UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:
WU-16J

PROPOSAL TO REISSUE AN EXEMPTION TO AK STEEL CORPORATION FOR THE CONTINUED INJECTION OF HAZARDOUS WASTE SUBJECT TO THE LAND DISPOSAL RESTRICTIONS OF THE HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984

Action: Notice of Intent to Grant an Exemption for the Injection of Certain Hazardous Wastes to AK Steel Corporation for Two Injection Wells Located at 1801 Crawford Street, Middletown, Ohio.

Summary: Through this notice, the United States Environmental Protection Agency (U.S. EPA), Region 5, Chicago office, proposes to grant an exemption from the ban on disposal of hazardous wastes through injection wells to AK Steel Corporation (AK Steel) of Middletown, OH. If the exemption is granted, AK Steel may continue to inject hazardous wastes as designated under the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §§ 6901-6992k, by waste code K062 through waste disposal wells UIC Well No. 1 and UIC Well No. 2.

On March 6, 2006, AK Steel submitted a petition to the U.S. EPA seeking an exemption from the ban based on a showing under 40 C.F.R. § 148.20(a)(1)(i) that any fluids injected will not migrate vertically out of the injection zone or laterally to a point of discharge or interface with an underground source of drinking water (USDW) within 10,000 years. U.S. EPA has conducted a comprehensive review of the petition, its revisions, and other materials submitted and has determined that the petition submitted by AK Steel, as revised on August 9 and December 12, 2007, meets the requirements of 40 C.F.R. Part 148, Subpart C.

Supplementary Information:

I. Background

A. Regulatory Requirements – Section 3004 of the RCRA prohibits the land disposal of untreated hazardous waste. RCRA specifically defines land disposal to include any placement of hazardous waste into an injection well (RCRA Section 3004(k)). Under 40 C.F.R. § 148.20, any person seeking an exemption from that prohibition must submit a petition demonstrating that, to a reasonable degree of certainty, there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous. These petitions, commonly referred to as "no-migration" petitions, must meet the regulatory standards promulgated in 40 C.F.R. Part 148, Subpart C.

The demonstration of no-migration requires a showing that either 1) injected fluids will not migrate upwards out of the injection zone or laterally to a point of contact with a USDW, or 2) before such migration occurs, the injected fluids will no longer be hazardous. The Underground

Injection Control (UIC) regulations specify the time frame for which these predictions must be demonstrated as 10,000 years.

B. Facility Information – The AK Steel injection wells are located at 1801 Crawford Street in the City of Middletown in Butler County, Ohio. The Ohio Environmental Protection Agency (Ohio EPA) previously issued permits to the AK Steel facility to dispose of liquid wastes by deep well injection. The operator has constructed two wells. The proposed exemption is based on a long term average injection rate for the facility (both wells together) of 90 gallons per minute (gpm) averaged over one-month periods, for a total of 390,000 gallons per month. The long term average rate limit is used to bound the area of the waste plume so that the plume will be no larger than the area estimated in the petition. The rate at which AK Steel may inject is also limited by the maximum allowable surface injection pressure.

C. Today's Proposed Decision – On March 6, 2006, AK Steel submitted a petition for exemption from the land disposal restrictions of hazardous waste injection under RCRA. U.S. EPA reviewed this submission and requested additional information. Based on the additional supporting documents received on August 9 and December 12, 2007, U.S. EPA has determined that AK Steel has demonstrated, to a reasonable degree of certainty, that any fluids injected will not migrate vertically out of the injection zone or laterally to a point of discharge or interface with a USDW within 10,000 years.

II. Basis for Determination

A. Waste Identification and Analysis (40 C.F.R. § 148.22(a)) – AK Steel has petitioned the U.S. EPA, to grant an exemption to allow injection of wastes from the processes of steel pickling and galvanizing bearing the RCRA waste code K062. Under the proposed exemption, AK Steel can inject only this waste. A waste analysis was performed and submitted in the no-migration petition. This analysis was conducted in accordance with the quality assurance standards required by 40 C.F.R. § 148.21(a), and adequately describes the characteristics of the waste.

