

**EPA Superfund
Record of Decision:**

**FAIRFIELD COAL GASIFICATION PLANT
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OU 01
FAIRFIELD, IA
09/21/1990**

THREE GAS HOLDERS, A GAS HOLDER PIT, A RELIEF GAS HOLDER AND A GAS HOLDER BASE; AN OPERATIONS BUILDING; A FORMER TAR SEPARATOR; A FORMER RAILROAD RIGHT-OF-WAY AREA; AND AN AREA SOUTH OF THE SITE THAT WAS FORMERLY A DITCH. THESE FEATURES ARE SHOWN ON FIGURE 2.

INFORMATION FROM THE US DEPARTMENT OF THE INTERIOR AND THE IOWA DEPARTMENT OF NATURAL RESOURCES (IDNR) INDICATE THAT THERE ARE NO SENSITIVE ENVIRONMENTS WITHIN A ONE-MILE RADIUS OF THE SITE. SENSITIVE ENVIRONMENTS WOULD INCLUDE WETLANDS, CRITICAL HABITATS OF ENDANGERED SPECIES, AND NATIONAL WILDLIFE REFUGES.

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SITE HISTORY AND ENFORCEMENT ACTIVITIES

COAL GASIFICATION OPERATIONS BEGAN AT THE FAIRFIELD SITE IN 1878. THE PROCESS UTILIZED INVOLVED THE CARBONIZATION OF COAL IN RETORTS. COKE WAS BURNED BENEATH A RETORT, CARBONIZING THE COAL AND GIVING OFF GAS. THIS GAS WAS THEN PURIFIED AND PIPED TO GAS HOLDERS FOR FUTURE DISTRIBUTION. THE TWO BY-PRODUCTS OF THE CARBONIZATION PROCESS WERE COKE AND COAL TAR. THE COKE WAS SOLD FOR HOME HEATING AND THE TAR WAS SOLD PRIMARILY FOR FENCEPOST PRESERVATION.

IN 1937 THE PROCESS WAS CHANGED FROM CARBONIZED COAL TO CARBURETED WATER GAS. THIS PROCESS INVOLVED THE BURNING OF COKE BENEATH AN UPRIGHT CIRCULAR GENERATOR CONTAINING COAL. STEAM WHICH PASSED THROUGH THE COAL WAS CAPTURED AND THE GAS IT CONTAINED WAS THEN PURIFIED. THE BY-PRODUCTS PRODUCED WERE COAL TAR AND AMMONIUM LIQUOR, BOTH OF WHICH WERE DISPOSED ON-SITE. ANOTHER BY-PRODUCT OF THIS PROCESS WAS SPENT OXIDE WASTE FROM GAS PURIFICATION PROCESSES WHICH PRODUCE CYANIDE SALTS. THE DISPOSAL LOCATION OF THESE WASTES IS UNKNOWN.

IN 1950 THE GAS SYSTEM IN FAIRFIELD WAS CONVERTED TO NATURAL GAS. AS A RESULT, OPERATIONS AT THE SITE WERE TERMINATED AND THE BUILDINGS WERE CONVERTED FOR USE AS AN OPERATIONS FACILITY.

THE OWNER OF THE SITE IS IOWA ELECTRIC LIGHT AND POWER COMPANY (IELP), WHO, UNDER DIFFERENT CORPORATE NAMES, HAS OWNED THE SITE SINCE 1917. IELP CONDUCTED A STUDY IN 1986 IN WHICH CONTAMINANTS WERE FOUND IN THE SOIL AND GROUND WATER AT THE SITE. THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA) CONDUCTED AN INVESTIGATION IN 1987 WHICH CONFIRMED THE PRESENCE OF THIS CONTAMINATION ON-SITE AND ALSO FOUND CONTAMINANTS IN THE DRAINAGE DITCH SOUTH OF THE SITE. IELP CONTINUED TO MONITOR THE GROUND WATER AT THE SITE FROM 1986 TO 1988. THE SITE WAS PROPOSED FOR THE NATIONAL PRIORITIES LIST (NPL) IN JUNE, 1988 AND WAS PLACED ON THE NPL IN AUGUST, 1990.

IELP ENTERED INTO AN ADMINISTRATIVE ORDER ON CONSENT WITH EPA IN MARCH, 1989 TO CONDUCT A REMEDIAL INVESTIGATION (RI) AND FEASIBILITY STUDY (FS) AT THE SITE. THE PURPOSE OF THE RI WAS TO DETERMINE THE SOURCE OF CONTAMINATION AND THE NATURE AND EXTENT OF CONTAMINATION AT THE SITE AND TO COLLECT THE NECESSARY DATA TO DETERMINE THE PROPER ALTERNATIVES TO BE EVALUATED IN THE FS. ALSO, AS A NECESSARY MEASURE TO RETARD THE FLOW OF CONTAMINANTS OFF SITE, IELP AGREED TO IMPLEMENT A GROUND WATER EXTRACTION AND TREATMENT SYSTEM. IELP CONTRACTED WITH B&V WASTE MANAGEMENT TO CONDUCT SAMPLING AT THE SITE, WHICH INCLUDED SURFACE AND SUBSURFACE SOIL, GROUND WATER, SEDIMENT, AND SURFACE WATER SAMPLES, AND DESIGN AND IMPLEMENT THE GROUND WATER TREATMENT SYSTEM. IELP PREPARED AN RI/FS REPORT WHICH WAS REVIEWED BY EPA. EPA, BASED ON THE FINDINGS OF THE FS, PREPARED A PROPOSED PLAN WHICH DESCRIBED THE PREFERRED ALTERNATIVE FOR THIS SITE.

COMMUNITY RELATIONS ACTIVITIES

THE RI/FS REPORT AND THE PROPOSED PLAN FOR THE FAIRFIELD SITE WERE RELEASED TO THE PUBLIC FOR COMMENT. THE PUBLIC COMMENT PERIOD WAS FROM JULY 17, 1990 TO AUGUST 15, 1990. THESE TWO DOCUMENTS WERE MADE AVAILABLE TO THE PUBLIC WITH THE ADMINISTRATIVE RECORD, WHICH IS LOCATED AT INFORMATION REPOSITORIES MAINTAINED AT THE FAIRFIELD PUBLIC LIBRARY AND AT THE EPA REGION VII OFFICE. THE NOTICE OF AVAILABILITY FOR THESE DOCUMENTS WAS PUBLISHED IN THE FAIRFIELD COUNTY LEDGER ON JULY 17, 1990. A PUBLIC MEETING WAS HELD ON JULY 26, 1990 IN FAIRFIELD, IOWA. AT THIS MEETING, REPRESENTATIVES FROM EPA, THE STATE OF IOWA, AND THE AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR) ANSWERED QUESTIONS ABOUT PROBLEMS AT THE SITE AND THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION. A SUMMARY OF COMMENTS RECEIVED AT THIS MEETING AND

DURING THE COMMENT PERIOD AND EPA'S RESPONSE TO THOSE COMMENTS, THE RESPONSIVENESS SUMMARY, IS ATTACHED HERETO AS APPENDIX A.

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SCOPE OF RESPONSE ACTIVITIES

THE RESPONSE ACTIVITIES DESCRIBED IN THIS DECISION SUMMARY ADDRESS ALL CONTAMINANTS KNOWN AT THE SITE. WHEN IMPLEMENTED, THESE ACTIONS WILL ELIMINATE THE NEED FOR FUTURE RESPONSE ACTIONS AT THE SITE. THIS ROD IS INTENDED TO BE THE FINAL ROD FOR THE FAIRFIELD SITE.

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SUMMARY OF SITE CHARACTERISTICS

CONTAMINANT CHARACTERIZATION

COAL TAR WASTE CONTAINS POLYNUCLEAR AROMATIC HYDROCARBONS (PAHS) SUCH AS NAPHTHALENE AND BENZO(A)PYRENE. ALSO PRODUCED FROM COAL TAR WASTES ARE VOLATILE ORGANIC CONTAMINANTS, SUCH AS BENZENE, ETHYLBENZENE, TOLUENE AND XYLENE, AND SEMI-VOLATILE CONTAMINANTS, SUCH AS 4-METHYLPHENOL, DIBENZOFURAN, AND PHENOL. METAL CONTAMINATION, SUCH AS BARIUM, LEAD, AND MERCURY, AND CYANIDE CAN ALSO BE ASSOCIATED WITH COAL TAR WASTES.

CHARACTERIZATION OF THE NATURE AND EXTENT OF CONTAMINATION

THE INVESTIGATION PERFORMED BY IELP'S CONTRACTOR IDENTIFIED THE SOURCE OF CONTAMINATION AND CHARACTERIZED THE NATURE AND EXTENT OF CONTAMINATION AT THE SITE. THE DISCUSSION OF THESE FINDINGS ARE DIVIDED INTO FOUR MAIN GROUPS: SOURCE AREA RESULTS, SURFACE AND SHALLOW SUBSURFACE RESULTS, DEEP SUBSURFACE RESULTS, AND GROUND WATER RESULTS.

SOURCE AREA RESULTS

THREE AREAS OF SOURCE CONTAMINATION WERE IDENTIFIED AT THE SITE, THE GAS HOLDER PIT AREA, THE TAR SEPARATOR, AND THE RELIEF GAS HOLDER AREA. THESE AREAS ARE FORMER COAL TAR DISPOSAL OR TREATMENT AREAS. A SUMMARY OF THE MAXIMUM CONTAMINANT CONCENTRATIONS DETECTED IN SOURCE AREAS IS PROVIDED IN TABLE 1.

SURFACE WATER SAMPLES FROM INSIDE THE GAS HOLDER PIT HAD TOTAL PAH CONCENTRATIONS OF 39,780 PARTS PER BILLION (PPB), TOTAL METALS ABOVE PRIMARY DRINKING WATER STANDARDS FOR SIX COMPOUNDS, AND CYANIDE CONCENTRATION OF 29,000 PPB (UNDETECTED IN BACKGROUND SAMPLES). A SEDIMENT SAMPLE FROM THE GAS HOLDER PIT YIELDED TOTAL PAHS OF 24.8 PERCENT, CARCINOGENIC PAHS OF 2.24 PERCENT, AND BETX COMPOUNDS (BENZENE, ETHYL BENZENE, TOLUENE AND XYLENE) HAVING TOTAL CONCENTRATIONS OF 13.1 PERCENT; THESE WERE THE HIGHEST SEDIMENT VALUES ON THE SITE (SEE FIGURE 2).

A BORING WAS DRILLED AT THE TAR SEPARATOR, RESULTING IN TOTAL PAHS OF 6,604 PARTS PER MILLION (PPM) AND CARCINOGENIC PAHS OF 1,406 PPM. TWO AND A HALF FEET OF COAL TAR WAS OBSERVED AT THE BASE OF THE TAR SEPARATOR.

THE MAIN SOURCE OF CONTAMINATION AT THE SITE, HOWEVER, HAS BEEN SHOWN TO BE THE RELIEF GAS HOLDER AT THE SOUTHWEST CORNER OF THE SITE. HEAVY AMOUNTS OF COAL TAR WERE OBSERVED IN BORINGS TAKEN FROM THIS AREA. MIGRATION FROM THIS AREA HAS ALSO BEEN DOCUMENTED BY BORINGS SHOWING COAL TAR IN DENSE NONAQUEOUS-PHASE LIQUID FLOWS THAT HAVE PENETRATED FRACTURES AND TRAVELED ALONG THE SEAMS AWAY FROM THE SITE. THE GROUND WATER RESULTS HAVE ALSO SHOWN THE RELIEF GAS HOLDER TO BE THE MAIN SOURCE OF CONTAMINATION.

SURFACE AND SHALLOW SUBSURFACE RESULTS

TABLE 2 PROVIDES A SUMMARY OF THE MAXIMUM CONTAMINANT CONCENTRATIONS THAT WERE DETECTED IN THE SURFACE AND SUBSURFACE SOILS. THE HIGHEST CONCENTRATIONS OF TOTAL PAHS IN SURFACE AND SHALLOW SUBSURFACE BORINGS OUTSIDE OF THE SOURCE AREAS WERE AT A LOCATION 4.5 - 5.5 FEET DEEP NORTHEAST OF THE RELIEF GAS HOLDER (BORING #22, OR B-22: 187 PPM TOTAL PAHS/37.6 PPM

CARCINOGENIC PAHS), IN THE VICINITY OF THE RELIEF GAS HOLDER, AND AT A DEPTH OF 3 - 4 FEET IN THE DITCH SOUTH OF THIS SITE (B-31: 191.9 PPM TOTAL PAHS/48.7 PPM CARCINOGENIC PAHS). THESE SAMPLES SHOW CONTAMINANT MIGRATION FROM THE RELIEF GAS HOLDER.

A BORING FROM 2.5 - 3.5 FEET TAKEN SOUTHEAST OF THE GAS HOLDER BASE (B-26) SHOWED 25.1 PPM TOTAL PAHS AND 16.6 PPM CARCINOGENIC PAHS. THIS INDICATES THAT CONTAMINANTS ARE PROBABLY MIGRATING FROM THE GAS HOLDER BASE.

THE RESULTS OBTAINED FOR BETX COMPOUNDS CONFIRM THE PAH RESULTS. THE HIGHEST CONCENTRATIONS WERE LOCATED AT B-22 (332 PPM TOTAL BETX), IN THE DITCH SOUTH OF THE SITE (B-30: 27.8 PPM TOTAL BETX), AND IN THE VICINITY OF THE RELIEF GAS HOLDER (B-14: 542 PPM TOTAL BETX AND B-15: 1,413 PPM). IN ADDITION, AT B-23, LEAD WAS DETECTED IN CONCENTRATIONS OF 170 PPM, MERCURY AT 0.67 PPM, AND CYANIDE AT 200 PPM. THESE RESULTS ALSO APPEAR TO CONFIRM THE CONTAMINANT MIGRATION FROM THE RELIEF GAS HOLDER. MORE INVESTIGATIONS WILL BE PERFORMED DURING THE REMEDIAL ACTION (RA) TO DEFINE POSSIBLE CONTAMINATION IN THE DITCH SOUTH OF THE SITE. ALSO, IF ANY WASTES OTHER THAN THOSE THAT WERE IDENTIFIED IN THE RI ARE DISCOVERED, THE DISPOSAL OF THESE WASTES WILL BE ADDRESSED DURING THE RA.

DEEP SUBSURFACE RESULTS

THE HIGHEST CONCENTRATIONS OF CONTAMINANTS IN THE DEEP SUBSURFACE TESTING WERE IN TWO BORINGS, ONE AT A DEPTH OF 22 - 24 FEET EAST OF THE RELIEF GAS HOLDER BASE (B-21) AND THE OTHER AT 26 - 27 FEET SOUTH OF THE RELIEF GAS HOLDER BASE (B-29). B-21 HAD RESULTS OF 312.9 PPM TOTAL PAHS, 58.7 PPM CARCINOGENIC PAHS AND TOTAL BETX OF 7,000 PPM. B-29 YIELDED 200.9 PPM TOTAL PAHS, 30.9 PPM CARCINOGENIC PAHS AND 473 PPM TOTAL BETX. THESE VALUES CAN BE SEEN IN TABLE 3, WHICH SUMMARIZES THE MAXIMUM CONCENTRATIONS FOR CONTAMINANTS DETECTED IN THE DEEP SUBSURFACE.

COAL TAR WAS OBSERVED TO BE MIGRATING INTO SUBSURFACE FRACTURES DURING THE DRILLING OF THESE BORINGS. THIS INDICATES THAT THE DENSE NONAQUEOUS-PHASE LIQUID IS MIGRATING FROM THE RELIEF GAS HOLDER AT DEPTHS OF APPROXIMATELY 22 - 27 FEET. SAMPLES TAKEN AT LOWER DEPTHS SHOW CONTAMINATION, BUT AT MUCH LOWER LEVELS. ONE EXCEPTION, HOWEVER, IS A SAMPLE TAKEN FROM THE BORING OF A MONITORING WELL INSTALLED SOUTHEAST OF THE GAS HOLDER PIT (FI-7; SEE FIGURE 3), WHICH HAD VALUES OF 30.2 PPM TOTAL PAHS AND 10 PPM CARCINOGENIC PAHS AT THE 47.5 - 50 FEET DEPTH.

