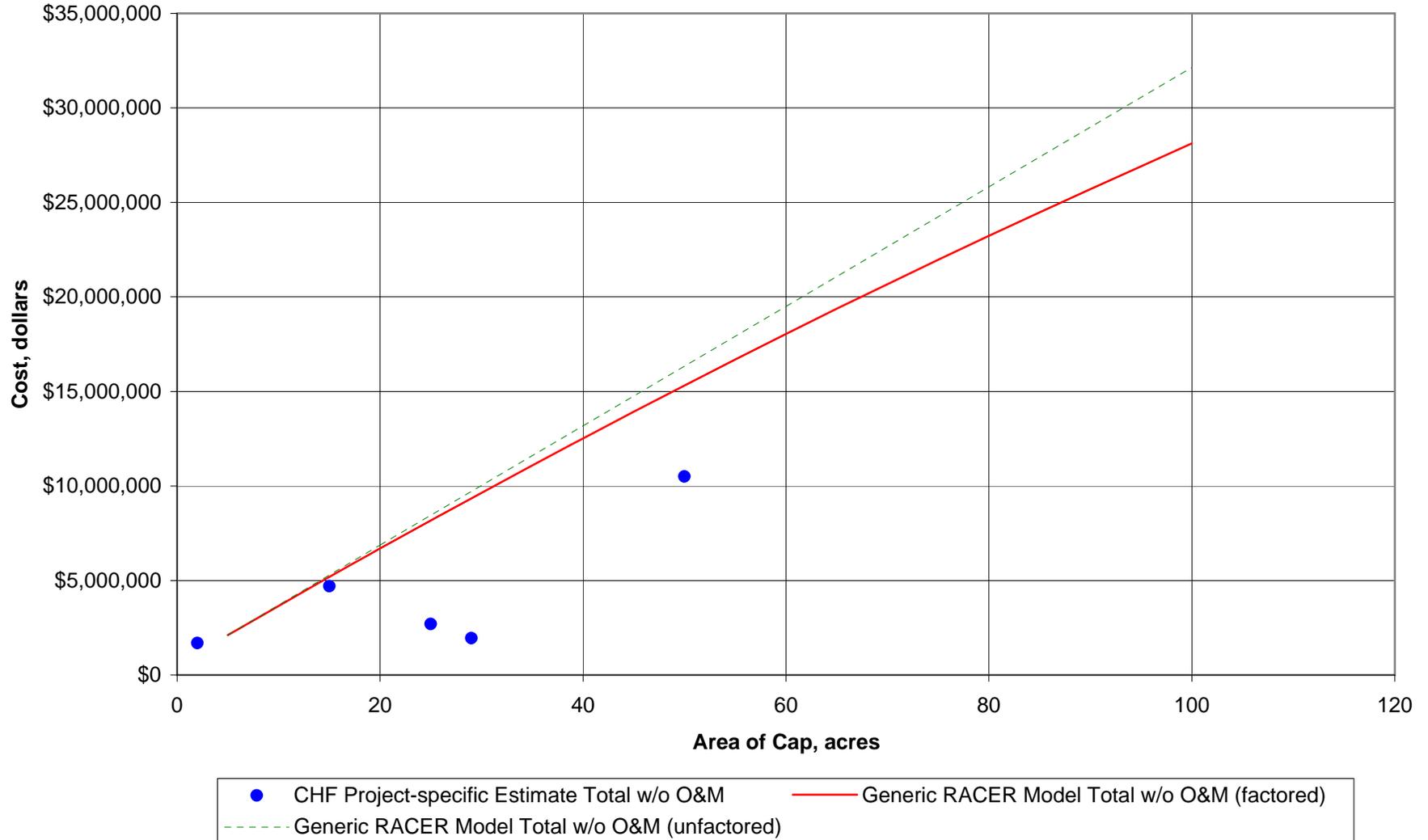


● CHF project-specific RACER Remediation — Generic RACER Model - Remediation

**RACER Cost Estimates for Landfill/Dump O&M per Year vs Area of Cap**  
(Cost shown in 2003 dollars)



**RACER Cost Estimates for Landfills/Dumps (Total w/o O&M) vs Area of Cap**  
(Cost shown in 2003 dollars)



**Industrial**  
(Costs shown in 2003 dollars)

**DOI CHF Project-specific RACER Cost Estimates**

Description	Area (Acres)	Studies (eg, RI/FS)	Remediation (RD + RA)	Total for Studies and Remediation	O&M/year	O&M Years	O&M for Total Years
USGS Facility (1)	0.5	Completed	\$160,000	\$160,000	\$14,000	7	\$98,000
FWS Facility (1)	0.6	\$50,000	\$125,000	\$175,000	\$13,000	30	\$390,000
FWS Facility (2)	43,500	\$25,000,000	\$37,000,000	\$62,000,000	\$930,000	30	\$27,900,000