B. Mechanical Integrity Test Information (40 C.F.R. § 148.20(a)(2)(iv)) – In order to confirm that all injected fluids are entering the approved injection interval and not channeling up the well bore out of the injection zone, 40 C.F.R. § 148.20(a)(2)(iv) requires the petitioner to submit the results of a successful annulus pressure test and a radioactive tracer survey. These tests demonstrate the mechanical integrity of a well's long string casing, injection tubing, annular seal, and bottom hole cement. Both wells at AK Steel demonstrated successful tests in June of 2007.

C. Local and Regional Geology (40 C.F.R. § 148.21(b)) – Class I hazardous waste injection wells must be located in areas that are geologically suitable. AK Steel provided site-specific geologic, hydrologic, and geochemical information, including descriptions of the depositional environments of the formations, well logs, cross-sections, well and formation tests, and geologic maps, to support the demonstration of no-migration. U.S. EPA's evaluation of the structural and stratigraphic geology of the local and regional area determined that the AK Steel facility is located at a geologically suitable site.

1. Identification of Underground Sources of Drinking Water – The lowermost USDW at the site is the Cincinnatian Group, less than 522 feet (Figure 1)[1] . There are approximately 1,901 feet of separation between the lowermost USDW and the Injection Interval, where the waste is emplaced. This separation zone is composed of dolomites, shales, sandstones and siltstones which are predominantly characterized by low permeability at this location.

2. Injection Zone – The Injection Zone must have sufficient permeability, porosity, thickness, and extent to contain the injected fluids. The injection zone for the AK Steel facility is composed of the Middle Run Formation, Mount Simon Formation, and Eau Claire Formation, between 2,423 and 3,296 feet below the surface. The Injection Zone is composed of the Injection Interval, into which the waste is placed, and the overlying Arrestment Interval (Figure 1). Waste is directly emplaced at depths from 2,900 feet to 3,296 feet into formations that can accept the waste because they have high permeability and porosity.

The Arrestment Interval, from 2,423 to 2,900 feet, is composed of the upper Eau Claire Formation, a continuous rock formation of low vertical permeability, and is free of transecting, transmissive faults or fractures over an area sufficient to prevent the upward movement of waste.

3. Confining Zone – (40 C.F.R. § 146.62) – The regulations which specify the minimum criteria for siting Class I hazardous waste injection wells require that the Injection Zone must be overlain by at least one additional formation which can confine the injected fluids. This formation is known as the Confining Zone, and it must be (1) laterally continuous, (2) free of transecting, transmissive faults or fractures over an area sufficient to prevent fluid movement, and (3) of sufficient thickness and lithologic and stress characteristics to prevent vertical propagation of fractures. The Confining Zone at the AK Steel facility is the Knox Dolomite which is found between 1,172 and 2,423 feet (Figure 1). It is 1,251 feet thick, has no known transmissive faults or fractures within the area of review, and will resist vertical migration because of its low natural permeability.

The confining zone must be separated from the lowermost USDW by at least one sequence of permeable and less permeable strata that will provide added layers of protection by either allowing pressure bleed-off (high permeability units), or by providing additional confinement (low permeability units). The “bleed-off” unit is the Wells Creek Formation found between 1,148 feet and 1,172 feet, which is comprised of shaley sandstone having moderate porosity and permeability. It is capable of accepting significant amounts of fluid without developing excessive hydrostatic pressure. Overlying the Wells Creek Formation, the Black River Limestone, found between 666 and 1,148 feet, has much lower porosity and permeability, and can provide additional confinement. These rock formations are laterally continuous for hundreds of square miles and provide the required additional layers of protection.