GROUND WATER RESULTS

GROUND WATER SAMPLES WERE COLLECTED FROM ELEVEN MONITORING WELLS ON-SITE AND OFF-SITE, FIVE PRIVATE OFF-SITE WELLS, TWO ON-SITE EXTRACTION WELLS, AND ONE TEMPORARY ON-SITE MONITORING WELL. THE ANALYTICAL RESULTS OF THESE SAMPLES SHOW THAT THE RELIEF GAS HOLDER IS THE PRIMARY SOURCE OF GROUND WATER CONTAMINATION. TABLE 4 SUMMARIZES THE GROUND WATER MAXIMUM CONTAMINANT LEVELS.

THE HIGHEST PAH CONCENTRATIONS FOUND IN MONITORING WELLS WERE IN FI-3, WEST OF THE RELIEF GAS HOLDER; FI-7, NORTHEAST OF THE RELIEF GAS HOLDER AND SOUTHEAST OF THE GAS HOLDER PIT; AND FI-9, SOUTHEAST OF THE RELIEF GAS HOLDER. FI-3 HAD TOTAL PAHS OF 3396.4 PPB AND TOTAL CARCINOGENIC PAHS OF 133.9 PPB. FI-7 HAD TOTAL PAHS OF 2874 PPB AND FI-9 HAD TOTAL PAHS OF 5176 PPB AND CARCINOGENIC OF 108 PPB. AN EXTRACTION WELL WAS INSTALLED SOUTHEAST OF THE SITE (EX-1) WHICH WAS ANALYZED AND FOUND TO CONTAIN 3085 PPB OF TOTAL PAHS. A GROUND WATER SAMPLE WAS ALSO TAKEN FROM THE EXTRACTION WELL INSTALLED IN THE RELIEF GAS HOLDER (EX-2) AND A TOTAL PAH CONCENTRATION OF 7501 PPB WAS FOUND.

THE WELLS WERE ANALYZED FOR BETX COMPOUNDS AND SIMILAR RESULTS WERE FOUND. WELL FI-3 HAD A TOTAL BETX CONCENTRATION OF 54,430 PPB, FI-7 HAD 6560 PPB TOTAL BETX AND FI-9 HAD 104,000 PPB TOTAL BETX. GROUND WATER SAMPLES WERE TAKEN FROM EX-1, WHICH CONTAINED 57,900 PPB OF TOTAL BETX, AND FROM EX-2, WHICH CONTAINED A TOTAL BETX VALUE OF 101,200 PPB. MANY OF THE SAMPLES EXCEEDED EPA PRIMARY DRINKING WATER STANDARDS FOR BETX COMPOUNDS.

THE ANALYTICAL RESULTS FROM WELL FI-9 INDICATE THE PRIMARY GROUND WATER FLOW IS TO THE SOUTHEAST. THIS PATHWAY WILL BE INVESTIGATED FURTHER DURING THE RA TO DEFINE THE FARTHEST EXTENT OF CONTAMINATED GROUND WATER. THE EXTENT OF GROUND WATER CONTAMINATION WILL ALSO BE FURTHER DEFINED TO THE WEST AND SOUTH OF THE SITE. SUFFICIENT INFORMATION IS AVAILABLE FROM THE RI, HOWEVER, TO DETERMINE A PROPER REMEDY FOR THE GROUND WATER.

CHROMIUM AND LEAD WERE DETECTED IN WELL FI-3 ABOVE THE PRIMARY DRINKING WATER STANDARDS. WATER SAMPLES TAKEN FROM THE TEMPORARY WELL LOCATED JUST NORTH OF WELL FI-7 (B-24 ON FIGURE 2) HAD RESULTS ALSO ABOVE EPA DRINKING WATER STANDARDS FOR ARSENIC, CHROMIUM, LEAD, AND MERCURY. THE RESULTS FROM THIS WELL MAY INDICATE CONTAMINANT MIGRATION FROM THE GAS HOLDER PIT. IN ADDITION, BENZENE AND NAPHTHALENE WERE DETECTED OFF SITE IN RESIDENTIAL WELLS.

FIGURE 4 SHOWS THE EXTENT OF BENZENE CONTAMINATION IN THE GROUND WATER. FIGURE 5 INDICATES THE PLUME REPRESENTED BY TOTAL CARCINOGENIC PAH CONTAMINATION. THE NON-CARCINOGENIC PLUME IS SHOWN ON FIGURE 6 AND THE CONTAMINANT PLUME FOR NAPHTHALENE IS SHOWN ON FIGURE 7. THE PRIVATE WELL LOCATIONS ARE ALSO SHOWN ON FIGURE 7.

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SUMMARY OF SITE RISKS

OVERVIEW OF BASELINE RISK ASSESSMENT

A BASELINE RISK ASSESSMENT IS AN EVALUATION OF THE POTENTIAL THREAT TO HUMAN HEALTH AND THE ENVIRONMENT IN THE ABSENCE OF ANY REMEDIAL ACTION. IT PROVIDES INFORMATION TO HELP EPA DETERMINE WHETHER REMEDIAL ACTION IS NECESSARY AT A SITE. A BASELINE RISK ASSESSMENT WAS CONDUCTED FOR THIS SITE TO DETERMINE THE POTENTIAL EFFECTS ON HUMAN HEALTH AND THE ENVIRONMENT. IN THIS EVALUATION, BOTH CURRENT AND FUTURE LAND-USE SCENARIOS WERE EVALUATED.

INDICATOR COMPOUNDS

TABLES 5, 6, AND 7 LIST THE COMPOUNDS DETECTED IN ANALYSES PERFORMED ON SAMPLES TAKEN AT THE SITE. OF THESE, A TOTAL OF 30 CHEMICALS WERE IDENTIFIED IN THE RISK ASSESSMENT TO BE OF POTENTIAL CONCERN, 17 OF WHICH WERE PAHS. TOXICITY INFORMATION WAS EVALUATED FOR ALL CHEMICALS OF CONCERN, INCLUDING CANCER POTENCY FACTORS AND NONCARCINOGENIC EFFECTS. THESE CHEMICALS ARE IDENTIFIED IN TABLE 8 WITH THEIR REPRESENTATIVE CONCENTRATIONS USED IN CALCULATIONS.

EXPOSURE ASSESSMENT

PATHWAYS BY WHICH HUMANS COULD BE EXPOSED TO THE CHEMICALS OF CONCERN AT THE SITE WERE EVALUATED BASED ON REASONABLE ASSUMPTIONS ABOUT CURRENT AND FUTURE LAND USES. THE FOLLOWING PATHWAYS WERE EVALUATED:

- EXPOSURE OF CURRENT RESIDENTS TO OFF-SITE CONTAMINATED GROUND WATER THROUGH OCCASIONAL INGESTION OF WELL WATER DURING OUTSIDE ACTIVITIES, INGESTION OF GARDEN PRODUCE WATERED WITH CONTAMINATED GROUND WATER, AND INHALATION OF CONTAMINANTS VOLATILIZED DURING WATERING;
- EXPOSURE OF FUTURE WORKERS ON-SITE AND OFF-SITE TO CONTAMINATED SOIL THROUGH DERMAL CONTACT AND INGESTION;
- EXPOSURE OF FUTURE RESIDENTS TO OFF-SITE CONTAMINATED GROUND WATER USED AS A PRIMARY POTABLE WATER SOURCE.

ASSUMPTIONS WERE MADE IN CALCULATING DAILY INTAKE RATES UNDER EACH OF THESE EXPOSURE PATHWAYS. THESE ASSUMPTIONS ARE EXPLAINED IN THE RISK ASSESSMENT, CHAPTER 6 OF THE RI/FS REPORT. THE UNCERTAINTIES INVOLVED WITH THE CALCULATIONS ARE ALSO LISTED IN THE RISK ASSESSMENT. THE DAILY INTAKE RATES ARE LISTED IN TABLE 9 FOR EACH PATHWAY. CALCULATIONS ARE PERFORMED FOR SUBCHRONIC (0.5 YEARS), CHRONIC (10 YEARS), AND LIFETIME (70 YEARS) EXPOSURE DURATIONS.

TOXICITY ASSESSMENT

REFERENCE DOSES (RFDS) HAVE BEEN DEVELOPED BY EPA FOR INDICATING THE POTENTIAL FOR ADVERSE EFFECTS FROM EXPOSURE TO CHEMICALS EXHIBITING NONCARCINOGENIC EFFECTS. RFDS, WHICH ARE EXPRESSED IN UNITS OF MG/KG/DAY, ARE ESTIMATES OF DAILY EXPOSURE LEVELS FOR HUMANS THAT ARE NOT LIKELY TO BE WITHOUT AN APPRECIABLE RISK OF ADVERSE HEALTH EFFECTS. ESTIMATED INTAKES OF CHEMICALS FROM ENVIRONMENTAL MEDIA (E.G., THE AMOUNT OF A CHEMICAL INGESTED FROM CONTAMINATED DRINKING WATER) CAN BE COMPARED TO THE RFD. RFDS ARE DERIVED FROM HUMAN EPIDEMIOLOGICAL STUDIES OR ANIMAL STUDIES TO WHICH UNCERTAINTY FACTORS HAVE BEEN APPLIED (E.G., TO ACCOUNT FOR THE USE OF ANIMAL DATA TO PREDICT EFFECTS ON HUMANS). THESE UNCERTAINTY FACTORS HELP ENSURE THAT THE RFDS WILL NOT UNDERESTIMATE THE POTENTIAL FOR ADVERSE NONCARCINOGENIC EFFECTS TO OCCUR. THE RFDS APPLICABLE AT THE FAIRFIELD SITE ARE LISTED IN TABLE 10.

CANCER POTENCY FACTORS OR SLOPE FACTORS (SFS) HAVE BEEN DEVELOPED FOR ESTIMATING EXCESS LIFETIME CANCER RISKS ASSOCIATED WITH EXPOSURE TO POTENTIALLY CARCINOGENIC CHEMICALS. SFS, WHICH ARE EXPRESSED IN UNITS OF $1/(MG/KG/DAY)$, ARE MULTIPLIED BY THE ESTIMATED INTAKE OF A POTENTIAL CARCINOGEN, IN MG/KG/DAY, TO PROVIDE AN UPPER-BOUND ESTIMATE OF THE EXCESS LIFETIME CANCER RISK ASSOCIATED WITH EXPOSURE AT THAT INTAKE LEVEL. THE TERM "UPPER-BOUND" REFLECTS THE CONSERVATIVE ESTIMATE OF THE RISKS CALCULATED FROM THE SF. USE OF THIS APPROACH MAKES UNDER-ESTIMATION OF THE ACTUAL CANCER RISK HIGHLY UNLIKELY. CANCER SLOPE FACTORS ARE DERIVED FROM THE RESULTS OF HUMAN EPIDEMIOLOGICAL STUDIES OR CHRONIC ANIMAL BIOASSAYS TO WHICH ANIMAL-TO-HUMAN EXTRAPOLATION AND UNCERTAINTY FACTORS HAVE BEEN APPLIED. THE SFS ARE LISTED IN TABLE 11.

RISK CHARACTERIZATION

POTENTIAL CONCERN FOR NONCARCINOGENIC EFFECTS OF A SINGLE CONTAMINANT IN A SINGLE MEDIUM IS EXPRESSED AS THE HAZARD QUOTIENT (HQ), OR THE RATIO OF THE ESTIMATED INTAKE DERIVED FROM THE CONTAMINANT CONCENTRATION IN A GIVEN MEDIUM TO THE CONTAMINANT'S REFERENCE DOSE. BY ADDING THE HQS FOR ALL CONTAMINANTS WITHIN A MEDIUM OR ACROSS ALL MEDIA TO WHICH A GIVEN POPULATION MAY REASONABLY BE EXPOSED, THE HAZARD INDEX (HI) CAN BE GENERATED. THE HI PROVIDES A USEFUL REFERENCE POINT FOR GAUGING THE POTENTIAL SIGNIFICANCE OF MULTIPLE CONTAMINANT EXPOSURES WITHIN A SINGLE MEDIUM OR ACROSS MEDIA.

A HI WAS CALCULATED FOR EACH PATHWAY EVALUATED. AN HI OF LESS THAN 1.0 (UNITY) INDICATES THAT THE RISKS ASSOCIATED WITH THAT PATHWAY ARE LOW. AN HI ABOVE 1.0 INDICATES THAT SOME RISK OF NONCARCINOGENIC EFFECTS EXIST AND THESE RISKS INCREASE PROPORTIONAL TO THE HI VALUE. THE HI VALUE FOR CURRENT OFF-SITE RESIDENTS IS AT UNITY, INDICATING THAT THEY ARE NOT CURRENTLY AT RISK, BUT TREATMENT OF CONTAMINANTS TO REDUCE THE SPREAD IS NECESSARY. THE FUTURE RISK TO OFF-SITE RESIDENTS THROUGH THE GROUND WATER PATHWAY WAS EVALUATED AND THE HI WAS CALCULATED TO BE 50, WHICH INDICATES THAT TREATMENT OF THE SOURCE, SOIL AND GROUND WATER IS ESSENTIAL AT THIS SITE. THE HI FOR FUTURE WORKERS ON-SITE AND OFF-SITE WAS DETERMINED TO BE LESS THAN ONE, INDICATING NO SIGNIFICANT NONCARCINOGENIC RISKS.

EXCESS LIFETIME CANCER RISKS ARE DETERMINED BY MULTIPLYING THE INTAKE LEVELS WITH THE CANCER SLOPE FACTORS. THESE RISKS ARE PROBABILITIES THAT ARE GENERALLY EXPRESSED IN SCIENTIFIC NOTATION. AN EXCESS LIFETIME CANCER RISK OF $1 \times (10^{-6})$ INDICATES THAT, AS A PLAUSIBLE UPPER BOUND LIMIT, AN INDIVIDUAL HAS A ONE IN A MILLION CHANCE OF DEVELOPED CANCER AS A RESULT OF SITE-RELATED EXPOSURE TO A CARCINOGEN OVER A 70-YEAR LIFETIME UNDER THE SPECIFIC EXPOSURE CONDITIONS AT A SITE.

THE CARCINOGENIC RISKS WERE ALSO CALCULATED FOR THE EVALUATED PATHWAYS AT THE SITE. THE RISK ASSOCIATED WITH EACH PATHWAY IS SUMMED FOR EACH RECEPTOR. THE CARCINOGENIC RISK TO CURRENT RESIDENTS IS $4 \times (10^{-6})$. THE RISK TO FUTURE OFF-SITE RESIDENTS IS $7 \times (10^{-2})$. THE RISK TO FUTURE OFF-SITE WORKERS AT THE SITE WAS CALCULATED TO BE $3 \times (10^{-5})$ AND THE RISK TO FUTURE ON-SITE WORKERS WAS $5 \times (10^{-4})$.

ACCORDINGLY, EPA HAS DETERMINED THAT THE ACTUAL OR THREATENED RELEASE OF HAZARDOUS SUBSTANCES FROM THIS SITE, IF NOT ADDRESSED BY IMPLEMENTING THE RESPONSE ACTION SELECTED IN THIS ROD, MAY PRESENT A CURRENT OR POTENTIAL THREAT TO THE PUBLIC HEALTH, WELFARE OR THE ENVIRONMENT.

REMEDIATION GOALS

FEDERAL AND STATE SOIL CLEANUP STANDARDS FOR THE CONTAMINANTS OF CONCERN HAVE NOT BEEN ESTABLISHED AT THIS TIME. THEREFORE, IT IS APPROPRIATE TO DETERMINE SOIL CLEANUP LEVELS ON A SITE-SPECIFIC BASIS USING THE RISK ASSESSMENT'S CARCINOGENIC RISK FACTORS. AT THE FAIRFIELD SITE, THE (10-6) RISK LEVEL WOULD BE PROTECTIVE IF NO INSTITUTIONAL CONTROLS WERE IN PLACE. WITH PROPER INSTITUTIONAL CONTROLS AT THE SITE, THE CLEANUP OF SOIL TO A (10-4) RISK LEVEL AT THIS SITE WOULD BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. BASED ON THIS RISK LEVEL, THE CLEANUP LEVEL FOR SOIL WILL BE 500 PPM FOR TOTAL PAH CONTAMINANTS AND 100 PPM CARCINOGENIC PAH CONTAMINANTS. THE (10-4) LEVEL WILL ALSO BE USED TO DETERMINE THE CLEANUP LEVEL FOR BENZENE IN SOIL.