**Agricultural**  
(Costs shown in 2003 dollars)

**DOI CHF Project-specific RACER Cost Estimates**

Description	Area (Acres)	Studies (eg, RI/FS)	Remediation (RD + RA)	Total for Studies and Remediation	O&M/year	O&M for 2 Years
FWS Agricultural Site (1)	0.6	\$150,000	\$230,000	\$380,000	\$52,000	\$104,000
BIA Agricultural Site (1)	3	\$310,000	\$1,650,000	\$1,960,000	\$70,000	\$140,000

## **RACER O&M ASSUMPTIONS FOR LANDFILLS/DUMPS**

Assume all Landfill/Dump sites need the following O&M (monitoring) for a minimum of 30 years

### **Monitoring:**

1. Average safety level D
2. Average site distance is 50 miles
3. Include QA/AC samples
4. Include data management/reporting
5. Average crew size of two field technicians
6. Monitor (1<sup>st</sup> year):
  - a. Groundwater:
    - i. One aquifer at an average sample depth of 50 feet:
      1. Two sample location per five acres:
        - a. One sample per location
      2. On average, test for:
        - a. Lead (SW 3005A/SW 7421)
        - b. Polynuclear Aromatic Hydrocarbons, PAH (EPA 610)
    - b. Subsurface soil:
      - i. Average sample depth of 25 feet:
        1. Two sample location per five acres:
          - a. One sample per location
      - ii. On average, test for:
        1. Gasoline Group (8021B, Lead, EDE)
        2. Polynuclear Aromatic Hydrocarbons(PAH) (SW 8310)
    - c. Perform a soil gas investigation:
      - i. Average sample depth of 25 feet:
        1. Two sample location per five acres:
          - a. One sample per location
  7. Monitor (remaining 29 years):
    - a. Groundwater:
      - i. One aquifer at an average sample depth of 50 feet:
        1. Two sample location per five acres:
          - a. One sample per location
        2. On average, test for:
          - a. Lead (SW 3005A/SW 7421)
          - b. Polynuclear Aromatic Hydrocarbons, PAH (EPA 610)
      - b. Subsurface soil:
        - i. Average sample depth of 25 feet:
          1. Two sample location per five acres:
            - a. One sample per location
        - ii. On average, test for:
          1. Gasoline Group (8021B, Lead, EDE)

2. Polynuclear Aromatic Hydrocarbons(PAH) (SW 8310)
  - c. Perform a soil gas investigation:
    - i. Average sample depth of 25 feet:
      1. Two sample location per five acres:
        - a. One sample per location

## **RACER REMEDIATION ASSUMPTIONS FOR LANDFILLS/DUMPS**

Assume all landfill/dump sites' selected remediation is capping

### **Design:**

1. On average, the design phase is approximately 4-5% of the remedial cost

### **Capping:**

1. Safety level on average is D
2. Type of cover on average is a standard cover
  - a. At a 3:1 side slope
  - b. Source of topsoil is off-site
  - c. Depth of soil layer is 30 inches
  - d. Source of soil layer is off-site
  - e. Source of leveling layer is off-site

## **RACER STUDY ASSUMPTIONS FOR LANDFILLS/DUMPS**

Assume all landfill/dump sites need the following studies:

1. Installing Ground Monitoring Wells
2. Preliminary Assessment
3. Site Inspection
4. Remedial Investigation
5. Feasibility Study

### **Installing Ground Monitoring Wells:**

1. Safety level on average is D
2. One aquifer on average
  - a. Depth to groundwater on average is 50 feet
  - b. Install two wells per 5 acres:
    - i. Average well depth is 150 feet
    - ii. Average well diameter is 4 inches
    - iii. Assumed drilling method is air rotary
    - iv. Assumed formation type is consolidated

### **Preliminary Assessment:**

1. Site complexity on average is Moderate
2. Site distance one way on average is 50 miles
3. Tasks include:
  - a. Identify information needs:
    - i. Records search
    - ii. Photo interpretation
    - iii. Interviews
  - b. Conduct Site Reconnaissance
    - i. Identify on-site/off-site sources of contamination
    - ii. Identify on-site/off-site receptors
    - iii. Determine contaminants of concern
    - iv. Conduct site visit/inspection
  - c. Documentation
    - i. Complete revised HRS scoring package
    - ii. Compose preliminary assessment report
    - iii. Complete EPA preliminary assessment form
  - d. Community Relations
    - i. Update administrative record
    - ii. Contact state and local officials