4. Absence of Known Transmissive Faults (40 C.F.R. § 148.20(b)) – There are no known transmissive faults in the upper Eau Claire Formation, the stratum within the injection zone that will confine fluid movement, or in the overlying Knox Dolomite. In addition, an interference test conducted in 1989 indicates that there are no transmissive fractures cutting the injection

[1] All depths in this document are referenced to an eight-foot Kelly bushing (KB) unless labeled as referenced from ground surface.

interval within the area between and near the wells.

5. Seismicity – Ohio is an area of low seismic risk. Midwestern earthquakes are widely scattered and have epicenters deep within the Precambrian granitic rocks far below the injection reservoir. There is virtually no possibility of damage to the AK Steel wells or leakage of waste from the injection zone as a result of seismic activity.

6. Geochemical Conditions (40 C.F.R. § 148.21(b)(5)) – The petitioner must adequately characterize the injection and confining zone fluids and rock types to determine the waste stream's compatibility with these zones. The injection zone is composed mainly of permeable sandstone with some sandy dolomite and shale streaks. The confining zone is composed of glauconitic sandstones and shales with minor amounts of siltstone, dolomite, and limestone. The formation brine in the injection zone has a neutral pH. The injected fluid is compatible with these conditions.

D. Wells in Area of Review - Under 40 C.F.R. § 146.63, the area of review (AOR) of Class I hazardous waste wells is a two-mile radius around the well bore or a larger area specified by U.S. EPA based on the calculated cone of endangering influence of the well. The zone of endangering influence is the area within which pressurizing the injection interval can raise a column of formation fluid or injected fluid sufficiently to cause contamination of a USDW. The zone of endangering influence for the AK Steel injection wells has a radius of 2.6 miles. Therefore, the area of review for the two wells extends 2.6 miles from the wells.

Under 40 C.F.R. § 148.20(a)(2)(ii), a petitioner must locate, identify, and ascertain the condition of all wells within the injection well's area of review that penetrate the injection zone or the confining zone. AK Steel conducted a well search over the area of review and found that there are no wells penetrating the top of the confining zone within this distance. Because no wells penetrating the confining zone or injection zone are improperly plugged, completed or abandoned, a corrective action plan is not required under 40 C.F.R. § 148.20(a)(2)(iii).

E. Quality Assurance and Quality Control (40 C.F.R. § 148.21(a)) – AK Steel has demonstrated that adequate quality assurance and quality control plans were followed in preparing the petition. Most of the data was collected before the requirements for the no-migration demonstration, including those for quality control were promulgated. The quality of the data is indicated by the consistency of the values. Additionally, procedures for testing carried out since the requirements were promulgated were reviewed and given informal approval as necessary. AK Steel followed an appropriate protocol for locating records for penetrations in the AOR, for collection and analyses of geologic and hydrogeologic data, for waste characterization, and for all tasks associated with the modeling demonstration.

III. No-Migration Demonstration

AK Steel chose to demonstrate that waste injected at the AK Steel facility will remain in the injection zone and will not migrate to a point of discharge or interface with an USDW for a period of at least 10,000 years. This demonstration was based on a showing that a geological model representative of the disposal reservoir and the overlying rock strata would contain the

waste constituents within the disposal reservoir for a period of at least 10,000 years under the conditions of the simulation.

A. Model Development (40 C.F.R. § 148.21(a)) – A conceptual model was developed using information developed from logs, core, and other testing carried out during drilling and operation of UIC Well No. 1 and UIC Well No. 2. The site-specific information provided to the model includes hydrogeologic properties of the various rock layers and formation brines, as well as characteristics of the injected fluid. Where site-specific information was not available or necessary, values from peer-reviewed literature or that have been reported in similar situations were used. Where parameters were uncertain, conservative values were chosen.