THE NCP STATES THAT PRELIMINARY REMEDIATION GOALS ARE TO BE SET AT A (10-6) EXCESS UPPER BOUND LIFETIME CANCER RISK LEVEL AS A POINT OF DEPARTURE, BUT MAY BE REVISED TO A RISK LEVEL IN THE ACCEPTABLE RANGE (10-4) TO (10-6) BASED ON CONSIDERATION OF APPROPRIATE FACTORS, INCLUDING UNCERTAINTY, TECHNICAL AND EXPOSURE FACTORS.

FOR CHRONIC AND LIFETIME EXPOSURES, AN ASSUMPTION WAS EMPLOYED THAT ALL CONCENTRATION VALUES WILL REMAIN CONSTANT. THIS MAY RESULT IN SOME OVERESTIMATION OF CHRONIC AND LIFETIME EXPOSURE SINCE THE VOLATILE ORGANIC COMPOUNDS, AND TO SOME EXTENT THE PAHS, HAVE THE POTENTIAL TO BREAK DOWN AND EVAPORATE, RESULTING IN SOME REDUCTION OF RISK. A TECHNICAL FACTOR FOR SOIL THAT SHOULD BE CONSIDERED IS THE PRACTICAL LIMIT TO WHICH SOIL CAN BE REMEDIATED. THE (10-6) RISK LEVEL FOR CARCINOGENIC PAHS IS 0.43 PPM. IT WOULD BE TECHNICALLY IMPRACTICAL TO REMEDIATE SOIL TO THIS LEVEL BASED ON THE VOLUME OF SOIL THAT WOULD BE GENERATED. FINALLY, INSTITUTIONAL CONTROLS WILL BE IMPLEMENTED AT THE SITE, REDUCING THE POTENTIAL FOR EXPOSURE. FOR THESE REASONS, CLEANUP OF SOIL AT THE SITE TO THE (10-4) RISK LEVEL WOULD BE PROTECTIVE.

FEDERAL AND STATE GROUND WATER CLEANUP STANDARDS HAVE BEEN ESTABLISHED FOR SOME OF THE CONTAMINANTS OF CONCERN AT THE SITE. EPA HAS ESTABLISHED THE SAFE DRINKING WATER ACT NATIONAL PRIMARY DRINKING WATER STANDARDS' MAXIMUM CONTAMINANT LEVELS (MCLS) AS CLEANUP CRITERIA FOR DRINKING WATER. THE IOWA ADMINISTRATIVE CODE CHAPTER 133, EFFECTIVE AUGUST 16, 1989, ESTABLISHED CLEANUP LEVELS FOR CONTAMINATED GROUND WATER IN IOWA. THE LEVEL TO FIRST BE CONSIDERED IS THE EPA NEGLIGIBLE RISK LEVEL (NRL), THEN THE EPA LIFETIME HEALTH ADVISORY LEVEL (HAL), AND FINALLY MCLS.

FOR THE FAIRFIELD SITE, EPA BELIEVES THAT A CLEAN-UP LEVEL OF 1 PPB BENZENE, THE MOST ABUNDANT VOLATILE ORGANIC PRESENT IN THE CONTAMINATED GROUND WATER, WOULD BE PROTECTIVE OF HUMAN HEALTH, BASED ON THE NRL FOR BENZENE. THIS LEVEL COORDINATES TO A PROTECTIVE RISK LEVEL OF (10-6).

FOR CARCINOGENIC PAHS FOR WHICH THERE ARE NO STATE OR FEDERAL STANDARDS, THE PROPOSED CLEANUP LEVELS WILL BE ESTABLISHED USING THE DETECTION LIMITS FOR EACH SPECIFIC COMPOUND, BASED ON THE BEST AVAILABLE TECHNOLOGY AT THE TIME OF THE SIGNING OF THIS ROD. THE GOAL FOR THESE CLEANUP LEVELS IS TO ACHIEVE A LEVEL PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. EPA BELIEVES THAT A LEVEL ESTABLISHED USING THE CURRENT BEST AVAILABLE DETECTION LIMITS WILL FULFILL THIS GOAL. THE MINIMUM LABORATORY DETECTION LIMITS THAT CAN BE ACHIEVED UNDER IDEAL CONDITIONS FOR CARCINOGENIC PAHS COORDINATE TO A PROTECTIVE RISK LEVEL OF (10-5). THE BEST LEVEL THAT CAN BE MEASURED PRACTICALLY DURING ROUTINE LABORATORY OPERATING CONDITIONS COORDINATES TO A PROTECTIVE RISK LEVEL OF (10-4). THE (10-4) RISK LEVEL IS CONSIDERED APPROPRIATE FOR THIS SITE BASED ON THE UNCERTAINTY FACTOR PREVIOUSLY DISCUSSED AND THE TECHNICAL FACTORS ASSOCIATED WITH THE DETECTION/QUANTIFICATION LIMITS FOR CONTAMINANTS.

THE LEVELS DISCUSSED IN THIS SECTION HAVE BEEN REVIEWED AND APPROVED BY ATSDR. TABLE 12 LISTS THE REMEDIATION LEVELS THAT WILL BE USED FOR GROUND WATER REMEDIATION AT THIS SITE, INCLUDING THE DETECTION LIMITS FOR THE CARCINOGENIC PAHS.

#SOA

SUMMARY OF ALTERNATIVES

THE NCP REQUIRES THAT CERTAIN ALTERNATIVES BE DEVELOPED FOR EVALUATION IN THE FS:

- AN ALTERNATIVE THAT REMOVES OR DESTROYS THE HAZARDOUS CONSTITUENTS TO THE MAXIMUM EXTENT FEASIBLE AND ELIMINATES THE NEED FOR LONG-TERM MONITORING AND MANAGEMENT;
- ONE OR MORE ADDITIONAL ALTERNATIVES THAT REDUCE THE TOXICITY, MOBILITY, OR VOLUME OF THE HAZARDOUS CONSTITUENTS;
- ONE OR MORE ALTERNATIVES THAT INVOLVE LITTLE OR NO TREATMENT, BUT PROVIDE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT BY CONTAINING THE HAZARDOUS CONSTITUENTS TO CONTROL EXPOSURE TO THE WASTES;
- ONE OR MORE INNOVATIVE TREATMENT TECHNOLOGY ALTERNATIVES IF THOSE TECHNOLOGIES OFFER THE POTENTIAL FOR COMPARABLE OR SUPERIOR PERFORMANCE OR IMPLEMENTABILITY, FEWER ADVERSE EFFECTS, OR LOWER COSTS THAN DEMONSTRATED TECHNOLOGIES;
- A LIMITED NUMBER OF REMEDIAL ALTERNATIVES FOR GROUND WATER THAT ATTAIN SITE-SPECIFIC REMEDIATION LEVELS WITHIN DIFFERENT RESTORATION TIME PERIODS UTILIZING ONE OR MORE DIFFERENT TECHNOLOGIES; AND
- THE NO-ACTION ALTERNATIVE.

THE ALTERNATIVES THAT WERE EVALUATED IN DETAIL IN THE FEASIBILITY STUDY ARE DESCRIBED IN THIS SECTION. EIGHT ALTERNATIVES WERE DETERMINED TO BE APPROPRIATE FOR CONSIDERATION AT THIS SITE. THESE ALTERNATIVES PROVIDED A RANGE OF VARIOUS REMEDIAL OPTIONS TO SATISFY THE REQUIREMENT IN THE NCP. THE FOLLOWING DESCRIPTIONS SUMMARIZE THE ALTERNATIVES, INCLUDING THEIR TREATMENT COMPONENTS, IMPLEMENTATION REQUIREMENTS, THE ESTIMATED TIME FOR COMPLETION AND ESTIMATED COSTS.

NO ACTION

THE NCP REQUIRES THAT THE NO-ACTION ALTERNATIVE BE EVALUATED FOR EVERY SITE. THE NO-ACTION ALTERNATIVE PROVIDES A BASELINE FOR COMPARING THE EFFECTIVENESS OF OTHER REMEDIAL OPTIONS. THIS ALTERNATIVE, ALTERNATIVE 1, INVOLVES NO FURTHER ACTION AT THE SITE TO PREVENT THE MIGRATION OF CONTAMINANTS FROM THE SITE. THERE WOULD BE NO COSTS ASSOCIATED WITH THIS ALTERNATIVE.

ISOLATE SOURCE AREAS AND SOIL/CONDUCT GROUND WATER MONITORING

ALTERNATIVE 2 WOULD INCLUDE THE INSTALLATION OF A SHEET PILING VERTICAL BARRIER AROUND THE CONTAMINATED SOURCE AREAS OF THE SITE. CONCRETE CAPS WOULD ALSO BE PLACED OVER THE INDIVIDUAL SOURCE AREAS. AN EXTRACTION WELL WOULD BE USED FOR GRADIENT CONTROL INSIDE THE VERTICAL BARRIER TO WITHDRAW WATER SO THAT GROUND WATER WOULD TEND TO FLOW INWARD. THE ESTIMATED VOLUME OF CONTAINED GROUND WATER IS 1,403,000 GALLONS. CONTAMINATED WATER REMOVED FROM THE EXTRACTION WELLS WOULD BE TREATED USING FILTRATION, POLYMER INJECTION AND SETTLING, AND CARBON ADSORPTION. THE ESTIMATED VOLUME OF TREATED GROUND WATER IS 526,000 GALLONS PER YEAR FOR 30 YEARS. THE TREATED WATER WOULD BE DISCHARGED TO A PUBLICLY OWNED TREATMENT WORKS FACILITY (POTW).

ADDITIONAL GROUND WATER MONITORING WELLS WOULD BE INSTALLED AND SAMPLED IN CONJUNCTION WITH ALREADY EXISTING MONITORING WELLS TO CONFIRM THE EFFECTIVENESS OF THE ALTERNATIVE. THE SITE WOULD ALSO BE FENCED TO MINIMIZE ACCESS. GROUND WATER USE RESTRICTIONS WOULD BE IMPLEMENTED FOR ALL WELLS WITHIN THE CONTAMINANT PLUME.

THE INSTALLATION OF THE SOURCE AREA CAPS AND BARRIER WOULD BE EXPECTED TO TAKE 4 TO 6 MONTHS. IT IS ESTIMATED THAT TWO YEARS OF MONITORING WOULD BE REQUIRED TO SHOW THAT THE GROUND WATER PLUME IS BEING CONTAINED, HOWEVER LONG-TERM MONITORING WOULD BE NEEDED. THE CONSTRUCTION

COSTS ARE ESTIMATED TO BE APPROXIMATELY \$1,446,000. CONTINUED MONITORING, CAP MAINTENANCE, WELL INSTALLATION, AND GROUND WATER EXTRACTION AND TREATMENT COSTS ARE ESTIMATED TO BE APPROXIMATELY \$1,517,000 FOR 30 YEARS OF OPERATIONS AND MAINTENANCE (O&M). THIS YIELDS A PRESENT WORTH OF \$2,963,000 FOR THIS ALTERNATIVE.

CAP SOURCE AREAS AND SOIL/PUMP-CONTAIN-TREAT GROUND WATER

ALTERNATIVE 3 WOULD INVOLVE CAPPING THE SOURCE AREAS OF CONTAMINATION AND INSTALLING ADDITIONAL EXTRACTION WELLS TO REMOVE AND TREAT THE CONTAMINATED GROUND WATER THUS CONTAINING THE PLUME OF CONTAMINATION. THE CONTAMINATED WATER WOULD BE TREATED USING FILTRATION, POLYMER INJECTION AND SETTLING, AND CARBON ADSORPTION. THE ESTIMATED VOLUME OF TREATED GROUND WATER IS 1,577,000 GALLONS PER YEAR. THIS WATER WOULD BE DISCHARGED TO A POTW.

ADDITIONAL GROUND WATER MONITORING WELLS WOULD BE INSTALLED AND SAMPLED IN CONJUNCTION WITH ALREADY EXISTING MONITORING WELLS TO CONFIRM THE EFFECTIVENESS OF THE ALTERNATIVE. THE SITE WOULD ALSO BE FENCED TO MINIMIZE ACCESS. GROUND WATER USE RESTRICTIONS WOULD BE IMPLEMENTED FOR ALL WELLS WITHIN THE CONTAMINANT PLUME.

THE INSTALLATION OF THE SOURCE AREA CAPS IS ESTIMATED TO TAKE 4 TO 6 MONTHS. THE CONSTRUCTION COSTS ARE ESTIMATED TO BE APPROXIMATELY \$295,000. THE TIME ESTIMATED FOR WELL INSTALLATION, SYSTEM DEBUGGING, AND THE ESTABLISHMENT OF THE PLUME CONTAINMENT WOULD BE 13 TO 18 MONTHS. CONTINUED MONITORING, CAP MAINTENANCE, AND GROUND WATER EXTRACTION AND TREATMENT COSTS ARE ESTIMATED TO BE APPROXIMATELY \$3,255,000 FOR 30 YEARS OF O&M. THIS YIELDS A PRESENT WORTH OF \$3,550,000 FOR THIS ALTERNATIVE.

EXCAVATE AND INCINERATE SOURCE AREAS AND SOIL OFFSITE/CONDUCT GROUND WATER MONITORING

ALTERNATIVE 4 WOULD INCLUDE THE EXCAVATION AND THERMAL TREATMENT OF SOURCE AREAS AND CONTAMINATED SOIL AREAS. THE ESTIMATED VOLUME OF THE SOURCE AREAS TO BE EXCAVATED IS APPROXIMATELY 3800 CUBIC YARDS. THE VOLUME OF SOIL WOULD BE DETERMINED DURING THE REMEDIAL DESIGN/REMEDIAL ACTION (RA/RA) PHASE. THE EXCAVATED MATERIAL WOULD BE INCINERATED IN AN OFF-SITE INCINERATOR. THIS ALTERNATIVE WOULD ALSO INCLUDE THE TEMPORARY STORAGE, SEPARATION, AND SIZING OF EXCAVATED MATERIAL.

A TRIAL BURN PLAN FOR THE INCINERATOR WOULD BE DEVELOPED DURING THE RD/RA TO ENSURE THAT THE SUBSTANTIVE REQUIREMENTS OF RCRA COULD BE MET, INCLUDING THE DESTRUCTION OF CONTAMINANTS TO AN EFFICIENCY OF AT LEAST 99.99 PERCENT.

DURING EXCAVATION, CHEMICAL DUST SUPPRESSANTS AND/OR WATER WOULD BE USED TO MINIMIZE DUST GENERATION. BERMS WOULD BE CONSTRUCTED TO CONTROL SURFACE RUN-ON AND RUN-OFF AND SUMPS WOULD BE USED TO COLLECT RAIN WATER. ALL WATER COLLECTED AT THE SITE WOULD BE TREATED USING FILTRATION, POLYMER INJECTION AND SETTLING, AND CARBON ADSORPTION. THIS WOULD INCLUDE THE WATER CURRENTLY OBSERVED IN THE GAS HOLDER PIT AREA, WHICH WOULD BE DISCHARGED TO A POTW.

ADDITIONAL GROUND WATER MONITORING WELLS WOULD BE INSTALLED AND SAMPLED IN CONJUNCTION WITH ALREADY EXISTING MONITORING WELLS TO CONFIRM THE EFFECTIVENESS OF THE ALTERNATIVE. THE SITE WOULD ALSO BE FENCED TO MINIMIZE ACCESS. GROUND WATER USE RESTRICTIONS WOULD BE IMPLEMENTED FOR ALL WELLS WITHIN THE CONTAMINANT PLUME.