### **Site Inspection:**

1. Site complexity on average is Moderate
2. Site distance one way on average is 50 miles
3. Tasks include:
  - a. Planning:
    - i. Data review

- ii. SI work plan
- iii. SI supplemental plans (health and safety, sampling and analysis, investigation derived waste)
- b. Site investigation:
  - i. Provide fieldwork support
  - ii. Data validation
  - iii. Compose SI report
  - iv. Complete revised HRS scoring package
  - v. Implement community relations
- c. Sampling and analysis (S&A):
  - i. Groundwater:
    - 1. One aquifer at an average sample depth of 50 feet:
      - a. One sample location per five acres:
        - i. One sample per location
    - 2. On average, test for:
      - a. Lead (SW 3005A/SW 7421)
      - b. Polynuclear Aromatic Hydrocarbons, PAH (EPA 610)
  - ii. Subsurface soil:
    - 1. Average sample depth of 25 feet:
      - a. One sample location per five acres:
        - i. One sample per location
    - 2. On average, test for:
      - a. Gasoline Group (8021B, Lead, EDE)
      - b. Polynuclear Aromatic Hydrocarbons(PAH) (SW 8310)
  - iii. Perform a soil gas investigation:
    - 1. Average sample depth of 25 feet:
      - a. One sample location per five acres:
        - i. One sample per location

**Remedial Investigation:**

- 1. Site complexity on average is Moderate
- 2. Site distance one way on average is 50 miles
- 3. Tasks include:
  - a. Scoping:
    - i. RI work plan
    - ii. Data quality objectives
    - iii. Preliminary Alternatives
    - iv. Community relations activities
    - v. RI supplemental plans (HASP, FSP, QAPP)
  - b. Site characterization:
    - i. Fieldwork support
    - ii. Evaluate site geology/hydrogeology
    - iii. Evaluate site soils/surface hydrology
    - iv. Evaluate site meteorology

- v. Evaluate populations and land usage
- vi. Evaluate site ecology
- vii. Evaluate nature and extent of contamination
- viii. Evaluate contaminant fate and transport
- ix. Conduct baseline risk assessment
- c. Sampling and Analysis (S&A):
  - i. Groundwater:
    - 1. One aquifer at an average sample depth of 50 feet:
      - b. Two sample location per five acres:
        - i. One sample per location
    - 2. On average, test for:
      - a. Lead (SW 3005A/SW 7421)
      - b. Polynuclear Aromatic Hydrocarbons, PAH (EPA 610)
  - ii. Subsurface soil:
    - 1. Average sample depth of 25 feet:
      - a. Two sample location per five acres:
      - b. One sample per location
    - 2. On average, test for:
      - a. Gasoline Group (8021B, Lead, EDE)
      - b. Polynuclear Aromatic Hydrocarbons(PAH) (SW 8310)
  - iii. Perform a soil gas investigation:
    - 1. Average sample depth of 25 feet:
      - a. Two sample location per five acres:
      - b. One sample per location

**Feasibility Study:**

- 1. Site complexity on average is Moderate
- 2. Level of study detail on average is Moderate
- 3. Level of study documentation on average is Moderate
- 4. Tasks include:
  - a. Scoping:
    - i. RI review
    - ii. FS work plan
    - iii. Data quality objectives
    - iv. Preliminary alternatives
    - v. Community relations activities
  - b. Development/Screening of alternatives:
    - i. Identify/Evaluate treatment technologies
    - ii. Assemble technologies into alternatives
    - iii. Identify action-specific ARARs
    - iv. Screen alternatives
    - v. Evaluate action-specific ARARs
  - c. Analysis of alternatives:
    - i. Evaluate alternatives by nine criteria

- ii. Compose draft FS report
- iii. Implement community relations
- iv. Further develop preferred alternative
- v. Public meeting(s)/prepare transcript
- d. Remedy selection:
  - i. Compose final FS report
  - ii. Prepare ROD/decision document/proposed plan
  - iii. Update administrative record

## RACER O&M ASSUMPTIONS FOR MINES

Assume all mine sites need the following O&M (monitoring) for a minimum of 30 years