Some model parameters are uncertain within a range, yet are critical to the predictions of pressure build-up and waste migration. In accordance with 40 C.F.R. § 148.21(a)(6), a range of values for these parameters was modeled in order to determine the sensitivity of the model to the uncertainties, and to predict the "worst-case scenarios." This sensitivity testing indicated that the range of uncertainties does not cause significant differences in the predictions of pressure build-up and waste migration. The preponderance of conservative assumptions and the use of "worst-case scenario" parameters lend conservatism to the no-migration demonstration.

B. Model Verification, Calibration, and Validation (40 C.F.R. § 148.21(a)(3)) – The estimates of pressurization and lateral plume movement were made using the SWIFT/98 version of the Sandia Waste-Isolation Flow and Transport Model for Fractured Media (SWIFT). The SWIFT/98 computer codes have been used in previous no-migration demonstrations and have been verified extensively.

The model represents a 404-foot thick section of rock strata, and is divided into seven layers which correlate to distinct geologic subunits in and adjacent to the open well bore interval. The seven-layer SWIFT model was calibrated to the hydrogeologic information gathered from a 1989 interference test by increasing pore-volume compressibility. The model was further calibrated by modifying the permeabilities of the individual layers to match the observed responses from pressure transient tests run from 1992 through 2004. The model is validated in representing a homogeneous, infinite-acting reservoir by its repeated success in predicting these responses. The parameters of the layers are shown in the table below.

Model Layer	Depths (feet below surface, KB)	Porosity	Calibrated permeability (md)	Thickness (ft)
EC_1	2,856-2,955	15.46	5.23	99
EC_2	2,955-2,980	15.18	90.38	25
MS_1	2,980-3,020	13.11	115.03	40
MS_2	3,020-3,045	14.05	22.41	25
MS_3	3,045-3,150	13.17	14.94	105
MS_4	3,150-3,240	12.55	6.72	90
MR_1	3,240-3,260	9.35	5.23	20
Total				**404**

C. Model Predictions – Two simulated time periods were considered in the demonstration: a 46-year operational period and a 10,000-year post-operational period. The operational period

included actual historical injection rates through July 1, 2005, and a maximum injection rate of 90 gpm through September 30, 2017. This rate history determined the plume size and the maximum pressure build up in the injection zone. The post-operational period was modeled to predict the maximum vertical molecular diffusion and the horizontal drift of the waste plumes.

1. Vertical Migration – Vertical movement was calculated using analytical methods. To ensure a conservative result, the maximum pressure which SWIFT/98 predicted to occur at the end of the injection life was assumed to exist during the entire 46-year operational period plus an additional 12 years. Vertical movement was assumed to begin at the base of the arrestment interval at 2,900 feet below the surface. The vertical permeability of this part of the arrestment interval has been measured in cores taken from the AK Steel and other wells, and in most samples, the permeability is less than 10^{-6} millidarcy (md). The extent of vertical movement was predicted to be 4.03 feet.

AK Steel used an empirical method to calculate the vertical diffusion distance of hazardous constituents in the post-operational period. A number of conservative assumptions were used to maximize this distance. In the current demonstration, the predicted distance is that at which the concentration of any constituent will be less than one part per million. The greatest distance calculated is 156 feet, much less than the 477-foot thickness of the Arrestment Interval (Figure 1).

2. Lateral Migration – SWIFT/98 was used to simulate lateral plume movement. To enlarge the predicted plume size, the preparers of the AK Steel demonstration used reasonably conservative estimates for longitudinal and transverse dispersivity. At the end of the modeled 12-year operational period, the distance from the center of the plume to the edge (determined at the one in 1,000,000 concentration ratio) is 4,842 feet. Therefore, the plume would be less than one mile from the wells, which is within the area of review.