THE EXCAVATION AND INCINERATION IS ESTIMATED TO TAKE 4 TO 6 MONTHS. IT IS ESTIMATED THAT TWO YEARS OF MONITORING WOULD BE REQUIRED TO SHOW THAT THE GROUND WATER PLUME HAS BEEN REDUCED, HOWEVER LONG-TERM MONITORING WOULD BE NEEDED. THE CONSTRUCTION, INCINERATION, AND EXCAVATION COSTS ARE ESTIMATED TO BE APPROXIMATELY \$875,000. CONTINUED MONITORING COSTS ARE ESTIMATED TO BE APPROXIMATELY \$197,000 FOR 30 YEARS OF O&M. THIS YIELDS A PRESENT WORTH OF \$1,072,000 FOR THIS ALTERNATIVE.

EXCAVATE AND INCINERATE SOURCE AREAS AND SOIL OFFSITE/PUMP-CONTAIN-TREAT GROUND WATER

ALTERNATIVE 5 WOULD INCLUDE THE EXCAVATION AND INCINERATION OF SOURCE AREAS AND CONTAMINATED SOIL AREAS AS DESCRIBED IN SECTION 4.4. IN ADDITION, THE GROUND WATER WOULD BE REMOVED AND

TREATED AS DESCRIBED IN SECTION 4.3.

ADDITIONAL GROUND WATER MONITORING WELLS WOULD BE INSTALLED AND SAMPLED IN CONJUNCTION WITH ALREADY EXISTING MONITORING WELLS TO CONFIRM THE EFFECTIVENESS OF THE ALTERNATIVE. THE SITE WOULD ALSO BE FENCED TO MINIMIZE ACCESS. GROUND WATER USE RESTRICTIONS WOULD BE IMPLEMENTED FOR ALL WELLS WITHIN THE CONTAMINANT PLUME.

THE EXCAVATION AND INCINERATION IS EXPECTED TO TAKE 4 TO 6 MONTHS. THE TIME ESTIMATED FOR WELL INSTALLATION, SYSTEM DEBUGGING, AND THE ESTABLISHMENT OF THE PLUME CONTAINMENT WOULD BE 13 TO 18 MONTHS. THE CONSTRUCTION, INCINERATION, EXCAVATION, AND EXTRACTION WELL INSTALLATION COSTS ARE ESTIMATED TO BE APPROXIMATELY \$904,000. CONTINUED MONITORING AND GROUND WATER EXTRACTION AND TREATMENT COSTS ARE ESTIMATED TO BE APPROXIMATELY \$3,247,000 FOR 30 YEARS OF O&M. THIS YIELDS A PRESENT WORTH OF \$4,151,000 FOR THIS ALTERNATIVE.

EXCAVATE AND INCINERATE SOURCE AREAS AND SOIL OFFSITE/PUMP-CONTAIN-TREAT GROUND WATER WITH ENHANCED IN-SITU BIOREMEDIATION

ALTERNATIVE 6 WOULD INCLUDE THE EXCAVATION AND THERMAL TREATMENT OF SOURCE AREAS AND CONTAMINATED SOIL AREAS IN COMBINATION WITH THE GROUND WATER TREATMENT SYSTEM USING FILTRATION, POLYMER INJECTION AND SETTLING, AND CARBON ADSORPTION, AS PROPOSED IN SECTION 4.5 AND ORIGINALLY DESCRIBED IN SECTIONS 4.3 AND 4.4. THIS ALTERNATIVE WOULD ALSO INCLUDE THE INJECTION OF NUTRIENT-ENRICHED GROUND WATER AND ENGINEERED BIOLOGICAL ORGANISMS INTO SUBSURFACE DENSE NONAQUEOUS-PHASE LAYER AREAS TO ENHANCE BIOLOGICAL DEGRADATION.

A PILOT OR BENCH-SCALE STUDY WOULD BE PERFORMED TO DETERMINE THE PROPER NUTRIENTS AND THE PROPER AMOUNTS IN ORDER TO PROVIDE THE BEST DEGRADATION RATES. THE STUDY WOULD ALSO DETERMINE WHETHER AN ENGINEERED ORGANISM MAY PROVIDE A BETTER DEGRADATION RATE AND ENHANCE THE NATURAL BIOLOGICAL POPULATION.

AFTER THE STUDY IS COMPLETED, THE PROPER NUTRIENTS WOULD BE ADDED TO 75 PERCENT OF THE TREATED GROUND WATER AND REINJECTED INTO THE AQUIFER THROUGH AN INJECTION WELL. THE EXTRACTION SYSTEM WOULD PULL THE ENHANCED GROUND WATER THROUGH THE DENSE NONAQUEOUS-PHASE LAYER AREAS AND STIMULATE BIOLOGICAL DEGRADATION. A SINGLE INJECTION WELL WOULD BE USED DURING THE FIRST TWO YEARS, DURING WHICH TIME THE OPERATING CONDITIONS, EQUIPMENT DESIGN AND THE OVERALL EFFECTIVENESS OF THE SYSTEM CAN BE EVALUATED AND IMPROVED UPON. SOIL BORINGS WOULD BE DRILLED AND SAMPLED REGULARLY TO DETERMINE CONTAMINANT CHARACTERISTICS, MICROBIAL POPULATIONS AND NUTRIENT LEVELS. AFTER THE SECOND YEAR, TWO MORE INJECTION WELLS WOULD BE INSTALLED AND OPERATED.

ADDITIONAL GROUND WATER MONITORING WELLS WOULD BE INSTALLED AND SAMPLED IN CONJUNCTION WITH ALREADY EXISTING MONITORING WELLS TO CONFIRM THE EFFECTIVENESS OF THE ALTERNATIVE. THE SITE WOULD ALSO BE FENCED TO MINIMIZE ACCESS. GROUND WATER USE RESTRICTIONS WOULD BE IMPLEMENTED FOR ALL WELLS WITHIN THE CONTAMINANT PLUME.

THE EXCAVATION AND INCINERATION IS EXPECTED TO TAKE 4 TO 6 MONTHS. THE TIME ESTIMATED FOR WELL INSTALLATION, SYSTEM DEBUGGING, AND THE ESTABLISHMENT OF THE PLUME CONTAINMENT WOULD BE 13 TO 18 MONTHS. THE CONSTRUCTION, INCINERATION, EXCAVATION, AND EXTRACTION WELL INSTALLATION COSTS ARE ESTIMATED TO BE APPROXIMATELY \$1,053,000. CONTINUED MONITORING AND GROUND WATER EXTRACTION AND TREATMENT COSTS ARE ESTIMATED TO BE APPROXIMATELY \$4,762,000 FOR 30 YEARS OF O&M. THIS YIELDS A PRESENT WORTH OF \$5,815,000 FOR THIS ALTERNATIVE.

EXCAVATE AND INCINERATE SOURCE AREAS OFFSITE/EXCAVATE AND BIOLOGICALLY TREAT SOIL AREAS OFFSITE/PUMP-CONTAIN-TREAT GROUND WATER

ALTERNATIVE 7 WOULD INVOLVE THE EXCAVATION OF SOURCE AREAS, WHICH WOULD BE INCINERATED AS DESCRIBED IN SECTION 4.4. THE CONTAMINATED SOIL AREAS WOULD BE EXCAVATED AND REMEDIATED IN AN OFF-SITE LAND TREATMENT UNIT. SOIL AREAS ARE DEFINED AS NON-COAL TAR AREAS THAT CONTAIN CONTAMINANTS ABOVE THE 500 PPM TOTAL PAHS/100 PPM CARCINOGENIC PAHS LEVEL. THE GROUND WATER WOULD BE REMOVED AND TREATED AS DESCRIBED IN SECTION 4.3.

THE LAND TREATMENT UNIT WOULD CONSIST OF A BERMED AREA WHICH CAN BE CONTROLLED TO PROVIDE THE PROPER OPERATING CONDITIONS FOR THE BIOLOGICAL TREATMENT OF THE CONTAMINATED SOIL. A TREATABILITY TEST WOULD BE PERFORMED TO DETERMINE THE PROPER NUTRIENTS, AMOUNTS AND POSSIBLE ENGINEERED ORGANISMS TO ADD FOR ENHANCED DEGRADATION. THE SOIL WOULD BE IRRIGATED TO CONTROL THE MOISTURE LEVEL AND THE NUTRIENTS AND ORGANISMS WOULD BE ADDED AND THE SOIL TILLED WEEKLY TO PROVIDE A PROPER DISTRIBUTION. THE TREATMENT AREA WOULD BE SAMPLED MONTHLY TO DETERMINE PAH LEVELS AND NUTRIENT AND CONTROL LEVELS.

ADDITIONAL GROUND WATER MONITORING WELLS WOULD BE INSTALLED AND SAMPLED IN CONJUNCTION WITH ALREADY EXISTING MONITORING WELLS TO CONFIRM THE EFFECTIVENESS OF THE ALTERNATIVE. THE SITE WOULD ALSO BE FENCED TO MINIMIZE ACCESS. GROUND WATER USE RESTRICTIONS WOULD BE IMPLEMENTED FOR ALL WELLS WITHIN THE CONTAMINANT PLUME.

THE EXCAVATION AND INCINERATION OF THE SOURCE AREAS IS ESTIMATED TO TAKE 4 TO 6 MONTHS. THE EXCAVATION AND BIOLOGICAL TREATMENT OF THE SOIL AREAS IS ESTIMATED TO TAKE 12 TO 16 MONTHS. THE TIME ESTIMATED FOR WELL INSTALLATION, SYSTEM DEBUGGING, AND THE ESTABLISHMENT OF THE PLUME CONTAINMENT WOULD BE 13 TO 18 MONTHS. THE CONSTRUCTION, EXCAVATION, INCINERATION, BIOLOGICAL TREATMENT AND EXTRACTION WELL INSTALLATION COSTS ARE ESTIMATED TO BE APPROXIMATELY \$1,132,000. CONTINUED MONITORING AND GROUND WATER EXTRACTION AND TREATMENT COSTS ARE ESTIMATED TO BE APPROXIMATELY \$3,180,000 FOR 30 YEARS OF O&M. THIS YIELDS A PRESENT WORTH OF \$4,312,000 FOR THIS ALTERNATIVE.

EXCAVATE AND INCINERATE SOURCE AREAS OFFSITE/EXCAVATE AND BIOLOGICALLY TREAT SOIL AREAS OFFSITE/PUMP-CONTAIN-TREAT GROUND WATER WITH ENHANCED IN-SITU BIOREMEDIATION

ALTERNATIVE 8 WOULD INVOLVE THE EXCAVATION AND INCINERATION OF SOURCE AREAS AND THE EXCAVATION AND BIOLOGICAL REMEDIATION OF CONTAMINATED SOIL AREAS AS PROPOSED IN SECTION 4.7. THIS ALTERNATIVE WOULD ALSO INCLUDE THE GROUND WATER TREATMENT SYSTEM USING FILTRATION, POLYMER INJECTION AND SETTLING, AND CARBON ADSORPTION USED IN CONJUNCTION WITH THE SYSTEM DESCRIBED IN SECTION 4.6 WHICH INJECTS NUTRIENT-ENRICHED GROUND WATER AND ENGINEERED BIOLOGICAL ORGANISMS INTO SUBSURFACE DENSE NONAQUEOUS-PHASE LAYER AREAS TO ENHANCE BIOLOGICAL DEGRADATION.

ADDITIONAL GROUND WATER MONITORING WELLS WOULD BE INSTALLED AND SAMPLED IN CONJUNCTION WITH ALREADY EXISTING MONITORING WELLS TO CONFIRM THE EFFECTIVENESS OF THE ALTERNATIVE. THE SITE WOULD ALSO BE FENCED TO MINIMIZE ACCESS. GROUND WATER USE RESTRICTIONS WOULD BE IMPLEMENTED FOR ALL WELLS WITHIN THE CONTAMINANT PLUME.

THE EXCAVATION AND INCINERATION OF THE SOURCE AREAS IS ESTIMATED TO TAKE 4 TO 6 MONTHS. THE EXCAVATION AND BIOLOGICAL TREATMENT OF THE SOIL AREAS IS ESTIMATED TO TAKE 12 TO 16 MONTHS. THE TIME ESTIMATED FOR WELL INSTALLATION, SYSTEM DEBUGGING, AND THE ESTABLISHMENT OF THE PLUME CONTAINMENT WOULD BE 13 TO 18 MONTHS. THE CONSTRUCTION, EXCAVATION, INCINERATION, BIOLOGICAL TREATMENT AND EXTRACTION WELL INSTALLATION COSTS ARE ESTIMATED TO BE APPROXIMATELY \$1,282,000. CONTINUED MONITORING AND GROUND WATER EXTRACTION AND TREATMENT COSTS ARE ESTIMATED TO BE APPROXIMATELY \$4,828,000 FOR 30 YEARS OF O&M. THIS YIELDS A PRESENT WORTH OF \$6,110,000 FOR THIS ALTERNATIVE.

#SCAA

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

THE NCP HAS ESTABLISHED NINE CRITERIA THAT ARE USED TO EVALUATE REMEDIAL ALTERNATIVES. THESE CRITERIA SERVE AS THE BASIS FOR CONDUCTING DETAILED ANALYSES DURING THE FEASIBILITY STUDY AND SUBSEQUENTLY ARE USED TO DETERMINE THE APPROPRIATE REMEDY FOR THE SITE. APPENDIX B PROVIDES A GLOSSARY OF THE NINE CRITERIA.

A DETAILED ANALYSIS OF THE REMEDIAL ALTERNATIVES WAS PERFORMED, CONSISTING OF AN ASSESSMENT OF THE INDIVIDUAL ALTERNATIVES AGAINST EACH OF THE NINE CRITERIA AND A COMPARATIVE ANALYSIS THAT FOCUSED ON THE RELATIVE PERFORMANCE OF EACH ALTERNATIVE AGAINST THOSE CRITERIA. AS A RESULT OF THIS DETAILED ANALYSIS, EPA HAS DETERMINED THAT ALTERNATIVE 6 PROVIDES THE BEST BALANCE OF TRADE-OFFS AMONG THE ALTERNATIVES WITH RESPECT TO THE CRITERIA.

WHEN CONDUCTING THE ANALYSIS, THE NINE CRITERIA ARE ORGANIZED INTO THREE CATEGORIES. THE FIRST SUCH CATEGORY IS THRESHOLD CRITERIA. AN ALTERNATIVE MUST MEET THE FOLLOWING TWO REQUIREMENTS TO BE CONSIDERED AS A FINAL REMEDY FOR THE SITE:

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

THE SELECTED REMEDY WILL INVOLVE THE EXCAVATION AND INCINERATION OF THE SOURCE AREAS AND CONTAMINATED SOIL AREAS. THE DENSE NONAQUEOUS-PHASE LAYER AREAS WILL ALSO BE ADDRESSED BY THE IN-SITU BIOREMEDIATION METHOD AND GROUND WATER WILL BE CLEANED UP BY THE FILTRATION, POLYMER INJECTION AND SETTLING, AND CARBON ADSORPTION SYSTEMS. THIS WILL REDUCE EXPOSURE TO CONTAMINATED SOILS AND GROUND WATER TO PROTECTIVE LEVELS AND ALSO MINIMIZE THE POTENTIAL FOR CONTAMINANT MIGRATION.

THE NO-ACTION ALTERNATIVE WOULD NOT PROVIDE OVERALL PROTECTION TO HUMAN HEALTH AND THE ENVIRONMENT AND WAS NOT EVALUATED FURTHER BECAUSE THIS THRESHOLD CRITERIA WAS NOT MET. THE ALTERNATIVES INVOLVING INCINERATION, 4 - 8, WOULD PROVIDE THE PERMANENT ELIMINATION OF LONG-TERM RESIDUAL RISK. THE LONG-TERM RESIDUAL RISK WOULD ALSO BE ELIMINATED BY THE BIOLOGICAL TREATMENT TO HEALTH-BASED LEVELS OF THE CONTAMINATED SOIL IN ALTERNATIVES 7 AND 8. NEITHER ALTERNATIVE 2 OR 3 WOULD PERMANENTLY ELIMINATE RESIDUAL RISK IN SOIL. THE GROUND WATER TREATMENT ALTERNATIVES, 3 AND 5 - 8, WOULD PROVIDE THE OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT THAT ALTERNATIVES 2 AND 4 WOULD NOT.