### Monitoring:

1. Average safety level D
2. Average site distance is 50 miles
3. Include QA/AC samples
4. Include data management/reporting
5. Average crew size of two field technicians
6. Monitor (1<sup>st</sup> year):
  - a. Groundwater:
    - i. Average sample depth of 100 feet
    - ii. Take two samples per year per five acres
    - iii. On average, test for:
      1. Total dissolved solids (EPA 160.1)
      2. Total suspended solids (EPA 160.2)
      3. TAL metals (EPA 6010/7000s)
  - b. Surface water:
    - i. Take two samples per year per five acres
    - ii. On average, test for:
      1. Total dissolved solids (EPA 160.1)
      2. Total suspended solids (EPA 160.2)
      3. TAL metals (EPA 6010/7000s)
  - c. Surface soil:
    - i. Take two samples per year per five acres
    - ii. On average, test for:
      1. Pesticides/PCBs (SW 3550B/SW 8081/8082)
      2. TAL metals (EPA 6010/7000s)
  - d. Subsurface soil:
    - i. Average sample depth of 50 feet
    - ii. Take two samples per year per five acres
    - iii. On average, test for:
      1. Pesticides/PCBs (SW 3550B/SW 8081/8082)
      2. TAL metals (EPA 6010/7000s)
7. Monitor (remaining 29 years):
  - a. Groundwater:
    - i. Average sample depth of 100 feet
    - ii. Take two samples per year per five acres
    - iii. On average, test for:
      1. Total dissolved solids (EPA 160.1)
      2. Total suspended solids (EPA 160.2)
      3. TAL metals (EPA 6010/7000s)
  - b. Surface water:
    - i. Take two samples per year per five acres
    - ii. On average, test for:

1. Total dissolved solids (EPA 160.1)
  2. Total suspended solids (EPA 160.2)
  3. TAL metals (EPA 6010/7000s)
- c. Surface soil:
- i. Take two samples per year per five acres
  - ii. On average, test for:
    1. Pesticides/PCBs (SW 3550B/SW 8081/8082)
    2. TAL metals (EPA 6010/7000s)
- d. Subsurface soil:
- i. Average sample depth of 50 feet
  - ii. Take two samples per year per five acres
  - iii. On average, test for:
    1. Pesticides/PCBs (SW 3550B/SW 8081/8082)
    2. TAL metals (EPA 6010/7000s)

## **RACER REMEDIATION ASSUMPTIONS FOR MINES**

Assume all mine sites' selected remediation is consolidation and capping

### **Design:**

1. On average, the design phase is approximately 4-5% of the remedial cost

### **Consolidation:**

#### **Excavation:**

1. Safety level is D.
2. On average, the volume of tailings to be excavated is the area of cap times an average of 5 feet.
3. There is on average one confirmatory soil analysis per five acres:
  - a. Test for:
    - i. Pesticides/PCBs (SW 3550B/SW 8081/8082)
    - ii. TAL metals (EPA 6010/7000s)

### **Consolidation (continue):**

#### **Load & Haul:**

1. Safety level is D.
2. On average the one-way haul distance is ½ mile.
3. Load and haul a volume equal to the excavated volume.
4. Place and compact volume in 6-inch lifts.

### **Capping:**

1. Safety level on average is D
2. Type of cover on average is a standard cover
  - a. At a 3:1 side slope
  - b. Source of topsoil is off-site
  - c. Depth of soil layer is 30 inches
  - d. Source of soil layer is off-site
  - e. Source of leveling layer is off-site

## **RACER STUDY ASSUMPTIONS FOR MINES**

Assume all mine sites need the following studies:

1. Installing Ground Monitoring Wells
2. Preliminary Assessment
3. Site Inspection
4. Remedial Investigation
5. Feasibility Study

### **Installing Ground Monitoring Wells:**

1. Safety level on average is D
2. One aquifer on average
  - a. Depth to groundwater on average is 100 feet
  - b. Install two wells per 5 acres:
    - i. Average well depth is 150 feet
    - ii. Average well diameter is 4 inches
    - iii. Assumed drilling method is air rotary
    - iv. Assumed formation type is consolidated

### **Preliminary Assessment:**

1. Site complexity on average is Moderate
2. Site distance one way on average is 50 miles
3. Tasks include:
  - a. Identify information needs:
    - i. Records search
    - ii. Photo interpretation
    - iii. Interviews
  - b. Conduct Site Reconnaissance
    - i. Identify on-site/off-site sources of contamination
    - ii. Identify on-site/off-site receptors
    - iii. Determine contaminants of concern
    - iv. Conduct site visit/inspection
  - c. Documentation
    - i. Complete revised HRS scoring package
    - ii. Compose preliminary assessment report
    - iii. Complete EPA preliminary assessment form
  - d. Community Relations
    - i. Update administrative record
    - ii. Contact state and local officials