The simulation of plume-flow distance and direction during the 10,000 year post-operational period considered buoyancy and the natural flow within the lower Eau Claire Formation, Mt. Simon Sandstone, and upper Middle Run Sandstone. Calculations based on the measurements made at AK Steel's wells and several others indicated that the rate of regional flow is less than 0.5 ft/year. To maximize plume movement, the model incorporated regional flow in the same direction as the dip of the rock strata, which is to the southwest. In addition, the simulation does not consider the possibility of chemical and physical processes which in reality are likely to retard movement of hazardous constituents. The final plume boundary is shown in Figure 2, with a maximum distance from the injection wells of 3.55 miles.

The nearest point of discharge into a USDW is hundreds of miles away from the facility. Figure 2 shows the distance beyond which we can be very certain that the waste will not spread through a period of 10,000 years, which is 3.55 miles. Therefore, AK Steel has demonstrated that, to a reasonable degree of certainty, hazardous constituents will not migrate vertically out of the injection zone or laterally to a point of discharge in a 10,000 year period.

IV. Conditions of Petition Approval

This proposed reissuance of the land ban exemption for the continued injection of restricted hazardous waste is subject to the following conditions, which are necessary to assure compliance with the standard in 40 C.F.R. § 148.20(a). Non-compliance with any of these conditions is grounds for termination of the exemption in accordance with 40 C.F.R. § 148.24(a)(1). The facility must petition U.S. EPA for approval to change any of the following conditions. Petition modifications and reissuance should be made pursuant to § 148.20(e) or (f).

1) All regulatory requirements in 40 C.F.R. § 148.24 are incorporated by reference;

2) The exemption applies to the two existing injection wells, UIC Well No. 1 and UIC Well No. 2, located at the AK Steel facility at 1801 Crawford Street, Middletown, Ohio;

3) Injection is limited to that part of the lower Eau Claire Formation, Mt. Simon Sandstone, and upper Middle Run Sandstone at depths between 2,900 and 3,296 feet below the surface (referenced from an eight-foot Kelly bushing);

4) Only wastes denoted by the RCRA waste code K062 may be injected;

5) Maximum concentrations of chemical contaminants that are hazardous at less than one part per million are limited according to the table below:

Chemical constituent	Maximum concentration at the well head (mg/L)
Chromium	1,200
Hexavalent Chromium	1,200
Lead	1,000
Nickel	542

6) The specific gravity of the injected waste stream must at all times range from 1.00 to 1.30;

7) The volume of wastes injected in any month through both wells at the site must not exceed 2,629,800 gallons;

8) This exemption is approved for the 12-year modeled injection period, which ends on October 1, 2017. AK Steel may petition U.S. EPA for a reissuance of the exemption beyond that date, provided that a new and complete petition and no-migration demonstration is received at U.S. EPA, Region 5, by April 1, 2017.

9) AK Steel must quarterly submit to U.S. EPA a report containing the fluid analyses of the injected waste which must indicate the chemical and physical properties upon which the no-migration petition was based, including the levels of those constituents listed in Condition 5 of this exemption approval;

10) AK Steel must annually submit to U.S. EPA a report containing the results of a bottom hole pressure survey (fall-off test) performed on either UIC Well No. 1 or UIC Well No. 2. The survey must be performed after shutting in the well for a period of time sufficient to allow the pressure in the injection interval to reach equilibrium, in accordance with § 146.68(e)(1). The annual report must include a comparison of reservoir parameters determined from the fall-off test with parameters used in the approved no-migration petition; and

11) The petitioner must fully comply with all requirements set forth in Underground Injection Control Permits UIC 05-09-001-PTO-I and UIC 05-09-002-PTO-I issued by the Ohio Environmental Protection Agency. Upon the expiration, cancellation, reissuance, or modification of these permits by the Ohio Environmental Protection Agency, this exemption is subject to review. A new demonstration may be required if information shows that the basis for granting the exemption is no longer valid under 40 C.F.R. §§ 148.23 and 148.24.

Date: The U.S. EPA, Region 5, Chicago office, requests public comments on today's proposed decision. Comments will be accepted until August 5, 2008. Comments postmarked after the close of the comment period will be stamped **"Late"**. Late comments do not have standing and will not be considered in the decision process.