COMPLIANCE WITH ARARS

THE SELECTED REMEDY WILL COMPLY WITH ALL FEDERAL AND STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS). APPLICABLE REQUIREMENTS ARE THOSE STATE OR FEDERAL REQUIREMENTS LEGALLY APPLICABLE TO THE RELEASE OR REMEDIAL ACTION CONTEMPLATED THAT SPECIFICALLY ADDRESS A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION, LOCATION, OR OTHER CIRCUMSTANCE FOUND AT THE SITE. IF IT IS DETERMINED THAT A REQUIREMENT IS NOT APPLICABLE, IT MAY STILL BE RELEVANT AND APPROPRIATE TO THE CIRCUMSTANCES OF THE RELEASE. REQUIREMENTS ARE RELEVANT AND APPROPRIATE IF THEY ADDRESS PROBLEMS OR SITUATIONS SUFFICIENTLY SIMILAR TO THE CIRCUMSTANCES OF THE RELEASE OR REMEDIAL ACTION CONTEMPLATED, AND ARE WELL-SUITED TO THE SITE. TABLE 13 LISTS THE ARARS FOR THIS SITE.

APPLICABLE CHEMICAL-SPECIFIC REQUIREMENTS ASSOCIATED WITH THIS REMEDY INCLUDE THE NATIONAL AMBIENT AIR QUALITY STANDARDS, PROMULGATED UNDER THE CLEAN AIR ACT (CAA). SINCE THE CONTAMINATED AQUIFER IS A PRESENT OR POTENTIAL SOURCE OF DRINKING WATER, THE MCLS FOR THIS SITE ARE RELEVANT AND APPROPRIATE AS CLEAN-UP STANDARDS AND MUST BE MET. ALSO IDENTIFIED AS APPLICABLE FOR THIS SITE ARE THE REQUIREMENTS SET FORTH IN THE IOWA ADMINISTRATIVE CODE CHAPTER 133 STANDARDS DISCUSSED IN SECTION 3.2.

THE HAZARDOUS WASTE REGULATIONS UNDER SUBTITLE C OF THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) MAY BE APPLICABLE TO WASTES AT THIS SITE AS A RESULT OF THE TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP) REGULATIONS, WHICH BECOME EFFECTIVE ON SEPTEMBER 25, 1990. IF THE COAL TAR SLUDGES AND SOILS CONTAMINATED THEREWITH EXCEED THE TC LEVELS, THE WASTES WOULD BE HAZARDOUS AS DEFINED BY 40 CFR PART 261, AND THE HAZARDOUS WASTE REGULATIONS WOULD BE APPLICABLE. FOR ON-SITE ACTIVITY, THE SUBSTANTIVE REQUIREMENTS OF RCRA PERTINENT TO THE REMEDIATION WITH RESPECT TO TREATMENT, STORAGE AND DISPOSAL WOULD HAVE TO BE SATISFIED. FOR OFF-SITE ACTIVITIES, SUBSTANTIVE AND ADMINISTRATIVE REQUIREMENTS FOR TRANSPORTATION, TREATMENT, STORAGE AND DISPOSAL OF HAZARDOUS WASTES WOULD HAVE TO BE COMPLIED WITH. IF THE COAL TAR SLUDGES AND/OR CONTAMINATED SOILS DO NOT EXCEED THE TC LEVELS, THE RCRA REQUIREMENTS WOULD BE CONSIDERED RELEVANT AND APPROPRIATE DUE TO THE HAZARDOUS NATURE OF THE COAL TARS. ACCORDINGLY, THE SUBSTANTIVE REQUIREMENTS OF RCRA WOULD HAVE TO BE MET.

THE POTENTIAL APPLICABILITY OF THE TCLP REGULATIONS DOES NOT REPRESENT A SIGNIFICANT CHANGE IN THE BASIC FEATURES OF THE PROPOSED REMEDY WITH RESPECT TO SCOPE, PERFORMANCE OR COST, AS THE PROPOSED PLAN CONTEMPLATED THAT THE SELECTED REMEDY WOULD HAVE TO COMPLY WITH THE SUBSTANTIVE REQUIREMENTS OF THE RCRA REGULATIONS REGARDLESS OF THE TCLP REGULATIONS. NO LOCATION-SPECIFIC ARARS WERE IDENTIFIED FOR THE SITE. THE FEDERAL ACTION-SPECIFIC ARARS THAT THE SELECTED REMEDY WILL HAVE TO COMPLY WITH ARE: ALL PERTINENT OCCUPATIONAL SAFETY AND

HEALTH ACT REQUIREMENTS AND ALL HAZARDOUS MATERIALS TRANSPORTATION ACT REGULATIONS; THE RCRA REGULATIONS FOUND IN 40 CFR PARTS 264 AND/OR 266 REGARDING INCINERATION; THE CLEAN WATER ACT REGULATIONS APPLICABLE TO DISCHARGE TO POTWS; AND THE CAA REQUIREMENTS APPLICABLE TO INCINERATORS. THE ACTION-SPECIFIC STATE ARARS INCLUDE THE IOWA ENVIRONMENTAL QUALITY ACT REGULATIONS; THE IOWA AIR POLLUTION CONTROL REGULATIONS, SECTIONS 22.4, 22.5, 23.1, AND 23.3; AND THE IOWA WATER POLLUTION CONTROL REGULATIONS, SECTIONS 62.1, 62.6, 62.8, 62.9 63, 64.2 AND 64.3.

ALTERNATIVES 2 AND 4, WHICH CALLED FOR GROUND WATER MONITORING RATHER THAN TREATMENT, WOULD REDUCE THE SPREAD OF CONTAMINANTS IN GROUND WATER AND PROVIDE SOME PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT AND THEREFORE WERE APPROPRIATE FOR CONSIDERATION TO THIS POINT. THESE ALTERNATIVES, HOWEVER, WOULD NOT MEET THE CHEMICAL-SPECIFIC ARARS ASSOCIATED WITH THIS SITE. THEREFORE, THESE TWO ALTERNATIVES WERE NOT CONSIDERED FURTHER BASED ON THEIR FAILURE TO MEET THE THRESHOLD CRITERIA.

ALL THE OTHER ALTERNATIVES WOULD MEET THE GROUND WATER CLEANUP STANDARDS PREVIOUSLY IDENTIFIED (HALS, NRLS AND MCLS). OTHER CHEMICAL-SPECIFIC ARARS WOULD BE MET FOR ALL OTHER ALTERNATIVES.

THE ACTION-SPECIFIC ARARS WOULD BE MET FOR ALL OTHER ALTERNATIVES CONSIDERED. THESE ARARS INCLUDE ALL OSHA REQUIREMENTS, ALL HAZARDOUS MATERIALS TRANSPORTATION ACT REGULATIONS, AND THE RCRA REQUIREMENTS PREVIOUSLY DISCUSSED.

THE SECOND CATEGORY OF CRITERIA IS PRIMARY BALANCING CRITERIA. THE FOLLOWING FIVE CRITERIA WERE USED TO EVALUATE THE ALTERNATIVES TO DETERMINE THE OPTION THAT PROVIDED THE BEST BALANCE OF TRADE-OFFS FOR THE FINAL REMEDY FOR THE SITE:

LONG-TERM EFFECTIVENESS AND PERMANENCE

THE INCINERATION OF THE SOURCE AREAS AND SOIL AND THE TREATMENT OF GROUND WATER IN ALTERNATIVE 6 WILL ELIMINATE THE LONG-TERM RISKS ASSOCIATED WITH DIRECT CONTACT AND POTENTIAL MIGRATION FROM THESE AREAS, THUS PROVIDING A PERMANENT SOLUTION. THE DENSE NONAQUEOUS-PHASE LAYER AREAS WILL ALSO BE ADDRESSED BY THIS ALTERNATIVE. THESE AREAS WILL CONTINUE TO LEACH CONTAMINANTS INTO THE ENVIRONMENT AND THE ENHANCED IN-SITU BIODEGRADATION PROCESS WILL REDUCE CONTAMINATION IN THESE AREAS, ADDING TO THE LONG-TERM EFFECTIVENESS OF THIS ALTERNATIVE.

THE OTHER ALTERNATIVES INVOLVING INCINERATION, 5, 7 AND 8, WOULD ELIMINATE THE RISKS ASSOCIATED WITH SOURCE AREAS AND 7 AND 8 WOULD PROVIDE A PERMANENT REMEDY FOR CONTAMINATED SOILS. THE RESIDUAL RISK ASSOCIATED WITH CONTAMINANTS IN GROUND WATER ABOVE HEALTH-BASED LEVELS WOULD BE ELIMINATED BY ALTERNATIVES 3, 5, 7 AND 8, HOWEVER LONG-TERM GROUND WATER MONITORING WOULD BE REQUIRED FOR ALL THESE ALTERNATIVES.

ALTERNATIVE 3 WOULD NOT PERMANENTLY ELIMINATE RESIDUAL RISK, REQUIRING LONG-TERM CONTROL MEASURES THROUGHOUT THE LIFE OF THE ALTERNATIVE.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

THE SELECTED REMEDY TREATS THE CONTAMINANT SOURCE AND SOIL AREAS AND THE GROUND WATER TO ACHIEVE REDUCTION OF TOXICITY, MOBILITY AND VOLUME OF CONTAMINANTS AT THE SITE. THE INCINERATION PROCESS PROVIDES PERMANENT TREATMENT, BUT WILL GENERATE ASH AS A RESIDUAL. THE GROUND WATER TREATMENT IS ALSO PERMANENT, BUT WILL GENERATE USED FILTERS, SETTLED FLOC, AND SPENT ACTIVATED CARBON. THESE WASTES WILL BE DISPOSED OF IN ACCORDANCE WITH RCRA. INCINERATION IN ACCORDANCE WITH RCRA WILL ACHIEVE A 99.99 PERCENT DESTRUCTION OF CONTAMINANTS. THE ENHANCED IN-SITU BIOREMEDIATION PROCESS WILL REDUCE THE TOXICITY, MOBILITY OR VOLUME OF THE DENSE NONAQUEOUS-PHASE LAYER AREAS. THIS WILL ALSO REDUCE THE VOLUME OF CONTAMINATED GROUND WATER THAT WILL EVENTUALLY NEED TO BE TREATED AT THE SITE, SINCE THESE NONAQUEOUS-PHASE AREAS WILL CONTINUE TO LEACH CONTAMINANTS INTO THE ENVIRONMENT AND THIS PROCESS WILL TREAT THESE AREAS.

THE OTHER ALTERNATIVES INVOLVING INCINERATION, 5, 7 AND 8, WOULD PROVIDE A REDUCTION IN THE TOXICITY, MOBILITY AND VOLUME, AS WOULD THE GROUND WATER TREATMENT ALTERNATIVES. ALTERNATIVES 7 AND 8 WOULD ALSO PROVIDE FOR THE PERMANENT REDUCTION OF THE TOXICITY, MOBILITY OR VOLUME OF THE CONTAMINANTS IN THE SOIL AREAS. ALTERNATIVE 8 WOULD PROVIDE FOR THE REDUCTION OF TOXICITY, MOBILITY OR VOLUME OF THE DENSE NONAQUEOUS-PHASE LAYER AREAS AS WILL ALTERNATIVE 6. ALTERNATIVE 3 WOULD REDUCE THE MOBILITY OF THE CONTAMINANTS, BUT WOULD NOT PROVIDE FOR A REDUCTION OF TOXICITY OR VOLUME OF SOURCE AND CONTAMINATED SOIL AREAS.

SHORT-TERM EFFECTIVENESS

THE SHORT-TERM RISKS ASSOCIATED WITH THE SELECTED REMEDY WILL INVOLVE THE NORMAL CONSTRUCTION HAZARDS ASSOCIATED WITH THE EXCAVATION OF SOURCE AND SOIL AREAS AND WITH THE CONSTRUCTION AND INSTALLATION OF WELLS. VOLATILE EMISSIONS MAY ALSO BE RELEASED DURING EXCAVATION AND MATERIALS HANDLING, AND DURING THE DRILLING AND SAMPLING OF WELLS. THIS ALTERNATIVE INVOLVES THE TRANSPORTATION OF WASTES AND WOULD HAVE SHORT-TERM RISKS ASSOCIATED WITH OFF-SITE TRANSPORT.

HOWEVER, ANY POTENTIAL FOR EXPOSURE CAN BE EFFECTIVELY MINIMIZED OR CONTROLLED BY COMPLIANCE WITH THE ACTION-SPECIFIC ARARS AND BY IMPLEMENTING ENGINEERING CONTROLS AT THE SITE, SUCH AS RESTRICTING ACCESS TO THE SITE, MONITORING FOR VOLATILE EMISSIONS, AND ADHERING TO A SITE-SPECIFIC SAFETY PLAN. IN CONFORMANCE WITH OSHA STANDARDS, ALL WORKERS WILL BE HEALTH-AND-SAFETY TRAINED, WEAR THE APPROPRIATE PROTECTIVE CLOTHING, AND PARTICIPATE IN A MEDICAL MONITORING PROGRAM.

THE SELECTED ALTERNATIVE WILL REQUIRE 4 TO 6 MONTHS TO COMPLETE THE REMOVAL AND TREATMENT OF SOURCE AREAS AND CONTAMINATED SOIL. THE TIME ESTIMATED FOR WELL INSTALLATION, SYSTEM DEBUGGING, AND THE ESTABLISHMENT OF THE PLUME CONTAINMENT IS 13 TO 18 MONTHS. THE TIME NECESSARY TO ACHIEVE A REDUCTION IN CONTAMINANT LEVELS TO THE HEALTH-BASED STANDARDS IS UNKNOWN. HOWEVER, THIS TIME WILL BE REDUCED BY IMPLEMENTATION OF THE IN-SITU BIOREMEDIATION SYSTEM, SINCE THE COAL TAR MIGRATION AREAS WILL BE LEFT UNADDRESSED WITHOUT THE PROCESS.

ALL OTHER ALTERNATIVES WOULD ALSO HAVE MINIMAL SHORT-TERM RISKS, AS DESCRIBED ABOVE. AS PREVIOUSLY NOTED, COMPLIANCE WITH THE ACTION-SPECIFIC ARARS WOULD EFFECTIVELY MINIMIZE AND CONTROL THE POTENTIAL FOR EXPOSURES.

THE OTHER ALTERNATIVES UTILIZING INCINERATION WOULD ALSO REQUIRE 4 TO 6 MONTHS TO COMPLETE THE REMOVAL AND TREATMENT OF SOURCE AREAS AND CONTAMINANT SOIL. THIS SAME AMOUNT OF TIME WOULD BE NECESSARY FOR THE CONSTRUCTION OF THE CAP IN ALTERNATIVE 3. ALL THE REMAINING ALTERNATIVES WOULD REQUIRE 13 TO 18 MONTHS FOR WELL INSTALLATION, SYSTEM DEBUGGING, AND THE ESTABLISHMENT OF THE PLUME CONTAINMENT. THE EXCAVATION AND BIOLOGICAL TREATMENT OF THE SOIL AREAS IS ESTIMATED TO TAKE 12 TO 16 MONTHS FOR ALTERNATIVES 7 AND 8.

IMPLEMENTABILITY

IMPLEMENTATION OF THE SELECTED REMEDY WILL INVOLVE CONVENTIONAL CONSTRUCTION TECHNOLOGIES. EXCAVATION, PUMPING, DECONTAMINATION, SIZING, AND GRADIENT CONTROL ARE FREQUENTLY USED TECHNOLOGIES THAT HAVE BEEN PROVEN TO BE EFFECTIVE. INCINERATION IS A PROVEN TECHNOLOGY FOR COAL TAR WASTES. THE FILTRATION, POLYMER INJECTION AND SETTLING, AND CARBON ADSORPTION SYSTEMS ARE FREQUENTLY USED PROCESSES AND HAVE SHOWN TO BE EFFECTIVE AT THE SITE. THIS PROCESS IS CURRENTLY BEING USED AT THE SITE SINCE IT WAS IMPLEMENTED AS THE GROUND WATER TREATMENT PROCESS REQUIRED TO CONTAIN THE PLUME AS AGREED UNDER THE ADMINISTRATIVE ORDER ON CONSENT BETWEEN EPA AND IELP. THE ENHANCED IN-SITU BIOREMEDIATION PROCESS HAS NOT BEEN EXTENSIVELY USED AT COAL GAS SITES AND THEREFORE WILL BE IMPLEMENTED IN A PHASED APPROACH WITH A PILOT STUDY.