### **Site Inspection:**

1. Site complexity on average is Moderate
2. Site distance one way on average is 50 miles
3. Tasks include:
  - a. Planning:
    - i. Data review

- ii. SI work plan
- iii. SI supplemental plans (health and safety, sampling and analysis, investigation derived waste)
- b. Site investigation:
  - i. Provide fieldwork support
  - ii. Data validation
  - iii. Compose SI report
  - iv. Complete revised HRS scoring package
  - v. Implement community relations
- c. Sampling and analysis (S&A):
  - i. Groundwater:
    - 1. One aquifer at an average sample depth of 100 feet:
      - a. One sample location per five acres:
        - i. One sample per location
    - 2. On average, test for:
      - a. Total dissolved solids (EPA 160.1)
      - b. Total suspended solids (EPA 160.2)
      - c. TAL metals (EPA 6010/7000s)
  - ii. Surface water:
    - 1. One sample location per five acres:
      - a. One sample per location
    - 2. On average, test for:
      - a. Total dissolved solids (EPA 160.1)
      - b. Total suspended solids (EPA 160.2)
      - c. TAL metals (EPA 6010/7000s)
  - iii. Surface soil:
    - 1. One sample location per five acres:
      - a. One sample per location
    - 2. On average, test for:
      - a. Pesticides/PCBs (SW 3550B/SW 8081/8082)
      - b. TAL metals (EPA 6010/7000s)
  - iv. Subsurface soil:
    - 1. Average sample depth of 50 feet:
      - a. One sample location per five acres:
        - i. One sample per location
    - 2. On average, test for:
      - a. Pesticides/PCBs (SW 3550B/SW 8081/8082)
      - b. TAL metals (EPA 6010/7000s)

**Remedial Investigation:**

- 1. Site complexity on average is Moderate
- 2. Site distance one way on average is 50 miles
- 3. Tasks include:
  - a. Scoping:
    - i. RI work plan
    - ii. Data quality objectives

- iii. Preliminary Alternatives
- iv. Community relations activities
- v. RI supplemental plans (HASP, FSP, QAPP)
- b. Site characterization:
  - i. Fieldwork support
  - ii. Evaluate site geology/hydrogeology
  - iii. Evaluate site soils/surface hydrology
  - iv. Evaluate site meteorology
  - v. Evaluate populations and land usage
  - vi. Evaluate site ecology
  - vii. Evaluate nature and extent of contamination
  - viii. Evaluate contaminant fate and transport
  - ix. Conduct baseline risk assessment
- c. Sampling and Analysis (S&A):
  - i. Groundwater:
    - 1. One aquifer at an average sample depth of 100 feet:
      - a. Two sample locations per five acres:
        - i. One sample per location
    - 2. On average, test for:
      - a. Total dissolved solids (EPA 160.1)
      - b. Total suspended solids (EPA 160.2)
      - c. TAL metals (EPA 6010/7000s)
  - ii. Surface water:
    - 1. Two sample locations per five acres:
      - a. One sample per location
    - 2. On average, test for:
      - a. Total dissolved solids (EPA 160.1)
      - b. Total suspended solids (EPA 160.2)
      - c. TAL metals (EPA 6010/7000s)
  - iii. Surface soil:
    - 1. Two sample locations per five acres:
      - a. One sample per location
    - 2. On average, test for:
      - a. Pesticides/PCBs (SW 3550B/SW 8081/8082)
      - b. TAL metals (EPA 6010/7000s)
  - iv. Subsurface soil:
    - 1. Average sample depth of 50 feet:
      - a. Two sample locations per five acres:
        - i. One sample per location
    - 2. On average, test for:
      - a. Pesticides/PCBs (SW 3550B/SW 8081/8082)
      - b. TAL metals (EPA 6010/7000s)

**Feasibility Study:**

- 1. Site complexity on average is Moderate
- 2. Level of study detail on average is Moderate

3. Level of study documentation on average is Moderate
4. Tasks include:
  - a. Scoping:
    - i. RI review
    - ii. FS work plan
    - iii. Data quality objectives
    - iv. Preliminary alternatives
    - v. Community relations activities
  - b. Development/Screening of alternatives:
    - i. Identify/Evaluate treatment technologies
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