U.S. EPA will schedule a public hearing to allow comment on this proposed action, and will publish a notice of this hearing in a local paper. If you wish to be notified of the date and location of the public hearing please contact the person listed below. U.S. EPA will cancel the hearing if it has no evidence of a need for a hearing.

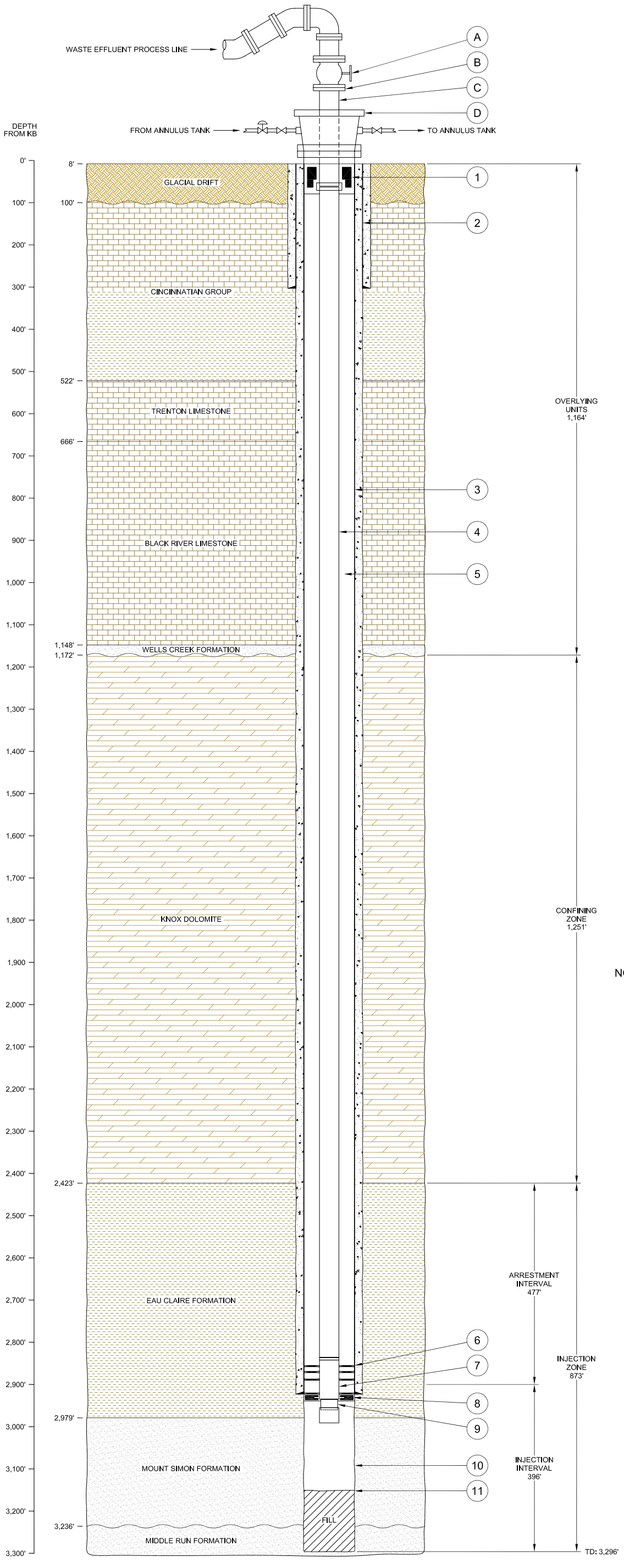
Addresses: Submit written comments by mail to:

Rebecca L Harvey, UIC Branch Chief
United States Environmental Protection Agency, Region 5,
Underground Injection Control Branch (WU-16J)
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Comments may be submitted by email to harvey.rebecca@epa.gov.