THE OTHER ALTERNATIVES INVOLVING INCINERATION AND THE GROUND WATER TREATMENT SYSTEM WOULD HAVE THE SAME EASE IN IMPLEMENTABILITY. CAPPING IS ALSO A FREQUENTLY USED TECHNOLOGY. THE BIOREMEDIATION OF THE SOIL AREAS IN ALTERNATIVES 7 AND 8 HAS BEEN PREVIOUSLY DEMONSTRATED, BUT WILL REQUIRE LABORATORY AND FIELD STUDIES TO DEMONSTRATE ITS EFFECTIVENESS UNDER SITE CONDITIONS AND THE RATE AND EXTENT OF REMEDIATION EXPECTED FOR FULL-SCALE OPERATION. THIS

UNCERTAINTY IN IMPLEMENTABILITY MAKES ALTERNATIVES 7 AND 8 LESS ATTRACTIVE THAN ALTERNATIVES 5 OR 6.

COST

THE CONSTRUCTION COST OF THE SELECTED REMEDY IS ESTIMATED TO BE \$904,000, PLUS THE ESTIMATED ADDED CONSTRUCTION COSTS FOR THE ENHANCED IN-SITU BIOREMEDIATION PROCESS, \$149,000. THIS PROCESS SHOULD REDUCE THE AMOUNT OF TIME NECESSARY FOR TREATING THE CONTAMINATED GROUND WATER. IF THE PROCESS IS PROVEN TO BE EFFECTIVE AND FULLY IMPLEMENTED, THE ADDED OPERATION AND MAINTENANCE COSTS ARE ESTIMATED TO BE \$1,515,000, FOR A TOTAL O&M COST OF \$4,762,000 OVER 30 YEARS. THE PRESENT WORTH COST IS \$5,815,000 FOR 30 YEARS. THESE COSTS ARE LISTED IN TABLE 14.

THE RANGE OF TOTAL PRESENT WORTH COSTS FOR THE ALTERNATIVES IS \$3,550,000 FOR ALTERNATIVE 3 TO \$6,100,000 FOR ALTERNATIVE 8. THE COSTS FIGURES STATED IN THE ROD ARE ESTIMATES TAKEN FROM THE RI/FS PREPARED BY IELP. THE ESTIMATES PREPARED INVOLVE APPROXIMATIONS, ASSUMPTIONS, ESTIMATIONS, AND ENGINEERING JUDGMENT AND MAY BE SUBJECT TO ADJUSTMENT. THE FIGURES ARE BASED ON ESTIMATES OF THE VOLUME OF GROUND WATER AND SOIL TO BE TREATED AND COULD GREATLY VARY, DEPENDING UPON THE FULL DEFINITION OF THE EXTENT OF CONTAMINATION DETERMINED IN THE RD/RA. THE FIGURES ARE ALSO BASED ON OFF-SITE INCINERATION IN A COAL-FIRED UTILITY BOILER. THE ESTIMATES ARE SIGNIFICANTLY HIGHER WHEN BASED UPON OFF-SITE INCINERATION AT A RCRA FACILITY. TABLE 15 PROVIDES A COST SENSITIVITY ANALYSIS FOR ALL ALTERNATIVES.

THE SELECTED REMEDY IS COST-EFFECTIVE BECAUSE IT PROVIDES THE BEST LONG-TERM EFFECTIVENESS AND PERMANENCE, A REDUCTION IN TOXICITY, MOBILITY AND VOLUME, AND SHORT-TERM EFFECTIVENESS AT COSTS THAT ARE PROPORTIONAL TO ITS OVERALL EFFECTIVENESS.

THE THIRD CATEGORY OF CRITERIA IS MODIFYING CRITERIA. THE FOLLOWING TWO CRITERIA ARE CONSIDERED WHEN EVALUATING THE ALTERNATIVES AND ARE USED TO HELP DETERMINE THE FINAL REMEDY FOR THE SITE:

STATE ACCEPTANCE

THE STATE OF IOWA SUPPORTS THE REMEDY SELECTED FOR CLEANUP OF CONTAMINATED SOURCE AREAS, SOIL, AND GROUND WATER AT THE FAIRFIELD SITE.

COMMUNITY ACCEPTANCE

COMMUNITY ACCEPTANCE OF THE SELECTED REMEDY WAS EVALUATED DURING THE PUBLIC COMMENT PERIOD. AFTER MINOR MODIFICATIONS, BASED ON COMMENTS RECEIVED, THE REMEDY WAS SELECTED AS DESCRIBED IN THIS ROD. THE COMMENTS RECEIVED ARE CONTAINED IN THE RESPONSIVENESS SUMMARY, APPENDIX A.

#SR

SELECTED REMEDY

BASED ON THE DETAILED ANALYSIS CONDUCTED FOR EACH OF THE PROPOSED ALTERNATIVES, EPA HAS DETERMINED THAT THE APPROPRIATE REMEDY FOR THE FAIRFIELD SITE IS THE EXCAVATION AND INCINERATION OF THE SOURCE AREAS AND CONTAMINATED SOIL, USED IN COMBINATION WITH A FILTRATION, POLYMER INJECTION AND SETTLING, AND CARBON ADSORPTION PROCESS TO TREAT THE CONTAMINATED GROUND WATER, WITH ENHANCED IN-SITU BIOREMEDIATION. THIS ALTERNATIVE PROVIDES THE BEST BALANCE OF THE FACTORS IDENTIFIED BY THE NINE CRITERIA. A MAP SHOWING THE PHYSICAL LAYOUT OF THE ALTERNATIVE IS PROVIDED IN FIGURE 8.

THE RELIEF GAS HOLDER PIT WILL BE EXCAVATED TO 20 FEET, 8 FEET BELOW THE WATER TABLE. THE TAR SEPARATOR WILL BE EXCAVATED TO 12 FEET. THE HORIZONTAL EXTENT OF EXCAVATION WILL BE DETERMINED USING THE 500 TOTAL PAH/100 CARCINOGENIC PAH LEVEL. THE VERTICAL EXTENT OF EXCAVATION MAY ALSO BE ADJUSTED IN THE FIELD, BASED ON THIS LEVEL. EXCAVATED MATERIAL WILL BE SEPARATED ON THE SEPARATOR PAD, NOTED AS THE SEPARATOR AREA IN FIGURE 8. ALL MATERIAL GREATER THAN 2 INCHES IN DIAMETER WILL BE SHREDDED IN THE RUBBLE SHREDDER AREA. MATERIAL LESS THAN 2 INCHES IN DIAMETER WILL BE PLACED ON THE CONTAMINATED SOIL STORAGE AREA PAD,

ALONG WITH SOURCE TARS, BEFORE BEING TRANSPORTED TO THE INCINERATOR. THIS PAD WILL MEET THE SUBSTANTIVE REQUIREMENTS OF RCRA. ALL MATERIAL THAT CANNOT BE REDUCED TO A MANAGEABLE SIZE WILL BE STEAM-CLEANED AND SENT FOR DISPOSAL IN ACCORDANCE WITH RCRA. THE PROPER TRANSPORTATION REQUIREMENTS WILL BE MET AND THE TRUCKS WILL BE DECONTAMINATED.

WATER WILL BE PUMPED FROM THE GAS HOLDER PIT AND TREATED IN THE GROUND WATER TREATMENT SYSTEM. THE CAP WILL BE DEMOLISHED AND ALL DEBRIS WILL BE SIZED FOR INCINERATION. THE WALLS OF THE PIT WILL BE STEAM-CLEANED AND THEN THE PIT WILL BE FILLED WITH CLEAN FILL.

CHEMICAL DUST-SUPPRESSANTS AND/OR WATER WILL BE USED FOR DUST CONTROL DURING ACTIVITIES AT THE SITE. VOLATILE EMISSIONS WILL BE MONITORED DURING ALL OPERATIONS. BERMS WILL BE CONSTRUCTED AND GRADING PERFORMED TO CONTROL WATER RUN-ON AND RUN-OFF, AND SUMPS WILL COLLECT WATER FOR TREATMENT. CLEAN FILL WILL BE ADDED TO EXCAVATED AREAS.

THE SEPARATOR PAD, SIZING PAD, AND STORAGE PAD WILL ALL BE 4 INCH CONCRETE PAVED PADS WITH BERMS. MATERIALS WILL BE COVERED WITH 60-MILE HPDE LINERS.

MONITORING WELLS WILL BE INSTALLED WEST, SOUTH AND SOUTHEAST OF THE SITE TO CONFIRM THE RESULTS OF THE GROUND WATER MODELING. EXTRACTION WELLS WILL BE INSTALLED FOR THE REMOVAL OF GROUND WATER AND SUBSEQUENT TREATMENT. THE GOAL OF THE TREATMENT PROCESS WILL BE 1 PPB BENZENE, WHICH CORRESPONDS TO THE (10-6) RISK LEVEL. THE PROCESS WILL ALSO MEET THE GROUND WATER REMEDIATION LEVELS LISTED IN TABLE 12, WHICH INCLUDES THE CURRENT DETECTION LIMITS FOR CARCINOGENIC PAHS. IF, IN EPA'S JUDGMENT, IMPLEMENTATION OF THE SELECTED GROUND WATER REMEDY CLEARLY DEMONSTRATES THAT IT WILL BE TECHNICALLY IMPRACTICABLE TO ACHIEVE AND MAINTAIN THE GROUND WATER REMEDIATION LEVELS ESTABLISHED IN THIS ROD, EPA WILL RE-EVALUATE THOSE LEVELS. FOR EXAMPLE, THE CLEANUP LEVELS FOR GROUND WATER MAY BE RE-EVALUATED IF IT HAS BEEN DEMONSTRATED THAT CONTAMINANT LEVELS HAVE CEASED TO DECLINE OVER TIME AND ARE REMAINING CONSTANT AT SOME STATISTICALLY SIGNIFICANT LEVEL ABOVE REMEDIATION GOALS. IN SUCH A CASE, AN ALTERNATE CONCENTRATION LEVEL MAY BE ESTABLISHED AND/OR A CHEMICAL-SPECIFIC ARAR WAIVER MAY BE INVOKED. ANY NEWLY ESTABLISHED REMEDIATION LEVELS MUST BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. THE ROD WILL BE AMENDED OR AN EXPLANATION OF SIGNIFICANT DIFFERENCES WILL BE ISSUED TO INFORM THE PUBLIC OF THE DETAILS IF SUCH ACTIONS OCCUR.

THE WATER WILL BE TREATED USING FILTRATION, POLYMER INJECTION AND SETTLING, AND CARBON ADSORPTION SYSTEMS. THE WATER WILL BE PUMPED INTO THE OPERATIONS BUILDING AT A RATE OF 20 GALLONS PER MINUTE. THE WATER WILL FIRST BE FILTERED TO REMOVE ANY OIL. THIS STEP MAY NOT BE USED IF THE WATER IS DETERMINED TO BE FREE OF OIL POLLUTANTS. THE FILTRATION UNIT WILL CONSIST OF FELT-LINED CYLINDERS AND BAG FILTERS. THE BAGS WILL BE CHANGED AS NECESSARY. THE WATER WILL THEN ENTER A CLARIFIER WHERE A POLYMER IS INJECTED TO PROMOTE SETTLING OF CONTAMINANTS. THE SLUDGE THAT SETTLES OUT WILL BE PERIODICALLY PUMPED TO A FILTER PRESS AND THEN DISPOSED OF IN ACCORDANCE WITH RCRA. THE SUPERNATANT WILL BE THEN TREATED IN ACTIVATED CARBON VESSELS. THE ESTIMATED CHANGEOUT PER VESSEL IS SIX MONTHS. THE SYSTEM WILL BE PLACED OFF OF ONE VESSEL ONTO ANOTHER DURING CHANGEOUT SO THAT NO CONTAMINANT GETS THROUGH. THE CLEAN WATER WILL BE THEN DISCHARGED TO THE SEWER FOR DISPOSAL IN THE POTW, OR USED IN THE IN-SITU GROUND WATER TREATMENT PROCESS. THE WHOLE SYSTEM WILL BE MONITORED DAILY TO CONTROL ANY VOLATILIZATIONS. THE DISCHARGE WILL BE SAMPLED QUARTERLY TO ENSURE THAT THE WATER IS BELOW THE PRETREATMENT AGREEMENT LIMITS ESTABLISHED BY THE CITY OF FAIRFIELD FOR ITS POTW. IF PROBLEMS DEVELOP IN THE SYSTEM SUCH THAT THE PRETREATMENT LIMITS ARE NOT MET, THE SYSTEM WILL BE EVALUATED AND CHANGED TO MEET THE LEVELS. THE SYSTEM WILL CONFORM TO THE SUBSTANTIVE REQUIREMENTS THAT APPLY TO TANK REGULATIONS UNDER RCRA.

THE IN-SITU BIOREMEDIATION PROCESS WILL BEGIN WITH A PILOT STUDY TO DETERMINE THE PROPER TYPES AND AMOUNTS OF NUTRIENTS AND POSSIBLE ENGINEERED ORGANISMS TO INJECT INTO THE AQUIFER FOR STIMULATING NATURAL BIOLOGICAL DEGRADATION. THE NUTRIENTS, DISSOLVED OXYGEN, AND ORGANISMS WILL BE ADDED TO TREATED GROUND WATER AND REINJECTED INTO THE AQUIFER USING INJECTION WELLS. INJECTION WELL PLACEMENT WILL BE DONE THROUGH A TRACER STUDY AND GROUND WATER MODELING. THE SYSTEM WILL USE ONE WELL FOR THE FIRST TWO YEARS, DURING WHICH THE PROCESS WILL BE EVALUATED TO DETERMINE THE OPERATING CONDITIONS AND EQUIPMENT DESIGN. SOIL BORINGS WILL BE DRILLED TO SAMPLE THE TREATED AREAS. IF THE SYSTEM IS SHOWN TO BE EFFECTIVE, IT WILL BE FULLY IMPLEMENTED USING TWO MORE INJECTION WELLS.

THE SITE WILL BE FENCED AND GROUND WATER AND LAND-USE RESTRICTIONS WILL BE IMPLEMENTED TO PREVENT ACTIVITIES WHICH WOULD PROVIDE CONTACT WITH CONTAMINANTS. INITIALLY, WELL-MONITORING WILL BE PERFORMED BIMONTHLY AFTER THE REMEDY IS IMPLEMENTED. AFTER THE FIRST YEAR, MONITORING WILL BE PERFORMED QUARTERLY FOR 5 YEARS, THEN BIANNUALLY FOR THE NEXT THIRTY YEARS, TO ENSURE THAT THE REMEDY WAS SUCCESSFUL.

TABLE 14 LISTS THE CAPITAL COSTS FOR EACH COMPONENT OF THE SELECTED REMEDY. THE TOTAL CONSTRUCTION COSTS ARE ESTIMATED TO BE \$1,053,000 AND THE TOTAL OPERATIONS AND MAINTENANCE COSTS ARE ESTIMATED TO BE \$4,762,000, GIVING A TOTAL PRESENT WORTH OF \$5,815,000.

CHANGES MAY BE MADE TO THE SELECTED REMEDY DURING REMEDIAL DESIGN WORK AND THE PROCESSES OF CONSTRUCTION.

STATUTORY DETERMINATIONS

THE SELECTED REMEDY SATISFIES THE STATUTORY REQUIREMENTS OF SECTION 121 OF CERCLA, 42 USC 9721, AS FOLLOWS:

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

THE SELECTED REMEDY WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT BY PROVIDING FOR THE PERMANENT DESTRUCTION OF THE SOURCE AND CONTAMINATED SOIL AREAS. THESE AREAS WILL BE EXCAVATED TO A LEVEL PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT THAT CORRESPONDS TO THE (10-4) RISK LEVEL. PROPER INSTITUTIONAL CONTROLS WILL BE TAKEN AT THE SITE, INCLUDING SITE FENCING, GROUND WATER USE RESTRICTIONS AND LAND USE RESTRICTIONS.

THE GROUND WATER WILL BE TREATED UNTIL THE OFF-SITE CONTAMINANTS ARE BELOW HEALTH-BASED STANDARDS, PROVIDING PROTECTION TO THE (10-6) RISK LEVEL FOR BENZENE AND THE (10-4) RISK LEVEL FOR CARCINOGENIC PAHS. THE ENHANCED IN-SITU BIOREMEDIATION PROCESS WILL ADDRESS THE CONTAMINATED DENSE NONAQUEOUS-PHASE LAYERS IN THE SUBSURFACE AND DETERMINE IF THESE AREAS CAN BE EFFECTIVELY TREATED.

THE SELECTED REMEDY WILL PROVIDE MAXIMIZED LONG-TERM EFFECTIVENESS AND WILL REDUCE THE TOXICITY, MOBILITY AND VOLUME OF WASTES TO THE GREATEST EXTENT PRACTICABLE. THE SELECTED ALTERNATIVE WILL ALSO HAVE MINIMAL SHORT-TERM RISKS AND THE PROPER CONTROLS WILL BE TAKEN TO MINIMIZE THESE RISKS.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

THE SELECTED REMEDY COMPLIES WITH ALL ARARS ASSOCIATED WITH THIS SITE. ALL CHEMICAL-SPECIFIC ARARS WILL BE MET, INCLUDING CAA, RCRA AND THE IOWA ADMINISTRATIVE CODE CHAPTER 133, WHICH REQUIRES ONE OF THREE STANDARDS, MCLS, HALS OR NRLS. ALL ACTION-SPECIFIC ARARS, INCLUDING ALL OSHA, RCRA, AND DOT REQUIREMENTS, WILL ALSO BE MET. NO LOCATION-SPECIFIC ARARS WERE IDENTIFIED AT THIS SITE.

COST-EFFECTIVENESS

THE OVERALL EFFECTIVENESS OF THE SELECTED REMEDY IS PROPORTIONAL TO ITS ESTIMATED COST. THE SOIL EXCAVATION AND INCINERATION AND THE GROUND WATER TREATMENT PROCESS ARE NECESSARY TO PROVIDE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. THE ADDED COST FOR THE PILOT STUDY AND THE ENHANCED IN-SITU BIOREMEDIATION INJECTION WELL ARE REASONABLE WHEN CONSIDERING THE ADDED PROTECTION THAT WILL BE PROVIDED FOR HUMAN HEALTH AND THE ENVIRONMENT IN ADDRESSING THE CONTAMINANTS. THERE WOULD BE A REDUCTION IN THE TIME NEEDED FOR TREATMENT OF THE AQUIFER, RESULTING IN A DECREASED COST.

UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

THE SELECTED REMEDY UTILIZES PROVEN TECHNOLOGIES IN INCINERATION AND THE GROUND WATER TREATMENT SYSTEM THAT CAN BE EFFECTIVELY IMPLEMENTED. THESE PROCESSES PROVIDE THE BEST

SOLUTIONS IN ADDRESSING THE CONTAMINANTS AT THE SITE. THE ENHANCED IN-SITU BIOREMEDIATION PROCESS WILL PROVIDE TREATMENT FOR THE DENSE NONAQUEOUS-PHASE LAYERS WHICH WOULD OTHERWISE HAVE TO BE LEFT UNATTENDED AND THEREFORE SIGNIFICANTLY ADD TO THE TIME REQUIRED FOR TREATING THE GROUND WATER. THEREFORE THIS REMEDY PROVIDES TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE AT THIS SITE.

THE SELECTED REMEDY PERMANENTLY DESTROYS THE CONTAMINATED SOIL AND SOURCE AREAS AND TREATS THE OFF-SITE GROUND WATER TO BELOW HEALTH-BASED STANDARDS, PROVIDING FOR LONG-TERM EFFECTIVENESS AND PERMANENCE. ALTERNATIVES 2, 3 AND 4 DO NOT PERMANENTLY ELIMINATE RISKS AT THE SITE. ALL OTHER ALTERNATIVES PROVIDE PERMANENT PROTECTION.

THE SELECTED REMEDY PROVIDES MAXIMUM REDUCTION OF TOXICITY, MOBILITY AND VOLUME. THE OTHER ALTERNATIVES INVOLVING INCINERATION, 4, 5, 7 AND 8, ALSO PROVIDE FOR THE REDUCTION OF TOXICITY, MOBILITY OR VOLUME, HOWEVER ALTERNATIVES 2 AND 4 WOULD NOT TREAT THE CONTAMINATED GROUND WATER. ALTERNATIVE 3 WOULD NOT TREAT THE SOURCE AND SOIL AREAS. ONLY ALTERNATIVE 8 AND THE SELECTED REMEDY ADDRESS THE REDUCTION OF TOXICITY AND VOLUME OF THE DENSE NONAQUEOUS-PHASE AREAS.

THE SHORT-TERM RISKS ASSOCIATED WITH THE SELECTED REMEDY ARE MINIMAL AND WILL BE ATTENDED TO WITH THE PROPER CONTROLS AT THE SITE. THE SAME GENERAL SHORT-TERM RISKS APPLY TO ALL ALTERNATIVES, HOWEVER THE ALTERNATIVES UTILIZING EXCAVATION AND TRANSPORT OF WASTE INVOLVE MORE SHORT-TERM RISKS. HOWEVER THESE RISKS WILL BE MINIMIZED THROUGH COMPLIANCE WITH ARARS.

THE SELECTED REMEDY UTILIZES PROVEN AND IMPLEMENTABLE TECHNOLOGIES IN EXCAVATION, INCINERATION AND GROUND WATER TREATMENT. THE ALTERNATIVE PORTIONS EMPLOYING CAPS ARE ALSO PROVEN AND IMPLEMENTABLE, BUT LESS PROTECTIVE. THE IN-SITU BIOLOGICAL ALTERNATIVE PORTIONS PROVIDE ADDED REDUCTION IN THE TOXICITY, MOBILITY, AND VOLUME AT A REASONABLE COST. THE LANDFARMING BIOLOGICAL ALTERNATIVE PORTIONS WILL REQUIRE FURTHER STUDY TO DETERMINE IF THEY ARE FULLY IMPLEMENTABLE AT THE SITE.

IN ORDER TO SATISFY THE PREFERENCE FOR A PERMANENT SOLUTION, ALTERNATIVES 2, 3, AND 4 WERE ELIMINATED. ALTERNATIVES 7 AND 8 WOULD BE PRACTICABLE ALTERNATIVES IF THE VOLUME OF CONTAMINATED SOIL WAS DETERMINED TO BE VERY LARGE, BECAUSE THE BIOLOGICAL TREATMENT OF THESE SOILS WOULD BE COST-EFFECTIVE ONLY IF A LARGE VOLUME WAS TREATED. OF THE ALTERNATIVES THAT REMAIN, ONLY ALTERNATIVE 6, THE SELECTED REMEDY, PROVIDES THE TREATMENT OF THE DENSE NONAQUEOUS-PHASE AREAS, WHICH WILL ULTIMATELY REDUCE THE VOLUME AND TOXICITY OF CONTAMINANTS IN THESE AREAS. THIS, IN TURN, WILL REDUCE THE TIME NECESSARY FOR TREATING THE CONTAMINATED GROUND WATER, MAKING IT MORE COST-EFFECTIVE THAN ALTERNATIVE 5. FOR THESE REASONS, ALTERNATIVE 6 PROVIDES THE BEST BALANCE OF TRADE-OFFS WITH RESPECT TO THESE CRITERIA.

PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

THE SELECTED REMEDY INVOLVES TREATMENT OF THE CONTAMINATED SOIL AND SOURCE AREAS BY INCINERATION. THE GROUND WATER IS TREATED BY FILTRATION, POLYMER INJECTION AND SETTLING, AND CARBON ADSORPTION. THE DENSE NONAQUEOUS-PHASE AREAS WILL ALSO BE TREATED BY THE IN-SITU ENHANCED GROUND WATER BIOREMEDIATION PROCESS. THEREFORE, THE STATUTORY PREFERENCE FOR REMEDIES THAT EMPLOY TREATMENT AS A PRINCIPAL ELEMENT IS SATISFIED.

DOCUMENTATION OF SIGNIFICANT CHANGES

NO SIGNIFICANT CHANGES WERE MADE IN SELECTING THE PREFERRED ALTERNATIVE AS DESCRIBED IN THE PROPOSED PLAN.

#RS

RESPONSIVENESS SUMMARY

OVERVIEW

EPA RECOMMENDED A REMEDY WHICH ADDRESSED THE CONTAMINATION AT THE FAIRFIELD SITE AND MADE THIS REMEDY AVAILABLE TO THE PUBLIC FOR COMMENT. ALL COMMENTS RECEIVED FROM THE PUBLIC ARE CONSIDERED WHEN EPA SELECTS THE REMEDY TO BE IMPLEMENTED DURING THE RA. THIS DOCUMENT SUMMARIZES THE COMMENTS RECEIVED REGARDING THE PROPOSED ALTERNATIVE AND DESCRIBES HOW THESE COMMENTS WERE CONSIDERED AND INCORPORATED INTO THE FINAL SELECTION OF THE REMEDY AT THE SITE.

THE PREFERRED ALTERNATIVE THAT EPA RECOMMENDED TO THE PUBLIC FOR IMPLEMENTATION AT THE FAIRFIELD SITE WAS THE EXCAVATION AND OFF-SITE INCINERATION OF THE SOURCE AND CONTAMINATED SOIL AREAS. THIS WAS PROPOSED TO BE PERFORMED IN CONJUNCTION WITH THE EXTRACTION AND TREATMENT OF CONTAMINATED GROUND WATER USING FILTRATION, POLYMER INJECTION AND SETTLING, AND CARBON ADSORPTION SYSTEMS AND ENHANCED IN-SITU BIOREMEDIATION OF THE COAL TAR MIGRATION AREAS. SEVERAL QUESTIONS ABOUT THE SITE WERE ASKED AT THE PUBLIC MEETING. THE ONLY WRITTEN COMMENTS RECEIVED WERE FROM THE OWNER AND OPERATOR OF THE SITE, IELP.

BACKGROUND ON COMMUNITY INVOLVEMENT

THE PRESENCE OF COAL TAR AT THE SITE WAS FIRST BROUGHT TO THE ATTENTION OF THE COMMUNITY IN FAIRFIELD IN MAY, 1985 WHEN NEWSPAPER ACCOUNTS DESCRIBED THE INVESTIGATION PERFORMED BY IELP. THE FAIRFIELD SITE WAS ALSO IN THE LOCAL NEWSPAPERS IN JUNE, 1988 WHEN THE SITE WAS PROPOSED FOR THE NPL. IN APRIL, 1989 IELP CONDUCTED COMMUNITY INTERVIEWS AS A PART OF THE FS. EPA ALSO CONDUCTED COMMUNITY INTERVIEWS IN MARCH, 1990, DURING WHICH THE COMMUNITY WAS INFORMED OF FUTURE SITE ACTIVITIES, INCLUDING THE PUBLIC COMMENT PROCESS.

EPA DISTRIBUTED FACT SHEETS THAT PROVIDED BACKGROUND INFORMATION ON THE FAIRFIELD SITE DURING THE PUBLIC MEETING. THE ADMINISTRATIVE RECORD, WHICH INCLUDED THE RI/FS REPORT AND THE PROPOSED PLAN, WAS MADE AVAILABLE TO THE PUBLIC AT THE FAIRFIELD PUBLIC LIBRARY AND AT THE EPA REGION VII OFFICE IN KANSAS CITY, KANSAS IN JULY, 1990.

THE NOTICE OF AVAILABILITY OF SITE-RELATED DOCUMENTS AND THE ANNOUNCEMENT OF THE PUBLIC COMMENT PERIOD AND THE PUBLIC MEETING WERE PUBLISHED IN THE FAIRFIELD COUNTY LEDGER IN JULY, 1990. THE PUBLIC COMMENT PERIOD WAS HELD FROM JULY 17 TO AUGUST 15, 1990. THE PUBLIC MEETING WAS HELD IN FAIRFIELD ON JULY 26, 1990. EPA, IN COORDINATION WITH IDNR, THE IOWA DEPARTMENT OF PUBLIC HEALTH, AND ATSDR, MET WITH REPRESENTATIVES FROM IELP AND THE PUBLIC AND ANSWERED QUESTIONS FROM THE PUBLIC RELATED TO THE SITE.

SUMMARY OF PUBLIC COMMENTS AND LEAD AGENCY RESPONSE

THIS RESPONSIVENESS SUMMARY ADDRESSES THE ORAL AND WRITTEN COMMENTS RECEIVED BY EPA CONCERNING THE ALTERNATIVE PREFERRED BY EPA WHICH WAS PRESENTED IN THE PROPOSED PLAN, AND HAS NOW BEEN SELECTED FOR IMPLEMENTATION IN THE ROD. THESE COMMENTS WERE SUBMITTED DURING THE PUBLIC COMMENT PERIOD AND/OR THE PUBLIC MEETING.

A COMMENT LETTER WAS SUBMITTED BY THE RESPONSIBLE PARTY FOR THE SITE, IELP. THIS COMMENT LETTER CONTAINED THE ONLY WRITTEN COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD. IELP'S COMMENTS ARE SUMMARIZED AS FOLLOWS, WITH EPA'S RESPONSE AFTER EACH INDIVIDUAL COMMENT.

1. IELP COMMENTS THAT MCLS ARE RELEVANT AND APPROPRIATE AT THE SITE, BUT NOT APPLICABLE. THEY BASE THIS ON THE FACT THAT GROUND WATER FROM THE WATER BEARING UNITS IN THE SITE AREA IS NOT CURRENTLY BEING USED AS A DOMESTIC WATER SUPPLY AND THE HYDROGEOLOGICAL CONDITIONS MAKE IT TECHNICALLY INFEASIBLE FOR GROUND WATER FROM THESE UNITS TO BE USED AS A WATER SUPPLY SOURCE.

EPA'S RESPONSE: EPA DISAGREES WITH IELP'S STATEMENT THAT THE HYDROGEOLOGICAL CONDITIONS MAKE IT TECHNICALLY INFEASIBLE FOR GROUND WATER FROM THESE UNITS TO BE USED AS A WATER SUPPLY SOURCE. WELLS IN THIS AREA HAVE BEEN USED IN THE PAST AND ARE CURRENTLY BEING USED FOR YARD

AND GARDEN WATERING PURPOSES. A DOWNGRADIENT RESIDENT COULD AT ANY TIME PLACE A WELL WHICH WOULD DRAW GROUND WATER AND USE THIS WELL FOR A DRINKING WATER SOURCE. EPA AGREES THAT MCLS ARE RELEVANT AND APPROPRIATE AS AQUIFER CLEANUP STANDARDS ON THE FEDERAL LEVEL. HOWEVER, THE STATE OF IOWA HAS ADOPTED THE MCLS INTO IOWA CHAPTER 133, AND THIS LAW IS APPLICABLE AT THE SITE.

2. IELP COMMENTS THAT IOWA CHAPTER 133 IS APPLICABLE TO THE CLEANUP OF THE GROUND WATER AT THE SITE, BUT IT DOES NOT BELIEVE THAT IT IS FEASIBLE OR PRACTICAL TO REMOVE ALL CONTAMINANTS TO THE CHAPTER 133 GOALS, BASED ON THE HYDROGEOLOGICAL CONDITIONS AT THE SITE, THE PHYSICAL CHARACTERISTICS OF THE DENSE NONAQUEOUS-PHASE LIQUIDS AND THE CHEMICAL CHARACTERISTICS OF THE PAHS. SPECIFICALLY, IELP FEELS THAT THE 1 PPB FOR BENZENE AND 0.0023 PPB FOR BENZO(A)PYRENE CANNOT BE PRACTICALLY ATTAINED. THEY ALSO STATE THAT THE 0.0023 PPB DETECTION LIMIT FOR BENZO(A)PYRENE IS UNATTAINABLE.