For Further Information: Contact Stephen Roy at the above address, by telephone at (312) 886-6556 or by email to roy.stephen@epa.gov or Leslie Patterson, Lead Petition Reviewer, by telephone at (312) 886-4904, or by email at patterson.leslie@epa.gov.

Figure 1



WELLHEAD DETAILS

A. Master Valve: 300# W.P.

B. Flange: grade 7 titanium, 3", 300#, 8 bolt x 3", 8V line pipe thread

C. Landing Joint: grade 7 titanium, 3", 8V line pipe pin x 3", 8V line pipe pin, 3½" O.D. x 3 1/16" I.D.

D. Stripper Head: Larkin wellhead, 7" x 3½" Strip-ez

BELOW GROUND DETAILS

1. Oil (annulus fluid-upper) appoximately 6 barrels for freeze protection

2. Surface Casing: 13⅜" O.D., 54.5 lb/ft, J-55, LT&C carbon steel set to 303' in 17½" hole and cemented to surface with 250 sacks cement

3. Protection Casing: 9⅝" O.D., 36 lb/ft, J-55, LT&C carbon steel set to 2,923' in 12¼" hole and cemented to surface with 850 sacks of 50/50 Pozmix (with 2% gel and 18% salt) and 50 sacks densified acid resistant cement

4. Injection Tubing: 3½" O.D., Fibercast

5. Annulus fluid filled with 9.7 ppg brine water and 1.0 % of Tretolite CRWO132F containing; corrosion inhibitor, biocide, and oxygen scavenger

6. Model "D" packer set at 2.855' RKB, additional Model "D" packers set at:
2,869' RKB
2,887' RKB
2,920' RKB

7. Seal assembly - 3 seals, 6.15' long (grade 7 titanium)

8. Oil (fluid buffer below packer)

9. Tailpipe: 3½" Fibercast; 92.91' long and 1 joint of 2⅜" Fibercast; 20.20' long stung into 36' of 3½" Fibercast which is stuck, bottom at 2,992'

10. Open hole completed in Mt. Simon drilled 8¾" O.D. from 2,923' to 3,296'

11. Top of fill and/or bridge at 3,141'

NOTE: All depths are referenced to KB based on Gamma Ray - Collar log dated August 24, 1991

GL elevation = 658.6'
RKB elevation = 666.6'

Injection Zone: 2,423' to 3,296'
Injection Interval: 2,900' to 3,296'

Legend

- Glacial Drift
- Limestone
- Dolomite
- Shale
- Sandstone

WELL SCHEMATIC CURRENT AS OF JULY, 2005

SUBSURFACE

HOUSTON, TX.
SOUTH BEND, IN.
BATON ROUGE, LA.