EPA'S RESPONSE: AS STATED IN THE ROD, THE PERFORMANCE STANDARDS WILL BE RE-EVALUATED IF EPA DETERMINES THAT IT IS TECHNICALLY IMPRACTICABLE TO ACHIEVE AND MAINTAIN THEM. IF THE REMEDIAL GOALS CANNOT BE REACHED, EPA MAY ESTABLISH AN ALTERNATE CONCENTRATION LEVEL AND/OR INVOKE A CHEMICAL-SPECIFIC ARAR WAIVER BASED ON TECHNICAL IMPRACTICABILITY. ANY NEWLY ESTABLISHED LEVEL MUST BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. THE PROPOSED PLAN INCORRECTLY STATED THE DETECTION LIMIT FOR BENZO(A)PYRENE AS 0.0023 PPB; THE CORRECT VALUE IS 0.023 PPB. THIS LEVEL IS ATTAINABLE ONLY UNDER IDEAL, CONTROLLED LABORATORY CONDITIONS. THE PRACTICAL DETECTION LIMIT FOR BENZO(A)PYRENE THAT IS STATED AS THE STANDARD TO BE ATTAINED IN THE ROD IS 0.2 PPB. THE REMEDIATION LEVELS/DETECTION LIMITS FOR GROUND WATER ARE LISTED IN TABLE 12.

3. IELP NOTED A MISTAKE IN THE PROPOSED PLAN; THE CARCINOGENIC RISK TO CURRENT RESIDENTS IS 4 X (10⁻⁶) RATHER THAN 4 X (10⁻⁴).

EPA'S RESPONSE: THIS CORRECTION HAS BEEN NOTED AND THE ROD REFLECTS THE CHANGE.

4. IELP COMMENTS THAT THE FS STATES THAT THE FIRST INJECTION WELL WOULD OPERATE FOR A MINIMUM OF TWO YEARS PRIOR TO THE INSTALLATION OF ANY ADDITIONAL INJECTION WELLS. TWO YEARS WOULD GIVE MORE TIME TO DEFINE THE MICROBIAL POPULATIONS AND NUTRIENT LEVELS, CONTAMINATE DEGRADATION AND THE EFFECTIVENESS OF THE IN-SITU BIOREMEDIATION.

EPA'S RESPONSE: THE PROPOSED PLAN INDICATED THAT A SINGLE YEAR WOULD BE USED TO STUDY THE INJECTION WELL AND THE EFFECTIVENESS OF THE IN-SITU BIOREMEDIATION SYSTEM. EPA AGREES THAT TWO YEARS WOULD BE MORE BENEFICIAL THAN A SINGLE YEAR FOR STUDYING THE PROCESS AND HAS REFLECTED THIS CHANGE IN THE ROD.

5. IELP COMMENTS THAT FILTRATION IS NOT NORMALLY REQUIRED, BUT WAS USED AS A TEMPORARY MEASURE TO TREAT WATER PUMPED FROM THE SOURCE AREAS DURING THE INTERIM (PRE-RI/FS) GROUND WATER TREATMENT SYSTEM, REQUIRED UNDER THE ADMINISTRATIVE ORDER ON CONSENT TO RETARD THE SPREAD OF THE CONTAMINANT PLUME.

EPA'S RESPONSE: FILTRATION WAS USED TO REMOVE OIL FROM THE GROUND WATER AS AN INITIAL MEASURE OF THE TREATMENT PROCESS. AS STATED IN THE ROD, THIS STEP MAY NOT BE USED IF THE WATER IS DETERMINED TO BE FREE OF OIL POLLUTANTS.

DURING THE PUBLIC MEETING, THE COMMUNITY ASKED QUESTIONS ABOUT THE SITE AND THE REMEDY PROPOSED. THESE QUESTIONS WERE FULLY ANSWERED DURING THE PUBLIC MEETING, AND A TRANSCRIPT OF THE MEETING IS AVAILABLE IN THE ADMINISTRATIVE RECORD. NO COMMENTS WERE RECEIVED WHICH PERTAINED TO THE SELECTION OF THE PROPOSED REMEDY OR OTHER REMEDIES.

TABLE 1
SUMMARY OF MAXIMUM CONTAMINANT CONCENTRATIONS
FOR SOURCE AREAS

COMPOUNDS OF CONCERN	SOURCE AREAS		
	GAS HOLDER	PIT	TAR SEPARATOR
	SEDIMENT (PPM)	SURFACE WATER (PPB)	SOIL (PPM)
TOTAL CARCINOGENIC PAHS	22400	2140	1406
TOTAL PAHS	248300	39780	6604
BETX	131000	930	6.89
ARSENIC	8.9	61	5.2
BERIUM	79	1500	170
CADMIUM	4.6	98.2	
CHROMIUM	84	72	35
LEAD	1900	1900	12
MERCURY	1.8	34	
SELENIUM	16	69	
CYANIDE	310	29000	

COMPOUNDS OF CONCERN	SOURCE AREAS	
	RELIEF	GAS HOLDER
	SOIL (PPM)	GROUNDWATER (PPB)
TOTAL CARCINOGENIC PAHS	12.1	475
TOTAL PAHS	79	7501
BETX	1413	101200
ARSENIC	9.8	
BERIUM	360	
CADMIUM	2.9	75.3
CHROMIUM	11	369
LEAD	89	7710
MERCURY		
SELENIUM		
CYANIDE	63	1870

NOTE: BLANK SPACES INDICATE THAT THE ANALYTE WAS UNDETECTED OR DETECTED
 BELOW THE CRDL FOR THAT SAMPLE

TABLE 5
CHEMICALS DETECTED IN SOURCE-RELATED GROUNDWATER SAMPLES

CHEMICAL	FREQUENCY OF DETECTION (A)	RANGE OF DETECTION LIMITS, UG/L
SEMI-VOLATILES		
2,4-DIMETHYLPHENOL	1/3	10
2-METHYLPHENOL	2/3	10
4-METHYLPHENOL	2/3	10
DIBENZOFURAN	3/3	--
PHENOL	2/3	10
VOLATILES		
ACETONE	1/3	100 - 5,000
CHLOROFORM	1/3	34 - 2,500
METHYLENE CHLORIDE	1/3	50 - 2,500
STYRENE	3/3	--
BETX		
BENZENE	5/9	5.0 - 8.0
ETHYLBENZENE	4/9	5.0
TOLUENE	4/9	5.0 - 34
XYLENE	4/9	5.0 - 5,000
PAH		
ACENAPHTHENE	4/9	0.02
ACENAPHTHYLENE	4/9	0.02 - 0.05
ANTHRACENE	4/9	0.02
BENZO(A)ANTHRACENE	2/9	0.02 - 0.26
BENZO(A)PYRENE	2/9	0.02 - 0.16
BENZO(A)FLUORANTHENE	2/9	0.02 - 0.08
BENZO(G,H,I)PERYLENE	2/9	0.02 - 0.09
BENZO(K)FLUORANTHENE	2/9	0.02 - 0.08
CHRYSENE	2/9	0.02 - 0.21
DIBENZ(A,H)ANTHRACENE	1/9	0.02 - 10.0
FLUORANTHENE	4/9	0.02
FLOURENE	4/9	0.02
INDENO(1,2,3-CD)PYRENE	2/9	0.02 - 0.07
2-METHYLNAPHTHALENE	3/3	---
NAPHTHALENE	6/9	0.02
PHENANTHRENE	4/9	0.02
PYRENE	4/9	0.02
METALS		
ALUMINUM	5/6	200
BARIIUM	5/6	140 - 200
COPPER	1/6	25 - 29
IRON	5/6	140
LEAD	2/6	6.4 - 12.0
MAGNESIUM	6/6	-
MANGANESE	5/6	15
ZINC	5/6	37
CYANIDE	4/7	5.0

(A) NUMBER OF SAMPLES IN WHICH THE CHEMICAL WAS POSITIVELY DETECTED OVER
THE NUMBER OF SAMPLES AVAILABLE.

CHEMICAL	RANGE OF CONCENTRATIONS UG/L
SEMI-VOLATILES	
2,4-DIMETHYLPHENOL	3,900
2-METHYLPHENOL	7.0 - 7,600
4-METHYLPHENOL	19 - 19,000
DIBENZOFURAN	19 - 36
PHENOL	30 - 6,100
VOLATILES	
ACETONE	310
CHLOROFORM	34
METHYLENE CHLORIDE	200
STYRENE	690 - 1,700
BETX	
BENZENE	710 - 73,000
ETHYLBENZENE	430 - 1100
TOLUENE	390 - 24,000
XYLENE	2,000 - 6,300
PAH	
ACENAPHTHENE	9.7 - 38
ACENAPHTHYLENE	36 - 250
ANTHRACENE	3.6 - 61
BENZO(A)ANTHRACENE	26 - 29
BENZO(A)PYRENE	17 - 19
BENZO(A)FLUORANTHENE	11 - 12
BENZO(G,H,I)PERYLENE	5.0 - 7.0
BENZO(K)FLUORANTHENE	11 - 12
CHRYSENE	25 - 29
DIBENZ(A,H)ANTHRACENE	2.5
FLUORANTHENE	0.49 - 47
FLOURENE	15 - 110
INDENO(1,2,3-CD)PYRENE	4.0 - 5.7
2-METHYLNAPHTHALENE	540 - 880
NAPHTHALENE	0.003 - 4400
PHENANTHRENE	14 - 220
PYRENE	1.0 - 70
METALS	
ALUMINUM	320 - 23,000
BARIUM	140 - 920
COPPER	27
IRON	640 - 14,000
LEAD	9.8 - 41
MAGNESIUM	13,000 - 49,000
MANGANESE	200 - 2,100
ZINC	37 - 210
CYANIDE	6.1 - 25

TABLE 6
ORGANIC CHEMICALS DETECTED IN SOURCE-RELATED SOIL SAMPLES

CHEMICAL	FREQUENCY OF DETECTION(A)	RANGE OF DETECTION LIMITS, UG/L
SEMI-VOLATILES		
BIS(2-ETHYLHEXYL)- PHTHALATE	3/4	370 - 3,900
2,4-DIMETHYLPHENOL	1/4	360 - 3,900
DIBENZOFURAN	2/4	370 - 3,900
2-METHYLPHENOL	1/4	360 - 3,900
4-METHYLPHENOL	1/4	360 - 3,900
PHENOL	1/4	360 - 3,900
VOLATILES		
ACETONE	1/26	12
BETX		
BENZENE	16/32	5.3 - 71,000
ETHYLBENZENE	10/32	5.3 - 71,000
TOLUENE	21/32	5.3 - 71,000
XYLENE	12/32	5.3 - 71,000
PAH		
ACENAPHTHENE	20/32	0.07 - 19,000
ACENAPHTHYLENE	25/32	0.07-190,000
ANTHRACENE	21/32	0.07 - 19,000
BENZO(A)ANTHRACENE	26/32	0.07 - 19,000
BENZO(A)PYRENE	25/32	250.07 - 19,000
BENZO(B)FLUORANTHENE	19/32	0.07 - 19,000
BENZO(G,H,I)PERYLENE	24/32	0.07 - 1,700
BENZO(K)FLUORANTHENE	21/32	0.07 - 19,000
CHRYSENE	29/32	0.07 - 19,000
DIBENZ(A,H)ANTHRACENE	16/32	0.07 - 1,700
FLUORANTHENE	27/32	0.07 - 19,000
FLOURENE	23/32	0.07 - 19,000
INDENO(1,2,3-CD)PYRENE	20/32	0.07 - 1,700
2-METHYLNAPHTHALENE	2/4	370 - 3,900
NAPHTHALENE	25/32	0.07 - 19,000
PHENANTHRENE	26/32	0.07-190,000
PYRENE	27/32	0.07 - 19,000

(A) NUMBER OF SAMPLES IN WHICH THE CHEMICAL WAS POSITIVELY DETECTED OVER THE NUMBER OF SAMPLES AVAILABLE.

TABLE 6 (CONTINUED)

CHEMICAL	RANGE OF SITE CONCENTRATIONS UG/L
SEMI-VOLATILES	
BIS(2-ETHYLHEXYL) PHTHALATE	280 - 2,400
2,4-DIMETHYLPHENOL	7,000
DIBENZOFURAN	900 - 15,000
2-METHYLPHENOL	4,700
4-METHYLPHENOL	190
PHENOL	7,100
VOLATILES	
ACETONE	22
BETX	
BENZENE	5.0 - 1,800,000
ETHYLBENZENE	89 - 300,000
TOLUENE	6 - 2,900,000
XYLENE	7 - 2,000,000
PAH	
ACENAPHTHENE	1.1 - 93,000
ACENAPHTHYLENE	1.2 - 660,000
ANTHRACENE	3.4 - 540,000
BENZO(A)ANTHRACENE	0.86 - 280,000
BENZO(A)PYRENE	1.1 - 280,000
BENZO(A)FLUORANTHENE	1.8 - 13,000
BENZO(G,H,I)PERYLENE	0.8 - 45,000
BENZO(K)FLUORANTHENE	1.3 - 410,000
CHRYSENE	1.0 - 380,000
DIBENZ(A,H)ANTHRACENE	3.0 - 17,000
FLUORANTHENE	0.86 - 440,000
FLOURENE	3.7 - 560,000
INDENO(1,2,3-CD)PYRENE	2.2 - 390,000
2-METHYLNAPHTHALENE	96 - 39,000
NAPHTHALENE	3.2 - 830,000
PHENANTHRENE	1.1 - 1,100,00
PYRENE	1.2 - 930,0000

TABLE 7
COMPARISON OF CONCENTRATIONS OF METALS IN SOURCE-RELATE
SOIL SAMPLES TO REPRESENTATIVE BACKGROUND CONCENTRATIONS

CHEMICAL	FREQUENCY OF DETECTION (A)	RANGE OF DETECTION LIMITS, UG/L
METALS		
ALUMINUM	26/26	40 - 59
ARSENIC	11/26	2.1 - 5.1
BARIUM	21/26	43 - 59
CHROMIUM	23/26	2.1 - 3.0
COBALT	5/26	11 - 15
COPPER	24/26	5.3 - 7.4
IRON	26/26	21 - 30
LEAD	26/26	1.1 - 12
MAGNESIUM	26/26	1,100 - 1,500
MANGANESE	26/26	3.2 - 4.4
MERCURY	3/26	0.11 - 0.15
NICKEL	11/26	8.5 - 12
VANADIUM	6/26	11 - 15
ZINC	26/26	4.3 - 5.9
CYANIDE	9/26	0.27 - 7.4

CHEMICAL	RANGE OF SITE CONCENTRATIONS UG/L	REPRESENTATIVE BACKGROUND SOIL CONCENTRATIONS UG/KG (A)
METALS		
ALUMINUM	1,308 - 19,000	57,00 - 90,000
ARSENIC	2.7 - 21	7.2 - 20
BARIUM	26 - 360	200 - 1000
CHROMIUM	11 - 52	50 - 100
COBALT	12 - 32	3 - 30
COPPER	7.3 - 68	10 - 70
IRON	2,400 - 40,000	18,000 - 51,000
LEAD	4.5 - 170	15 - 50
MAGNESIUM	1,200 - 11,000	2,300 - 10,000
MANGANESE	66 - 1,500	70 - 2,000
MERCURY	0.12 - 0.67	0.03 - 0.260
NICKEL	11 - 64	15 - 70
VANADIUM	9.2 - 53	70 - 150
ZINC	18 - 1100	31 - 194
CYANIDE	1.1 - 200	NA(B)

NOTE: (A) BACKGROUND CONCENTRATIONS OF METALS IN SOIL (RANGE) ARE PROVIDED HERE FOR COMPARISON PURPOSES. (CONNOR AND SHACKLETTE, 1975)

(B) NOT AVAILABLE.