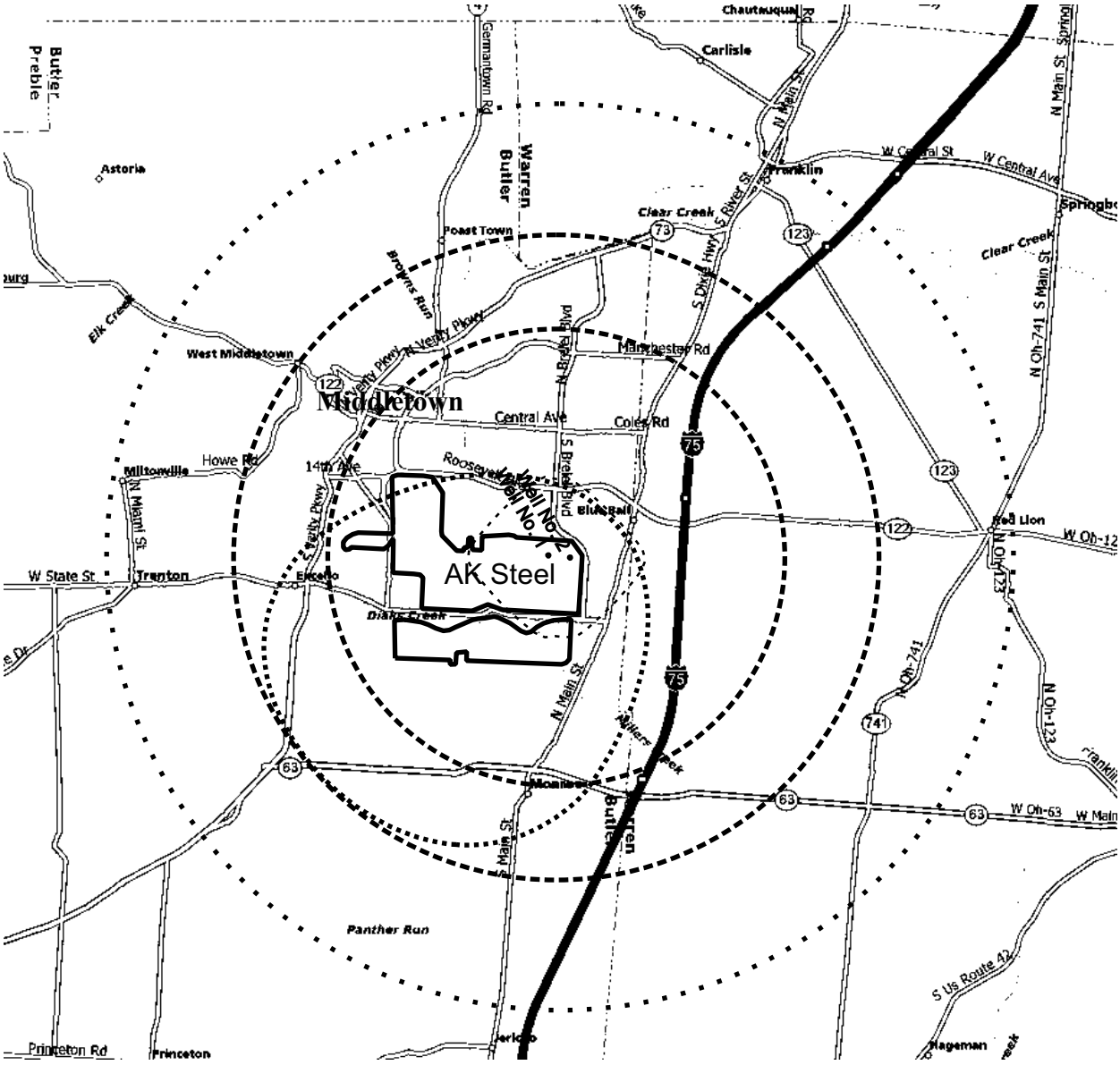
FIGURE II.A.–1

AK STEEL CORPORATION
MIDDLETOWN, OHIO

CONSTRUCTION DETAILS – UIC WELL NO.1

DATE: 1/13/06	CHECKED BY: RTB	JOB NO: 60Z5696
DRAWN BY: CRB	APPROVED BY: RWS	DWG. NO:

Figure 2



Legend

AK Steel facility boundary	———
Plume at the end of service life.	- - - - - - - - - - - - - -
Radius of Zone of Endangering Influence 2.52 miles.	- - - - - - - - - - - - - -
10,000-year plume migration as modeled: 3.55 miles.	. . . . .
Circumscribed radius of 10,000-year plume migration: 3.55 miles.	- - - - - - - - - - - - - -
5-mile radius area of review	. . . . .

SUBSURFACE

Houston, TX
South Bend, IN
Baton Rouge, LA

AK STEEL CORPORATION
MIDDLETOWN, OHIO

PLUME AND ZONE OF ENDANGERING INFLUENCE

DATE 03/07/08	CHECKED BY	JOB NO. 60G5696
DRAWN BY PWJ	APPROVED BY	DWG NO.